



## Michigan State Police Tests 1999 Patrol Vehicles

Patrol vehicles are one of the most critical purchases that a law enforcement agency makes. For both large and small agencies, patrol vehicle purchases frequently represent the second largest expenditure, after personnel, in their annual operating budgets. The selection of the right vehicle that balances both the agencies' budgetary and performance requirements has become an increasingly challenging task for police fleet administrators. Many agencies are painfully aware of the consequences that result from being "penny wise and pound foolish," where vehicles with inadequate performance, such as regular production passenger vehicles not specifically designed for police service, are selected because they cost less than "police-package" vehicles. While some agencies have had limited success with nontraditional police vehicles, most agencies find that the increased maintenance costs resulting from such vehicles breaking down under the stress of police service quickly offsets any initial "savings."

For more than 20 years, the Michigan State Police (MSP) has conducted extensive evaluations of the performance capabilities of each new model year's police vehicles as part of its annual vehicle procurement process. Since 1981, the National Institute of Justice (NIJ), through its National Law Enforcement and Corrections Technology Center (NLECTC), has sponsored these tests through a partnership with MSP. By disseminating these results to State and local law enforcement agencies, NIJ helps these agencies select vehicles that maximize their budgets and ensures that evaluated vehicles provide reliable and safe performance under the increased demands of police service.

The 1999 model year patrol vehicles were evaluated from September 19 through 21, 1998. For 1999, several enhancements have been made to the test

format and procedure. The braking evaluation has been made much more rigorous, requiring 12 measured panic stops instead of the 2 that had been done in previous years. The average deceleration rate of all 12 stops is calculated and used as a final score.

Another major change for 1999 is the distinction between "police-package" and "special-service" vehicles. For the purposes of the MSP evaluation, "police-package" vehicles are those that are designed and manufactured for use in the full spectrum of law enforcement patrol service, including high-speed pursuits. A "special-service" vehicle is a vehicle that may be used by law enforcement agencies for general or specialized use (e.g., off-road, inclement weather, K-9, or commercial vehicle enforcement), but is not designed or manufactured to be used in pursuit situations. By creating this distinction, it is hoped that it will be easier for agencies to realistically assess the capabilities of each vehicle.

Each vehicle is subjected to six major tests and evaluations. The results are weighted to reflect the relative importance of each attribute as related to MSP operational requirements. Table 1 lists the

Table 1 Tests and scoring

Test	Points
Vehicle dynamics	30
Acceleration	20
Top speed	15
Braking	20
Ergonomics and communications	10
Fuel economy	5
Total	100

tests and point scores. MSP scores each vehicle's overall performance, reviews the manufacturer's bid price, and calculates a final score for each vehicle using a sophisticated formula that combines the overall performance score and the manufacturer's price.

Ten police-package vehicles and three special-service vehicles were submitted for evaluation. Table 2 provides a complete listing and description of each vehicle. This NLECTC bulletin contains a synopsis of the test results; a detailed report is also available. Page 6 of this bulletin contains information on how to obtain the report.

It should be noted that the MSP vehicle specifications, test categories, and scoring reflect MSP needs. If your department employs this or a similar method, consider your own needs carefully and alter the weighting factors accordingly.

## What's New for 1999

**Chevrolet:** Chevrolet's lineup for 1999 remains basically unchanged from 1998, consisting of a Lumina four-door sedan and the Tahoe 2-wheel-drive, police-package vehicles. A special-service Camaro is also available. The new addition for 1999 is a 4-wheel-drive, special-service version of the Tahoe, which features a standard electronic 4-wheel-drive transfer case. Civilian 4-wheel-drive Tahoes have a manual transfer case and offer the electronic transfer case as an option.

**Ford:** Ford's Crown Victoria has undergone several cosmetic and mechanical changes for 1999. Now known as the Police Interceptor, it features the "Police Interceptor" name badges in place of

"Crown Victoria." All-chrome trim components have been changed to black; however, a "Street Appearance Package" is available for administrative/undercover units, which restores the chrome trim and other retail exterior trim components.

Mechanically, a new 3.55 rear-axle ratio and an 11.25-inch torque converter have been added, which Ford claims will enhance acceleration from 0 to 60 mph. The Antilock Braking System (ABS) will still be available as an option; however, the Traction Control System will no longer be available. The "Speed Sensitive Variable Assist" has been deleted from the power steering system. As in previous years, the Police Interceptor will be

Table 2 Vehicles tested

Category	Vehicle	Engine
Police	Chevrolet Camaro (Automatic)	5.7L (350 cid) SFI
Police	Chevrolet Camaro (6-speed manual)	5.7L (350 cid) SFI
Police	Chevrolet Lumina	3.8L (231 cid) SFI
Police	Chevrolet Tahoe (2-wheel drive)	5.7L (350 cid) SFI
Special Service	Chevrolet Tahoe (4-wheel drive)	5.7L (350 cid) SFI
Police	Chrysler Jeep Cherokee (2-wheel drive)	4.0L (242 cid) PFI
Police	Chrysler Jeep Cherokee (4-wheel drive)	4.0L (242 cid) PFI
Police	Ford Police Interceptor	4.6L (281 cid) SFI
Police	Ford Police Interceptor (CNG)	4.6L (281 cid) SFI
Special Service	Ford Expedition (4-wheel drive)	5.4L (329 cid) SFI
Special Service	Ford Explorer (2-wheel drive)	4.0L (245 cid) PFI
Police	Volvo S-70 T5 Sedan	2.3L (142 cid) PFI Turbo
Police	Volvo V-70 T5 Wagon	2.3L (142 cid) PFI Turbo

cid = Cubic inch displacement    CNG = Compressed natural gas    L = Liter  
PFI = Multiport fuel injection    SFI = Sequential port fuel injection  
Turbo = Turbocharged

**Ford Motor Company submitted three different models for testing (pictured from left to right): the Police Interceptor (tested in both gasoline and compressed natural gas (CNG) fueled versions), the Explorer, and the Expedition.**



Photo courtesy of Michigan State Police.

**Chevrolet Motor Division of General Motors Corporation submitted three models for testing (pictured from left to right): the Camaro (tested in two different versions—a six-speed manual transmission and an automatic transmission), the Lumina, and the Tahoe (also tested in two versions—a 2-wheel-drive police package and a 4-wheel-drive, special-service package).**



Photo courtesy of Michigan State Police.

offered in both a fuel-injected gasoline and a compressed natural gas (CNG) version.

The Explorer special-service package is now offered with a 4.0L (245 cid) engine instead of the 5.0L, which was offered last year. The Explorer is available in a 4-wheel-drive version, but Ford elected not to submit it for testing.

The Expedition special-service package remains basically unchanged from 1998.

**Chrysler/Jeep:** For the 1999 Chrysler/Jeep Cherokee, which once again will be available in both a 2- and 4-wheel-drive version, air conditioning, previously available as an option, is now standard equipment. The braking system also has been upgraded, which Chrysler/Jeep anticipates will enhance braking performance.

**Volvo:** Information not available at press time.

## Vehicle dynamics testing

**Objective:** To determine high-speed pursuit handling characteristics. The 1.635-mile road racing course contains hills, curves, and corners; except for the absence of traffic, it simulates actual pursuit conditions. The evaluation measures each vehicle's blending of suspension components, acceleration capabilities, and braking characteristics.

**Methodology:** Each vehicle is driven at least 12 timed laps by at least three drivers. The final score is the average of the 9 fastest laps.

Table 3 shows the average results of the vehicle dynamics test.

Table 3 Results of vehicle dynamics testing

Make/Model	Average*
Chevrolet Camaro (Automatic)	
5.7L SFI	1:20.37
Chevrolet Camaro (6-speed manual)	
5.7L SFI	1:21.65
Chevrolet Lumina	
3.8L SFI	1:26.80
Chevrolet Tahoe (2-wheel drive)	
5.7L SFI	1:27.50
Chevrolet Tahoe (4-wheel drive)	
5.7L SFI	**
Chrysler Jeep Cherokee (2-wheel drive)	
4.0L PFI	1:26.54
Chrysler Jeep Cherokee (4-wheel drive)	
4.0L PFI	1:27.62
Ford Police Interceptor	
4.6L SFI	1:25.87
Ford Police Interceptor (CNG)	
4.6L SFI	1:30.58
Ford Expedition (4-wheel drive)	
5.4L SFI	**
Ford Explorer (2-wheel drive)	
4.0L PFI	**
Volvo S-70 T5 Sedan	
2.3L PFI Turbo	1:24.29
Volvo V-70 T5 Wagon	
2.3L PFI Turbo	1:25.28

NOTE: Times are in minutes, seconds, and hundredths of a second; i.e., 1:29.74 = 1 minute, 29 seconds, and 74/100 of a second.

\* Average of the 9 fastest laps.

\*\* The vehicle manufacturer has indicated that these vehicles are neither designed for nor intended to be used as pursuit vehicles. Therefore, these vehicles were not subjected to vehicle dynamics testing.

## Acceleration and top-speed testing

### Acceleration

**Qualification test objective:** To determine the ability of each vehicle to accelerate from a standing start to 60 mph within 10 seconds, 80 mph within 17.2 seconds, and 100 mph within 28.2 seconds.

**Competitive test objective:** To determine acceleration time to 100 mph.

**Methodology:** Using a Datron noncontact optical sensor in conjunction with a personal computer, each vehicle is driven through four acceleration sequences—two northbound and two southbound—to allow for wind direction. The average of the four is the score on the competitive test.

### Top speed

**Qualification test objective:** To determine the vehicle's ability to reach 110 mph within 1 mile, and 120 mph within 2 miles.

**Competitive test objective:** To determine the actual top speed (up to 150 mph) attained within 14 miles from a standing start.

**Methodology:** Following the fourth acceleration run, the vehicle continues to accelerate to the top speed attainable within 14 miles from the start of the run. The highest speed attained within the 14 miles is the vehicle's score on the competitive test. Table 4 (page 5) summarizes the acceleration and top-speed test results.

## Braking testing

**Brake test objective:** To determine the deceleration rate attained by each test vehicle on 12, 60-to-0 mph impending skid (threshold) stops, with ABS in operation if the vehicle is so equipped. Each vehicle will be scored on the average deceleration rate it attains.

**Brake test methodology:** Each vehicle will make two decelerations at specific, predetermined points on the test road from 90-to-0 mph at 22 ft/sec<sup>2</sup>, with the driver using a decelerometer to maintain the deceleration rate. Immediately after these "heat-up" stops are completed, the vehicle will be turned around and will make six measured 60-to-0 mph impending skid (threshold) stops with ABS in operation, if the vehicle is so equipped, at specific, predetermined points. Following a 4-minute heat soak, the entire sequence will be repeated. The exact initial velocity at the beginning of each of the 60-to-0 mph decelerations and the exact distance required to make each stop will be recorded by means of a fifth wheel in conjunction with electronic speed and distance meters. The data resulting from the 12 stops will be used to calculate the average deceleration rate, which is the vehicle's score for this test. Table 5 (page 5) shows the results of the braking test.

## Ergonomics and communications

**Objectives:** To rate the vehicle's ability to provide a suitable environment for patrol officers to perform their job, to accommodate the required communications and emergency warning equipment, and to assess the relative difficulty of installing the equipment.

**The Jeep Division of the Chrysler Corporation submitted the Cherokee (pictured at right) in both a 2-wheel-drive and a 4-wheel-drive version.**



Photo courtesy of Michigan State Police.



Table 4 Results of acceleration\* and top-speed testing

Speed (mph)	Chevrolet Camaro (Automatic) 5.7L SFI	Chevrolet Camaro (6-speed manual) 5.7L SFI	Chevrolet Lumina 3.8L SFI	Chevrolet Tahoe (2-wheel drive) 5.7L SFI	Chevrolet Tahoe (4-wheel drive) 5.7L SFI	Chrysler Jeep Cherokee (2-wheel drive) 4.0L SFI	Chrysler Jeep Cherokee (4-wheel drive) 4.0L PFI	Ford Police Interceptor 4.6L SFI	Ford Police Interceptor (CNG) 4.6L SFI	Ford Expedition (4-wheel drive) 5.4L PFI	Ford Explorer (2-wheel drive) 4.0L PFI	Volvo S-70 T5 Sedan 2.3L PFI	Volvo V-70 T5 Wagon 2.3L PFI
0-20	1.64	1.72	2.15	2.10	2.23	2.06	2.19	1.73	2.59	2.11	2.10	2.56	2.65
0-30	2.58	2.60	3.38	3.50	3.70	3.47	3.71	2.93	4.48	3.76	3.61	3.86	4.03
0-40	3.57	3.54	4.85	5.17	5.56	5.03	5.38	4.56	6.44	5.53	5.28	5.23	5.47
0-50	4.81	4.80	6.87	7.47	8.12	7.42	8.04	6.34	8.55	7.93	7.30	6.83	7.19
0-60	6.32	6.12	9.32	10.16	11.06	10.09	10.88	8.55	12.40	11.04	9.88	8.86	9.24
0-70	7.93	7.81	12.10	13.32	14.90	13.26	14.53	11.39	16.17	14.44	13.05	11.13	11.55
0-80	9.80	9.65	15.69	17.62	20.11	18.40	20.38	14.96	20.85	19.54	17.16	13.67	14.30
0-90	12.36	11.75	20.55	23.95	26.31	24.58	27.31	19.27	27.41	26.89	23.33	17.27	17.96
0-100	15.18	14.46	26.71	32.00	—	32.77	36.66	25.33	38.21	38.26	—	21.30	22.37
<b>Top Speed in mph</b>	<b>159</b>	<b>159</b>	<b>124</b>	<b>121</b>	<b>97</b>	<b>111</b>	<b>111</b>	<b>129</b>	<b>106</b>	<b>107</b>	<b>99</b>	<b>146</b>	<b>140</b>

\* Figures represent the average of four runs.

Table 5 Results of braking test

Phase I	Chevrolet Camaro (Automatic) 5.7L SFI	Chevrolet Lumina 3.8L SFI	Chevrolet Tahoe (2-wheel drive) 5.7L SFI	Chevrolet Tahoe (4-wheel drive) 5.7L SFI	Chrysler Jeep Cherokee (2-wheel drive) 4.0L PFI	Chrysler Jeep Cherokee (4-wheel drive) 4.0L PFI	Ford Police Interceptor 4.6L SFI	Ford Police Interceptor (CNG) 4.6L SFI	Ford Expedition (4-wheel drive) 5.4L PFI	Ford Explorer (2-wheel drive) 4.0L PFI	Volvo S-70 T5 Sedan 2.3L PFI	Volvo V-70 T5 Wagon 2.3L PFI
Avg. initial speed (mph)*	60.28	60.13	60.92	60.67	60.35	60.60	60.73	60.63	60.43	60.60	60.50	60.73
Avg. stopping distance (ft)*	142.9	164.8	171.6	185.4	161.2	170.4	143.2	147.2	174.3	200.8	159.5	161.9
Avg. deceleration rate* (ft/sec sqd)	27.43	23.62	23.25	21.39	24.39	23.16	27.73	26.85	22.64	19.68	24.75	24.47
Phase II												
Avg. initial speed (mph)*	60.53	60.43	60.67	60.52	60.68	60.67	60.28	60.55	60.45	60.68	60.58	60.40
Avg. stopping distance (ft)*	140.1	167.7	171.0	192.7	166.0	184.1	139.9	149.3	170.4	177.0	162.9	160.2
Avg. deceleration rate* (ft/sec sqd)	28.13	23.43	23.15	20.46	23.94	21.52	27.94	26.43	23.07	22.40	24.25	24.50
<b>Average Deceleration Rate (ft/sec sqd)**</b>	<b>27.78</b>	<b>23.53</b>	<b>23.20</b>	<b>20.93</b>	<b>24.17</b>	<b>22.34</b>	<b>27.83</b>	<b>26.64</b>	<b>22.85</b>	<b>21.40</b>	<b>24.50</b>	<b>24.49</b>
Projected stopping distance from 60 mph based on average deceleration rate (ft)	139.4	164.6	166.9	185.0	160.2	173.3	139.1	145.4	169.4	184.1	158.0	158.1

All vehicles have antilocking braking systems.  
 \* Figures represent the average of six measured stops.  
 \*\* Calculated from the average deceleration rate (ft/sec sqd) of all 12 measured stops.

**Methodology:** A minimum of four officers independently and individually score each vehicle on comfort and instrumentation. Personnel from the Vehicle and Travel Services Division who are responsible for new car preparation conduct the communications portion of the evaluation based on the relative difficulty of the necessary installations. Each factor is graded on a 1-to-10 scale, with 1 representing totally unacceptable and 10 representing superior. The scores are averaged to minimize personal prejudice. Table 6 shows the results of the ergonomics and communications test. (Only one of each model was tested since the interior dimensions are essentially the same.)

## Fuel economy

**Objective:** To determine fuel economy potential. The scoring data are valid and reliable for comparison but may not necessarily be an accurate prediction of the car's actual fuel economy.

**Methodology:** The vehicles' scores are based on estimates of city fuel economy to the nearest one-tenth of a mile per gallon from data supplied by the vehicle manufacturers. Table 7 shows the estimated Environmental Protection Agency (EPA) fuel economy.

If you would like a copy of the full report, write or call the National Law Enforcement and Corrections Technology Center, P.O. Box 1160, Rockville, MD 20849-1160, 800-248-2742, or 301-519-5060; or download it from JUSTNET, <http://www.nlectc.org>.

Table 6 Results of ergonomics and communications test

Vehicle	Score
Chevrolet Camaro	155.43
Chevrolet Lumina	189.79
Chevrolet Tahoe (2WD)	222.07
Chevrolet Tahoe (4WD)	222.05
Chrysler Jeep Cherokee	176.59
Ford Police Interceptor	217.87
Ford Police Interceptor (CNG)	215.23
Ford Expedition	220.19
Ford Explorer	202.52
Volvo S-70 T5 Sedan	182.64
Volvo V-70 T5 Wagon	181.61

\*Scores are the total points the automobile received for each of 29 attributes the MSP considers important in determining the acceptability of the vehicle as a patrol car—for example, front seat adjustability, clarity of instrumentation, and front and back visibility. The higher the number, the better the vehicle scored.

Table 7 Fuel economy

Make/Model	City EPA miles per gallon
Chevrolet Camaro (Automatic) 5.7L (350 cid) SFI	**
Chevrolet Camaro (6-speed manual) 5.7L (350 cid) SFI	**
Chevrolet Lumina 3.8L (231 cid) SFI	**
Chevrolet Tahoe (2-wheel drive) 5.7L (350 cid) SFI	13.1
Chevrolet Tahoe (4-wheel drive) 5.7L (350 cid) SFI	12.3
Chrysler Jeep Cherokee (2-wheel drive) 4.0L (242 cid) PFI	15.9
Chrysler Jeep Cherokee (4-wheel drive) 4.0L (242 cid) PFI	15.8
Ford Police Interceptor 4.6L (281 cid) SFI	15.9
Ford Police Interceptor (CNG) 4.6L (281 cid) SFI*	14.3
Ford Expedition (4-wheel drive) 5.4L (329 cid) SFI	11.7
Ford Explorer (2-wheel drive) 4.0L (245 cid) PFI	15.7
Volvo S-70 T5 Sedan 2.3L (142 cid) PFI Turbo	18.4
Volvo V-70 T5 Wagon 2.3L (142 cid) PFI Turbo	18.4

\*EPA mileage estimate is in gasoline equivalent.

\*\*Information not available at press time.

**Pictured from left to right are the Volvo S-70 T5 Sedan and the Volvo V-70 T5 Wagon, which were also evaluated during this year's testing.**



Photo courtesy of Michigan State Police.

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The National Institute of Justice is a component of the Office of Justice Programs, which also includes the Bureau of Justice Assistance, Bureau of Justice Statistics, Office of Juvenile Justice and Delinquency Prevention, and Office for Victims of Crime.

# New Publications/Videos

**The following publications/videos are available from the National Law Enforcement and Corrections Technology Center–National:**

**TechBeat, Fall 1998.** Featured in this issue are process mapping computer technology which was used to improve a domestic violence response program, and the use of DNA analysis to solve crimes.

**TechBeat, Summer 1998.** This issue of *TechBeat* examines vehicle-stopping technology, communications interoperability among law enforcement and other public safety agencies, and computer software for fleet managers.

**Pursuit Management Task Force Report.** In August 1996, the National Institute of Justice's Office of Science and Technology created the Pursuit Management Task Force (PMTF) to conduct a multidisciplinary effort to define police practices and the role of technology in high-speed police pursuits. This report assesses current technologies and techniques related to pursuits and provides recommendations on technology development and commercialization, an overview of legal issues related to pursuits and related technologies, and information obtained from surveys completed by agencies, line officers, and the public related to pursuits and technology.

**Selection and Application Guide to Police Body Armor.** While body armor is a household word in the law enforcement community, questions about its selection and use are frequently asked. This guide provides information to help determine the level of protection required by officers.

**The following publications/videos will be available soon:**

**"Why Can't We Talk?" When Lives Are at Stake.** This videotape examines the issues and problems surrounding interoperability and public safety radio communications. Learn why planning, designing, and funding public safety wireless communications systems are critical activities for ensuring the public welfare.

**Positional Asphyxia Videotape.** This informational videotape, targeted to the many smaller county municipal jail facilities throughout the United States, details actions to prevent in-custody deaths related to positional asphyxia. The video highlights the correct procedures to use when restraining a violent prisoner and safety precautions to follow to help jail personnel prevent medical problems.

To obtain any of the above publications or videotapes, write NLECTC, P.O. Box 1160, Rockville, MD 20849-1160 or telephone 800-248-2742. Publications can also be downloaded from JUSTNET at <http://www.nlectc.org>.

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