CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

CALSPAN ON-SITE FORD CVPI SEVERE REAR CRASH INVESTIGATION

CASE NO: CA04-037

VEHICLE: 2003 FORD CROWN VICTORIA POLICE INTERCEPTOR

LOCATION: NEW YORK

CRASH DATE: AUGUST 2004

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. CA04-037	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Calspan On-Site Ford CVPI Severe Rear Crash Investigation Vehicle: 2003 Ford Crown Victoria Police Interceptor Location: State of New York		*5. Report Date*: August 2004 *6. Performing Organization Code*	
7. Author(s) Crash Data Research Center		*8. Performing Organization Report No.*	
9. Performing Organization Name and Address Crash Data Research Center Calspan Corporation P.O. Box 400 Buffalo, New York 14225		*10. Work Unit No.* C00410.0000.0231 *11. Contract or Grant No.* DTNH22-01-C-17002	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		*13. Type of Report and Period Covered* Technical Report Crash Date: August 2004 *14. Sponsoring Agency Code*	
15. Supplementary Note This on-site investigation focused on the severity of the crash and the performance of an aftermarket fire suppression system that was installed on a 2003 Ford Crown Victoria Police Interceptor (CVPI).			
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17. Key Words 2003 Crown Victoria Police Interceptor FirePanel Punctured fuel tank.		*18. Distribution Statement* General Public	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 14	*22. Price*

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BACKGROUND

This on-site investigation focused on the severity of the crash and the performance of an aftermarket fire suppression system that was installed on a 2003 Ford Crown Victoria Police Interceptor (CVPI) (**Figure 1**). The fire suppression system was manufactured by FirePanel, which consisted of a thin plastic panel filled with fire suppression powder that was form-fitted to the forward aspect of the vertically mounted steel fuel tank. The CVPI was parked on the roadside with the engine running and the overhead light bar activated while the Troopers were outside the vehicle conducting a routine traffic stop. A 1998 Jeep Grand Cherokee, driven by an intoxicated 27-year old male driver, struck the rear left area of the CVPI at high speed. The impact resulted in severe crush to the back left area of the CVPI. The fuel tank was crushed and punctured by the deformation, resulting in a fuel leak. The FirePanel fractured and disbursed the fire suppression powder, which probably prevented a fire. The CVPI was displaced forward into the back of a 2002 Chevrolet Cavalier. This impact deployed the frontal air bag system in the unoccupied CVPI. The Cherokee rotated in a clockwise direction back onto the roadway and overturned onto its left side.

Figure 1. Damaged 2003 Ford CVPI

The crash notification was provided to the Calspan SCI team on August 13, 2004 by the Fleet Manager of the New York State Police (NYSP). The notification was forwarded to NHTSA and an on-site investigation of the crash was assigned on August 20. The NYSP assembled a group representing Ford, FirePanel, Calspan SCI, the NYSP to conduct a joint vehicle inspection and disassembly of the CVPI on September 7-8, 2004. The crash site and the striking Jeep Grand Cherokee were inspected on the evening of September 8. The Cavalier was not available for inspection.

SUMMARY

Crash Site

This crash occurred on a two-lane state route during nighttime hours (**Figure 2**). At the time of the crash, the conditions were dark and overcast with visibility estimated at 0.8 km (0.5 miles). The north/south asphalt roadway consisted of two travel lanes that were bordered by 2.7 m (8.9') wide paved

Figure 2. Overall view of the crash site.

shoulders. A broken yellow centerline and solid white lane lines delineated the road. Adjacent to both shoulders was grass and a tree line. In the vicinity of the crash site, the roadway was straight and level. The posted speed limit was 89 km/h (55 mph). At the time of the SCI investigation, the physical evidence had eroded, or was masked by the wet environmental conditions. The scene schematic is included with this report as **Figure 18.**

Vehicle Data

2003 Ford Crown Victoria Police Interceptor (CVPI)

The 2003 Ford CVPI was a four-door sedan that was identified by Vehicle Identification Number (VIN) 2FAHP71W93X (production number deleted). At the time of the crash, the odometer reading was 129,209 km (80,289 miles). The Ford was equipped with the manufacturer Police Interceptor package that included the performance based 4.6 liter conventionally mounted gasoline engine linked to a heavy-duty four-speed automatic transmission and rear-wheel drive. The service brakes consisted of four-wheel disc with anti-lock (ABS). The CVPI was a marked police unit with an emergency light bar mounted to the roof of the vehicle, centered over the B-pillar area, and a left A-pillar mounted spotlight. The Ford was equipped with Goodyear Eagle RS-A Plus, size P225/60R16 all-season tires were mounted on OEM steel wheels. The specific tire data at the time of the SCI inspection is listed in the following table:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	0 kPa	9 mm (11/32”)	Sidewall cut, tire de-beaded
Right Front	264 kPa (38.5 PSI)	8 mm (10/32”)	None
Left Rear	0 kPa	8 mm (10/32”)	Inner bead deformed, tire air out
Right Rear	274 kPa (40.0 PSI)	3 mm (4/32”)	None

The interior of the Crown Victoria was configured as a five-passenger vehicle with front bucket seats and a fixed rear bench seat. An aftermarket center console that housed the vehicle’s onboard data system was located between the front seats. This CVPI was equipped with a police safety cage that extended between the B-pillars. The vehicle safety systems consisted of three-point lap and shoulder belts for the four outboard-seated positions and a center rear lap belt. An Advanced Occupant Protection System (AOPS) that included dual stage frontal air bags for the driver and right passenger positions, front seat belt retractor pretensioners, a driver’s seat track-positioning sensor, and an Event Data Recorder (EDR), provided supplemental protection. The frontal air bags deployed during the secondary crash event with the back of the Chevrolet Cavalier.

Design changes incorporated into the 2003 model year CVPI included rack and pinion steering, an alloy radiator support panel, an enhanced performance-oriented front

suspension redesign, and a redesigned frame for improved crash rigidity and performance. The rear aspect of the frame was widened to accommodate the redesigned rear suspension that positioned the rear shock absorber mounting brackets away from the fuel tank, outboard of the frame rails. The 2003 model was also equipped with the OEM shields covering the sway bar brackets and the tank straps, a molded rubber grommet that recessed the bolt heads on the lower aspect of the rear differential cover, and a redesigned vapor canister mounted to the lower surface of the trunk. An aftermarket FirePanel was installed over the rear aspect of the fuel tank. This unit is addressed in the section entitled ***FirePanel*** section of this report.

1998 Jeep Grand Cherokee

The striking 1998 Jeep Grand Cherokee was a four-door sport utility vehicle that was identified by VIN 1J4GZ48S5WC (production number deleted). The Grand Cherokee was powered by a 4.0 liter inline six-cylinder engine linked to a four-speed automatic transmission. The vehicle was a four-wheel drive platform with power-assisted four-wheel disc brakes. The Jeep was equipped with OEM five-spoke alloy wheels and Yokohama Geolander A/T all-season tires, size P225/70R15. The tire pressures and tread depths were not documented. Tire and wheel damage is addressed in the ***Exterior Damage*** section for this vehicle.

The interior of the Grand Cherokee was configured with leather covered front bucket seats and a three-passenger folding rear seat. A redesigned frontal air bag system provided supplemental protection for the driver and front right occupant positions. This system deployed as a result of the initial impact with the CVPI.

2002 Chevrolet Cavalier

The 2002 Chevrolet Cavalier was towed from the crash site and was not available for inspection at the time of the on-site SCI investigation.

Crash Sequence

Pre-Crash

The 2003 Ford CVPI was initially traveling in a southbound direction of the two-lane state route. Two on-duty State Troopers, a driver and front right passenger, conducted a routine traffic stop of a 2001 Chevrolet Cavalier. The Cavalier and the CVPI stopped on the east shoulder with the CVPI positioned behind the Cavalier. The CVPI was parked on the shoulder with the engine running, the transmission in the park-position, and the overhead light bar activated. The Cavalier was police reported in the neutral position (manual transmission). Following the initial radio communication regarding the stopped vehicle, the Troopers exited the vehicle and approached the Cavalier, with a Trooper positioned on each side of the stopped vehicle.

The 1998 Jeep Cherokee was traveling in a southerly direction on approach to the stopped CVPI. The investigating officer estimated visibility at 0.8 km (0.5 mile), due to the dark, overcast conditions. The driver of the Jeep Cherokee was intoxicated with a BAC of .36. The investigating officer estimated his travel speed at 113 km/h (70 mph).

On his approach to the impending crash site, the driver of the Cherokee allowed his vehicle to drift to the right, onto the east shoulder.

Crash

The front right area of the Cherokee impacted the left rear area of the parked CVPI. The resultant directions of force were within the 12 o'clock sector for the Jeep and 6 o'clock for the struck CVPI. The impact crushed the rear bumper of the Ford 113 cm (52.5") forward. The Jeep also engaged the leading edge of the left rear quarter panel, crushing the sheet metal to the level of the left C-pillar. The damage algorithm of the WinSMASH program computed total velocity changes of 37 km/h (23.0 mph) for the CVPI and 45 km/h (27.9 mph) for the Jeep. The specific longitudinal and lateral components were 37 km/h (23.0 mph) and 0 km/h for the CVPI and -45 km/h (27.9 mph) and 0 km/h for the Jeep. The impact deployed the redesigned frontal air bag system in the Jeep.

The Ford CVPI was displaced forward into the rear of the stopped Cavalier. This secondary impact resulted in a 12 o'clock direction of force to the CVPI and a probable 6 o'clock to the stopped Chevrolet. The missing vehicle algorithm of the WinSMASH program computed total velocity changes of 16 km/h (9.9 mph) for the CVPI and 26 km/h (16.1 mph) for the Cavalier. The specific longitudinal and lateral components were -16 km/h (-9.9 mph) and 0 km/h for the CVPI and 26 km/h (16.1 mph) and 0 km/h for the Cavalier**.** This impact deployed the frontal air bag system in the CVPI.

The Troopers were struck by the respective sides of the CVPI as it was accelerated past their pre-crash positions. Both Troopers sustained minor severity injuries.

This impact displaced the Cavalier forward to a measured police reported distance of 29.8 m (98'). The Cavalier came to rest on the southbound travel lane facing in a southerly direction. The CVPI came to rest on the grassy area adjacent to the west shoulder, near the location of impact with the Cavalier.

The Jeep Grand Cherokee rotated in a clockwise direction following the initial impact with the rear of the CVPI. As the vehicle neared a broadside attitude, the left side tire sidewalls rolled under and the alloy wheels gouge the asphalt road surface, tripping the Jeep into a lateral rollover onto its left side. The Jeep came to rest on its side on the east shoulder of the roadway.

Post-Crash

The occupants of the Cavalier, both Troopers, and the driver of the Jeep were transported by ambulances to a local hospital where they were treated for their injuries. All three vehicles were towed from the crash site. The CVPI was transferred via flatbed to the State Police Headquarters garage in Albany, a distance of approximately 160 km (100 miles) from the crash site. The CVPI was held at this facility for the joint inspection by SCI, Ford, FirePanel, and the NYSP.

Vehicle Damage

Exterior – 2003 Ford CVPI

Primary - The back of the CVPI sustained severe damage, concentrated at the left corner area (**Figures 3 and 4**). Maximum crush was 134 cm (52.5") located at the left corner of the bumper beam and at the back left corner of the sheet metal, at the junction of the rear trunk wall and left quarter panel. The direct contact damage began 18 cm (7.1") right of center and extended 79 cm (31.25") along the damage profile to the left rear corner. The impact deformed the full width of the back plane, resulting in a combined induced and direct damage length of 46 cm (18.0") at the bumper beam. The crush profile at the level of the bumper beam using was as follows: C1 = 134 cm (52.6"), C2 = 129 cm (50.9"), C3 = 76 cm (29.9"), C4 = 24 cm (9.6"). A secondary set of crush measurements were documented at the rear edge of the trunk wall, above the bumper system and were as follows: C1 = 134 cm (52.6"), C2 = 125 cm (49.25"), C3 = 92 cm (36.0"), C4 = 31 cm (12.2").

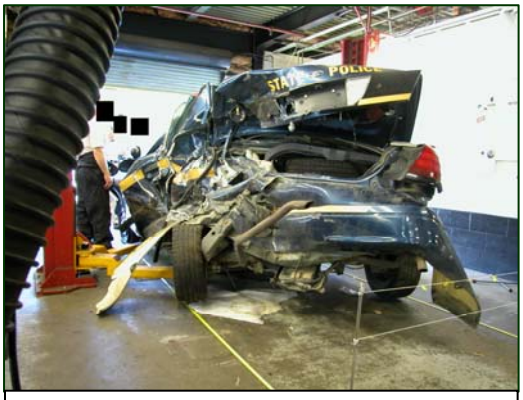

Figure 3. Damaged back plane of 2003 Ford CVPI.

Figure 4. Lateral view documenting the extent of crush.

The rear crush of the left quarter panel extended beyond the level of the left C-pillar with the induced damaged extending onto the left front door. The left C-pillar at the level of the beltline was crushed 80 cm (31.4") forward while the right side, same level was displaced 6 cm (2.4") forward. The junction of the upper C-pillar and backlight header was crushed 29 cm (11.5") forward on the left side and 3 cm (1.0") at the right. The Collision Deformation Classification (CDC) for this event was 06-BYEW-6.

The deformation of the rear impact to the CVPI jammed both left side doors and shattered the backlight and left door glazing. Both right side doors remained closed and operational post-crash with the door glazing remaining intact. The trunk latch released as the Jeep engaged the face of the trunk lid.

The undercarriage of the CVPI sustained significant damage. The left frame rail arch over the rear axle compressed due to the rear crush. The fuel tank was crushed between the forward wall of the trunk and the differential housing and tailpipes. The aluminum driveshaft fractured near the weld joint at the rear yoke. The right trailing arm of the rear suspension fractured at the aft mounting point to the body.

Secondary – The front left area of the CVPI impacted the back of the stopped Chevrolet Cavalier as it was displaced forward by the initial impact (**Figures 5 and 6**). The impact involved the bumper fascia and bumper beam, grille, left front fender, left headlamp assembly, hood, and the upper radiator support. Maximum crush was 13 cm (5.1") at the left corner of the bumper beam and 31 cm (12.2") at the left corner of the upper radiator support. Two crush profiles were documented at the bumper and upper radiator support levels. The profiles were as follows: Bumper – C1 = 13 cm (5.1"), C2 = 8 cm (3.0"), C3 = 8 cm (3.1"), C4 = 6 cm (2.25"), C5 = 4 cm (1.4"), C6 = 3 cm (1.0"); Radiator Support – C1 = 31 cm (12.2"), C2 = 24 cm (9.5"), C3 = 14 cm (5.5"), C4 = 3 cm (1.2"0), C5 = 0 cm C6 = 0 cm. The CDC for this event was 12-FYEW-2.

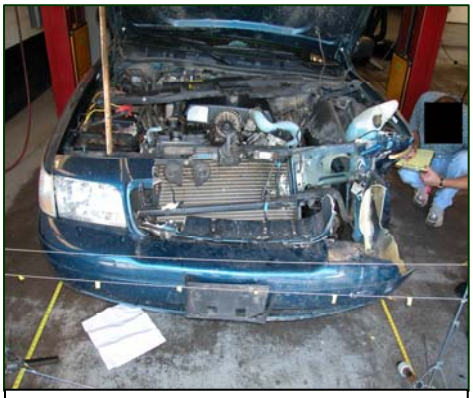

Figure 5- Damaged front plane of 2003 CVPI.

Figure 6. Lateral view documenting the extent of crush.

Exterior – 1998 Jeep Grand Cherokee Laredo

The Jeep Cherokee sustained moderate severity front right damage as a result of the front-to-rear impact sequence with the parked CVPI (**Figures 7 and 8**). Maximum crush was measured at 55 cm (21.5") located at the front right corner of the front bumper beam. The bumper fascia was removed from the vehicle and placed in the rear cargo area of the vehicle. The direct contact damage began 29 cm (11.25") right of center and extended 66 cm (26") to the right corner. The impact deformed the full width of the frontal structure resulting in a combined induced and direct damage width of 119 cm (47"). Six equidistant crush measurements were documented at the level of the bumper beam and were as follows: C1 = 0 cm, C2 = 3 cm (1.2"), C3 = 14 cm (5.4"), C4 = 24 cm (9.3"), C5 = 29 cm (11.4"), C6 = 55 cm (21.5"). The CDC for this impact event was 12-FREW-3.

As the front bumper system crushed rearward, the front right tire and wheel assembly engaged the back plane of the CVPI. This resulted in fracturing of the alloy wheel, penetration of the tire, and a 30 cm (11.75") reduction of the right wheelbase. The left wheelbase was elongated 9 cm (3.5").

Following maximum engagement, the Cherokee rotated in a clockwise direction and overturned onto the travel lanes. The left side alloy wheels engaged the asphalt road surface, which fractured the outer bead of both wheels. Although bead separation occurred, the tires did not de-bead or loose full pressure.

Figure 7. Overall view of 1998 Jeep Grand Cherokee.

Figure 8. Frontal crush to the Cherokee.

The Grand Cherokee initiated a one-quarter turn rollover onto its left side. The vehicle sustained minor severity damage as a result of the overturn. Surface abrasions were noted to the aft edge of the left front wheel flare, the left A-pillar area, both left side door handles, the left rear wheel flare, the left rear door window frame, and the side surface of the rear bumper fascia. Both door handles were damaged with shallow dent to the surrounding sheet metal. The direct contact damage began 4 cm (1.5") aft of the left front axle position and extended 364 cm (143.5") to the rear bumper corner. The CDC for this event was 00-LDAO-2. All left side glazing and the outside rear view mirror remained intact.

Fuel System – 2003 Ford CVPI

The fuel system of the 2003 Ford Crown Victoria consisted of a 72 liter (19 gallon) steel fuel tank that was mounted vertically to the undercarriage, aft of the rear axle and forward of the trunk. The tank was fastened to the vehicle by two steel tank straps that were hinged at the lower aspect of the tank and bolted to the top surface of the undercarriage. An internal electric fuel pump was mounted to the sending unit that was positioned on the upper forward surface of the tank. This sending unit was fastened to the tank with six bolts and sealed with a gasket. A single steel braded fuel supply line was attached to the sending unit output. This fuel line extended the length of the right frame rail to the engine compartment. **Figure 15** below is an undercarriage view of an exemplar 2003 Ford CVPI.

The top surface of the tank was equipped with three valves that were affixed to the tank with rubberized grommets. The blue over-pressurization valve leaked a minimal amount of fuel.

The fuel tank filler tube extended from the left upper side surface of the tank and was formed to fit within the contour of the left inner fender of the quarter panel. The tube was fastened to the quarter panel and was concealed by a door with an interior mounted release mechanism. The filler tube was constructed of a single length of formed steel and was sealed to the tank by a rubber grommet. A plastic spacer extended outboard of the

grommet. Located at this position was a riveted bracket that attached and positioned the filler tube to the outboard seam/flange of the tank.

The steel filler tube extended approximately 17.1 cm (6.75") into the steel fuel tank. A plastic spring loaded check valve was affixed to the inboard end of the tube and was 7.9 cm (3.125") in length. This valve opened during the refueling process and closed to prevent back flow of fuel through the tube. Upon removal from the tank, the check valve was found to be fractured. The filler tube was capped with a plastic ratcheting filler cap.

Fuel Consumption/Refueling

NYSP records indicated that this CVPI averaged 51.9 l/km (13.7 mpg) during the 12 months that preceded the crash. Records also indicated that the vehicle was refueled at 129209 km (80,289 miles), 160 km (100 miles) prior to the crash recorded mileage. Assuming the tank was full to the 72 liter (19 gallon) rating and running at the average fuel consumption rate, the CVPI had consumed approximately 27.6 liters (7.3 gallons) of fuel since the refueling. At the time of the crash, approximately 44.3 liters (11.7 gallons) of fuel remained in the tank.

OEM Shield Kit

The design changes for 2003 CVPI included the factory installed (vs. retrofitted) shield kit that covered the sway bar brackets on the rear axle tubes, the lower mounting points of the tank straps, and a rubberized band shield around the lower lip of the differential cover. This differential band cover (**Figure 9**) was removed for service to the differential unit and was not reinstalled.

The fiberglass reinforced hard plastic shields that covered the sway bar brackets remained intact. These brackets were engaged by the tailpipes. The left shield was cracked 4 cm (1.75") on the outboard aspect. The right shield was cracked at the inboard aspect, but remained intact. Both sway bar clamps released under the shields during the crash.

Figure 9. Rear axle and sway bar bracket shields.

The left tank strap shield was torn from compression of the left tailpipe as the tailpipe was compressed between the tank and the sway bar shield. The right tank strap shield remained intact.

The two rear bolts that fastened the vapor canister cover to the bottom of the trunk floor disengaged allowing the unit to drop and hinge forward on the three forward rivets. These rivets remained intact.

Fuel Tank Removal/Damage

The undercarriage of the CVPI was inspected with the vehicle elevated on a two-post hydraulic lift. The removal of the fuel tank required extensive efforts due to the crushing of the frame and forward displacement of the fuel tank and undercarriage components. This was accomplished by removing the rear drive axle from the vehicle. The shock mounts and link arms were cut to accomplish this task. The left frame rail was compressed at the arch, over the left axle position. The frame was cut at the forward aspect of the arch and a hydraulic spreader was positioned between the base of the left C-pillar and the deformed sheet metal of the trunk and quarter panel. This relieved the compression of the sheet metal against the left side filler tube. Both tank straps were cut and the tank was removed intact without further damage.

Figure 10. Tank engagement against strap.

Figure 11. Strap puncture of fuel tank.

The entire cavity that housed the tank was compressed by the severe crush to the rear of the vehicle. The forward wall of the trunk engaged the tank and compressed the tank against the differential housing. The engagement against the rear differential and tailpipes fractured the FirePanel, disbursing the retardant. There was no penetration of the tank from this contact. An area of deformation to the aft side of the tank began at the right tank strap and extended to the left side of the tank (**Figures 10 and 11**). The lower left aspect of the tank (when viewed in position) was crushed to near full thickness from compression against the left sway bar shield and mounting bracket. Although the shield cracked, the shield remained intact and protected the tank from the bracket.

Figure 12. Water leakage from tank.

The lower left aspect of the tank crushed against the lower left tank strap mount and rubberized shield. This engagement gouged the tank at the strap mount. The gouge measured 8 mm (5/16”) longitudinally and 2 mm (1/16”) in width. A small hole formed

within the gouge measuring approximately 2 mm (1/16") in diameter. Water was poured into the tank and a steady stream spewed from this hole (**Figure 12**).

The filler tube and grommet remained intact and were free of leaks. The two top mounted valves remained intact with only a minimal amount of leakage from the over-pressurization valve. There was no major penetration to the tank, or catastrophic fuel leakage.

Post-Crash Fuel Tank Capacity

An undamaged exemplar 2003 CVPI fuel tank was used as a baseline to establish the full capacity of the tank when removed from the vehicle (**Figure 13**). With the tank positioned vertically with the filler tube opening up, 90 degrees to its installed position, 78.5 liters (20.75 gallons) of water were poured into the tank.

Figure 13. Damaged and exemplar fuel tanks.

The damaged fuel tank from this crash involved CVPI was positioned in a similar placement and filled with water. The punctures of the tank were sealed. Water was poured into the tank using the same calibrated container as the above exercise. Although crushed by damaged, the fuel tank was able to hold 64.8 liters (17.125 gallons) of water, a reduction of 13.7 liters (3.625 gallons). It should be noted that during the crash, the tank probably crushed to a greater extent, and rebounded due to the dynamic properties of the crash.

FirePanel

The aftermarket FirePanel fire suppression system was purchased by the NYSP and installed on all in-service CVPIs. The system consists of a lightweight polymer shell that is molded to the shape of the vertically mounted CVPI fuel tank. The panel is comprised of five horizontally oriented veins filled with a fire suppression powder. The panel is mounted directly to the forward side of the fuel tank using two 5x36 cm (2x14") plastic-type Velcro fasteners. The installation process requires the cleaning of the exterior surface of the OEM fuel tank and the placement of two self-achieve Velcro strips. The mating strips are mounted on the FirePanel. The panel is positioned and the Velcro strips are engaged, which holds the panel securely in place. Two flexible ceramic heat shields are placed over the tail pipes, providing a heat shield between the exhaust and the polymer panel. The shields are held secure by stainless steel band clamps. Each shield measures 30x18 cm (12x7").

Figure 14. Exemplar CVPI without FirePanel.

Figure 15. Exemplar CVPI with FirePanel installed.

The FirePanel measured 103 cm (40.5”) in width and 38 cm (15.0”) in height (straight line measurements). The panel measured 107 cm (42.0”) in width and 46 cm (18.0”) in height when measured along the contour of the panel. FirePanel representatives who were present at the CVPI inspection indicated that the panel contains 2.7 kg (6 lb) of ABC fire retardant. The weight of the panel shell without powder was reported at 1.3 kg (2.9 lb) for a combined weight of 4 kg (8.9 lb). An exemplar FirePanel was weighed on a postal scale during the inspection. The recorded weight of this unit was 4 kg (8 lb, 14 oz), or (8.875 lb).

The panel was designed to fracture when crushed against the tailpipes and the differential of the CVPI. This fracturing disburses the fire retardant, which suppresses ignition in the event of a fuel leakage. Exemplar vehicles with and without a FirePanel are illustrated in **Figures 14 and 15.** Below in **Figure 17** is a comparison between an exemplar and the damaged FirePanel.

Figure 16. Damaged FirePanel.

Figure 17. Exemplar FirePanel.

The FirePanel involved in this crash remained engaged to the steel fuel tank post-crash (**Figure 16**). Due to the severe crush, the panel did engage the tailpipes and the differential cover. The panel cracked at both tailpipe locations and fragmented at the

location of the differential cover, disbursing approximately 50 percent of the fire retardant. Although cracked, the majority of the FirePanel remained intact in its cracked form against the fuel tank.

The panel and its remaining contents were removed from the fuel tank. A cardboard box cover and a plastic tarp were placed under the panel during its removal to capture its contents for evaluation. The final weight of the remaining panel and retardant was 2 kg (4.4 lb), a reduction of 2 kg (4.5 lb) of polymer and retardant. The majority of the weight loss was the retardant.

CVPI Trunk Contents

The trunk of the CVPI contained a multitude of police equipment that was organized in the Ford Trunk Pack, a drop-in formed, high-density polyethylene tub with a clear plastic cover and a Kevlar fabric on the forward wall of the unit. A laterally oriented center partition provided for lateral placement of trunk items, a design and concept to minimize forward displacement of hard, sharp objects such as road flares and fire extinguishers. These objects have penetrated the trunk wall and the fuel tanks in other high-speed rear-end CVPI crashes.

During the joint inspection of this vehicle, the trunk contents were removed and itemized. None of the contents penetrated the forward wall of the trunk or the Kevlar shield of the trunk pack. The trunk pack was crushed to near full thickness at the left side. The contents were as follows:

- First aid kit housed in a plastic case
- Plastic magazine rack to store paper goods
- Length of rope
- Teddy bear
- Carton of road flares (59) mounted laterally
- Wood night stick (broken by the impact)
- Bag containing reflective warning triangles
- 4 D-cell Mag flashlight
- HAZMAT Kit
- Legal clipboard
- Roll of printer paper
- Vehicle Owner's Manual
- Hanging file folders with plastic holder (fractured)
- 2 DWI Blood Kits
- 35 mm compact camera
- 2 paper evidence bags
- 4 oz bottle of hand cleaner
- Crime scene kit
- 2001 ICDA reference book
- Slim-Jim door tool
- NYSP Bio Handbook
- Bungee cord

- Plastic handle snowbrush
- 2 AA batteries
- 1 bag of sand stored on the right side
- OEM jack, captured by intrusion on left side of trunk

The OEM spare tire was properly mounted on the top shelf, above and forward of the trunk pack and underlying fuel tank. The tire was secured with the OEM hold-down; however, the hook end of the hold-down bracket was straightened out from the crash and was found separated on the trunk floor. The tire remained in its original position.

Frontal Air Bag System – CVPI

The 2003 Ford CVPI was equipped with dual stage frontal air bags for the driver and front right passenger positions. In addition, the vehicle was equipped with retractor pretensioners for the front belt systems and an occupant presence sensor in the front right seat. A Restraints Control Module that was mounted to the forward aspect of the center tunnel controlled the air bag system. A satellite crash sensor was mounted to the center of the upper radiator support panel.

The secondary crash with the rear of the 2002 Chevrolet Cavalier resulted in deployment of the driver's air bag. The vehicle was not occupied at the time of the crash, therefore the front right air bag did not deploy.

Occupant Demographics/Data

The CVPI was not occupied at the time of the crash.

Figure 18. Scene Schematic