

**CRASH DATA RESEARCH CENTER**

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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE  
CRASH INVESTIGATION**

**CALSPAN CASE NO: CA05-021**

**VEHICLE: 2005 JEEP LIBERTY**

**LOCATION: NEW YORK**

**CRASH DATE: JANUARY 2005**

Contract No. DTNH22-01-C-17002

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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 are 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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<p>16. Abstract This on-site investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2005 Jeep Liberty. The manufacturer of this vehicle has certified that this 2005 Jeep Liberty meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The CAC safety system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage. Additionally, the vehicle was equipped with retractor-mounted safety belt pretensioners. A restrained 28-year-old female driver and a 36-year-old male front right occupant occupied the Jeep. The Jeep was involved in an intersection collision with a 1994 Ford unknown model. As a result of the crash, the frontal air bags deployed and the front safety belt pretensioners fired. The driver and front right occupant of the Jeep were not injured. The Jeep sustained moderate severity frontal damage and was towed from the crash site.</p>			
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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE  
CRASH INVESTIGATION  
SCI CASE NO. – CA05-021  
SUBJECT VEHICLE – 2005 JEEP LIBERTY  
LOCATION - STATE OF NEW YORK  
CRASH DATE – JANUARY 2005**

**BACKGROUND**

This on-site investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2005 Jeep Liberty (**Figure 1**). The manufacturer of this vehicle has certified that this 2005 Jeep Liberty meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The CAC safety system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage. Additionally, the vehicle was equipped



**Figure 1. Subject vehicle 2005 Jeep Liberty.**

with retractor-mounted safety belt pretensioners. A restrained 28-year-old female driver and a 36-year-old male front right occupant occupied the Jeep. The Jeep was involved in an intersection collision with a 1994 Ford unknown model. As a result of the crash, the frontal air bags deployed and the front safety belt pretensioners fired. The driver and front right occupant of the Jeep were not injured. The Jeep sustained moderate severity frontal damage and was towed from the crash site.

This crash was identified from a list of claims provided by an insurance company to the National Highway Traffic Safety Administration (NHTSA) that identified Certified Advanced 208-Compliant vehicles that had been involved in crashes. The list was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The Jeep was located at a local salvage facility and cooperation was established with the facility to inspect the vehicle. An on-site investigation was assigned to the Calspan SCI team on March 18, 2005. The vehicle and crash site inspections were completed on March 18, 2005. \*Note: The images included in this report are replacement images that were taken of the Jeep during the repair process. The original images that depict the damage were lost due to a corrupt image card.

## SUMMARY

### *Crash Site*

This intersection crash occurred during the daylight hours of January 2005. At the time of the crash, it was snowing and the roadway was snow and ice covered. The crash occurred within a four-leg intersection. The north and south legs of the intersection were configured with one travel lane in each direction. Double yellow centerlines delineated the travel lanes for the north leg. The east and westbound legs were configured with one travel lane in each direction that was delineated by double yellow centerlines. The roadway curved left for the westbound travel direction. The posted speed limit for the roadways was 64 km/h (40 mph). The scene schematic is included as **Figure 8** of this report.

### *Vehicle Data – 2005 Jeep Liberty*

The 2005 Jeep Liberty was identified by the Vehicle Identification Number (VIN): 1J4GL48K75 (production sequence deleted). The odometer reading at the time of the SCI inspection was 7,192 kilometers (4,469 miles). The Jeep was a four-door sport-utility vehicle that was equipped with a 3.7-liter, V6 engine, 4-speed automatic transmission, four-wheel drive, power-front and rear disc brakes, and a tilt steering wheel. The Jeep was configured with Goodyear Wrangler ST tires, size P225/75R16 mounted on five-spoke OEM steel wheels. The manufacturer recommended front and rear tire pressure was 241 kPa (35 PSI). The specific tire data at the time of the SCI inspection was as follows:

<b>Tire</b>	<b>Measured Pressure</b>	<b>Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	228 kPa (33 PSI)	7 mm (9/32)	No	No
LR	234 kPa (34 PSI)	7 mm (9/32)	No	No
RF	241 kPa (35 PSI)	8 mm (10/32)	No	No
RR	234 kPa (34 PSI)	8 mm (10/32)	No	No

The seating positions in the Jeep were configured with cloth upholstered front bucket seats with integrated head restraints. The second row was configured with a three-passenger split (60/40) bench seat with height adjustable head restraints for the outboard seats. The second row seat was folded down at the time of the SCI inspection.

### *1994 Ford Unknown Model*

The non-subject vehicle in the crash was a 1994 Ford. The model and VIN of the vehicle were not documented on the police report. This vehicle could not be located for this on-site investigation.

### *Crash Sequence*

#### *Pre-Crash*

The restrained 28-year-old female driver of the 2005 Jeep Liberty was operating the vehicle westbound (**Figure 2**) approaching the four-leg intersection. The 17-year-old male was operating the 1994 Ford northbound approaching the intersection where he came to a stop (**Figure 3**). The driver of the Ford failed to observe the Jeep and entered the intersection to continue his northbound travel.



**Figure 2. Jeep's westbound approach to the four-leg intersection.**



**Figure 3. 1994 Ford northbound approach.**

#### *Crash*

The front aspect of the Jeep impacted the right side of the Ford within the northeast quadrant of the intersection (**Figure 4**). The resultant directions of force were with the 11 o'clock sector for the Jeep and 2 o'clock sector for the Ford. The exact model of the 1994 Ford was unknown; therefore, the barrier equivalent algorithm of the WINSMASH program was used to calculate a delta-V for the Jeep. The total delta-V for the Jeep was 13 km/h (8.1 mph) with longitudinal and lateral components of -12 km/h (-7.6 mph) and 4 km/h (2.8 mph).



**Figure 4. Area of impact from the Jeep's westbound approach.**

As a result of the crash, the CAC frontal air bag system deployed in the Jeep and the front safety belt pretensioners fired.

#### *Post-Crash*

Police and Emergency Medical Services personnel (EMS) responded to the crash site. The driver and the front right occupant of the Jeep were not injured. The Jeep sustained disabling damage and was towed from the crash site and subsequently deemed a total loss by the insurance company.

## ***Vehicle Damage***

### ***Exterior Damage – 2005 Jeep Liberty***

The 2005 Jeep Liberty sustained moderate severity frontal damage as result of the crash. It should be noted that the images included in this report are replacement images (**Figure 5**) that were taken of the Jeep during the repair process. The original images that depict the damage were lost due to a corrupt image card.



**Figure 5. Front of the 2005 Jeep under repair. (Replacement Image)**

The maximum crush measured 16 cm (6.3”) and was located 11 cm (4.3”) right of the centerline. The direct contact damage measured 91 cm (35.8”) and began 25 cm (9.5”) right of the centerline and extended to the front left corner. Six equidistant crush measurements were used to document the residual damage to the bumper beam and were as follows: C1 = 0 cm, C2 = 2 cm (0.8”), C3 = 0 cm, C4 = 13 cm (5.2”), C5 = 0 cm, C6 = 0 cm. The Collision Deformation Classification for this impact was 11-FDEW-1.

### ***Interior Damage – 2005 Jeep Liberty***

The driver and passenger of the 2005 Jeep Liberty were restrained during the crash. They loaded the manual safety belt systems, and as a result of the crash forces there were no occupant contact points to the interior of the Jeep. Additionally, there was no passenger compartment intrusion.

### ***Certified Advanced 208-Compliant Safety System – 2005 Jeep Liberty***

The 2005 Jeep Liberty was equipped with a Certified Advanced 208-Compliant (CAC) frontal safety system. The manufacturer of this vehicle has certified that this 2005 Jeep Liberty meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage.



**Figure 6. Deployed driver's frontal air bag.**

In the subject crash, both frontal air bags deployed (**Figure 6**). The driver's air bag was conventionally located in the center of the steering wheel hub. A single cover flap concealed the air bag. There were no damage or occupant contact points present on the air bag membrane; however, dirt was present on the membrane from post-crash handling.



The front right passenger air bag was a mid-mount design in the right instrument panel (**Figure 7**). Two cover flaps concealed the air bag with the instrument panel. The air bag membrane was not damaged and was free of occupant contact. The CAC system appeared to have performed as designed in the subject crash.



**Figure 7. Deployed front right air bag.**

### ***Manual Restraint Systems – 2005 Jeep Liberty***

The 2005 Jeep Liberty was equipped with manual 3-point lap and shoulder safety belts for the six outboard seating positions.

The second row center safety belt was equipped an integrated 3-point lap and shoulder safety belt. The driver's safety belt was configured with continuous loop webbing, sliding latch plate, height adjustable D-ring that was in the full-down position at the time of the SCI inspection, retractor mounted pretensioner, and an Emergency Locking Retractor (ELR). The driver utilized the safety belt during the crash, which was supported by loading abrasions on the latch plate, D-ring, and the vertical abrasions on the webbing from the latch plate. Furthermore, the fired pretensioner restricted the safety belt in the used position.

The front right safety belt was configured with continuous loop webbing, sliding latch plate, height adjustable D-ring that was in the full-down position at the time of the SCI inspection, retractor mounted pretensioner, and a switchable ELR/Automatic Locking Retractor (ALR). The front right occupant used the safety belt in the crash, which was supported by minor abrasions on the latch plate and D-ring. The firing of the retractor pretensioner locked the safety in a used position, which further supported belt usage.

The second and row safety belts were configured with continuous loop webbing, sliding latch plates and switchable ELR/ALR retractors.

### ***Occupant Demographics – 2005 Jeep Liberty***

#### ***Driver***

Age/Sex:	28-year-old/Female
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Full rear
Manual Restraint Use:	3-point manual lap and shoulder safety belt
Usage Source:	Vehicle inspection
Eyewear:	Unknown
Type of Medical Treatment:	Not injured

***Driver's Injuries***

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Source</b>
Not Injured	N/A	N/A

***Driver Kinematics***

The 28-year-old female driver of the 2005 Jeep Liberty was seated in a rear track position. At impact with the 1994 Ford, the driver's frontal air bag deployed and the safety belt pretensioner fired. The driver initiated a slight forward trajectory and loaded the safety belt, which arrested her forward motion. The driver was not injured as result of the crash. The combination of the safety belt usage and the deployed frontal air bag prevented the driver from possible injury.

***Front Right Occupant***

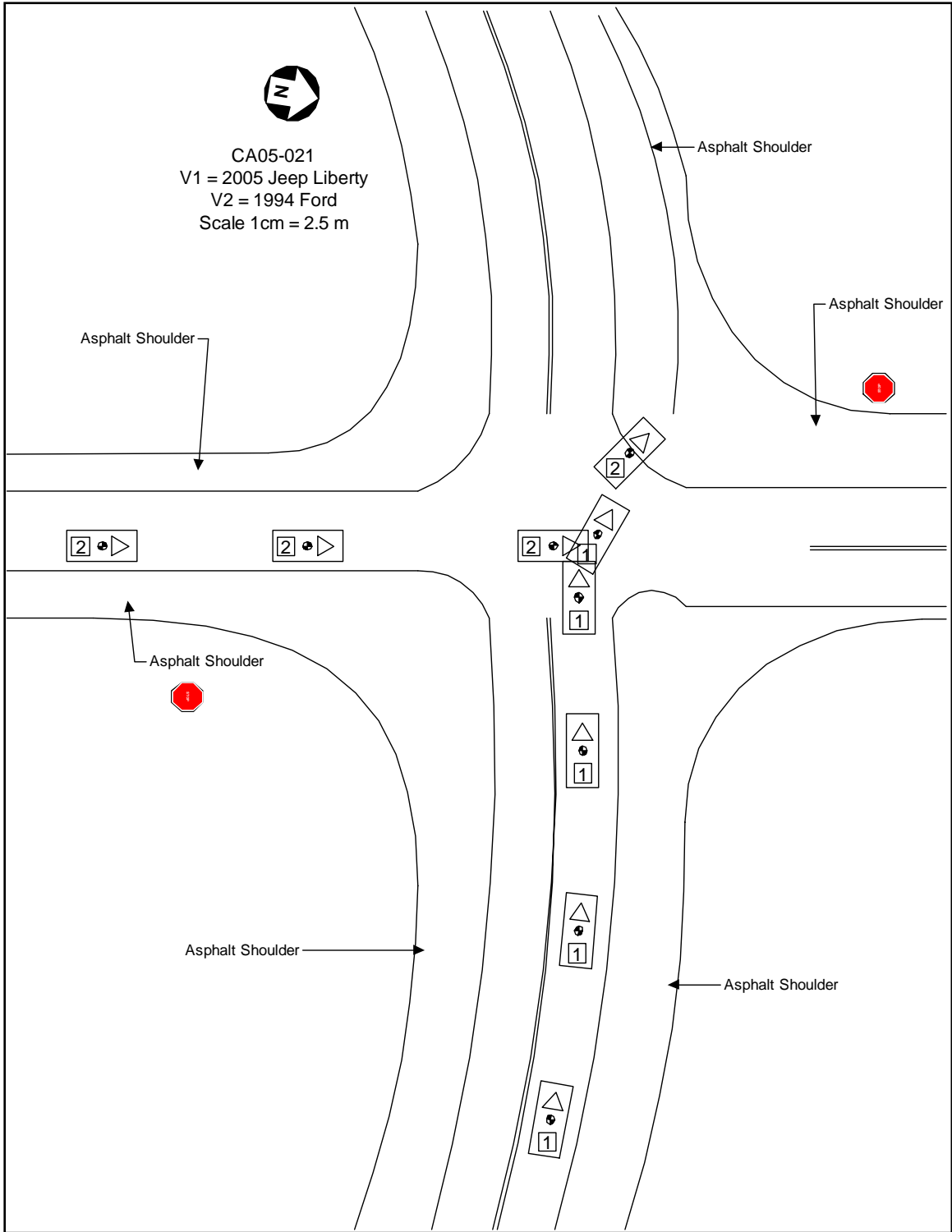
Age/Sex: 36-year-old/male  
Height: Unknown  
Weight: Unknown  
Seat Track Position: Rear third track position  
Manual Restraint Use: 3-point manual lap and shoulder safety belt  
Usage Source: Vehicle inspection  
Eyewear: Unknown  
Type of Medical Treatment: Not injured

***Front Right Occupant Injuries***

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Source</b>
Not Injured	N/A	N/A

***Front Right Occupant Kinematics***

The 36-year-old male front right occupant of the Jeep was seated in a rear track position in a presumed upright posture. At impact, the front right air bag deployed and the safety belt pretensioner fired. Due to the minor crash forces, he was minimally displaced in a forward trajectory and loaded the safety belt, which prevented him from contacting the interior components. The front right occupant was not injured as result of the crash.



**Figure 8. Scene Schematic**