National Law Enforcement and Corrections Technology Center

BULLETIN

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Michigan State Police Tests 2004 Patrol Vehicles

Patrol vehicles are among 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. Selecting a vehicle that balances both 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. Although 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 offset any initial savings.

For more than 25 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) system, 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 2004 model year patrol vehicles were evaluated from September 20 through 22, 2003. 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 pursuits. A special-service vehicle is a vehicle that may be used by law enforcement agencies for specialized use (e.g., off-road, inclement weather, K–9, or commercial vehicle enforcement), but is not designed or manufactured to be used in high-speed or 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. Exhibit 1 lists the 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 both factors.

Exhibit 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**

Four police-package vehicles and four special-service vehicles were submitted for evaluation. Exhibit 2 provides a list and description of each vehicle. This NLECTC bulletin contains a synopsis of the test results; a detailed report also is available. Page 8 of this bulletin contains information on how to obtain the report.

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 2004

Chevrolet: For the 2004 model year, the Impala is once again available in both the 9C1 police package and the 9C3 unmarked police package. Emission controls that comply with the New England States and California emissions requirements are now available on both the 9C1 and 9C3 Impalas, but must be specified at the time the vehicle is ordered. Also, for the 2004 model year, the turnkey equipment installation program available through Kerr Industries has been expanded to include such items as—

- Fold-down equipment tray and trunk organizers.
- Low-profile deck lamps.
- Power distribution center for accessory equipment.
- Full-size wheel covers.

The Tahoe is once again available in either a 2-wheel-drive (2WD) or 4-wheel-drive (4WD) special-service package, in what is essentially a carryover from the 2003 model. In addition to the standard 4.8L (292 cid) engine, the 5.3L (327 cid) engine, rated at 285 horsepower, is an available option on both models.

DaimlerChrysler: The Dodge Intrepid police-package sedan returns for a third consecutive model year. The 2004 Intrepid remains basically unchanged from last year, with the exception of new rear brake pads, which representatives of DaimlerChrysler's police vehicle engineering team say will assist in preventing premature front brake wear. DaimlerChrysler representatives also indicate that this will be the last year of production for the Intrepid police-package sedan, as DaimlerChrysler indicates it will introduce a completely new, yet-to-be-announced police-package vehicle in the 2005 model year.

Ford: For 2004, the Police Interceptor features several powertrain improvements. A new air induction system increases the maximum rated horsepower (hp) of the Police Interceptor to 250, an increase of 11 hp from last year. Also available is an optional 3.55 rear-axle ratio, which Ford representatives state will enhance

Exhibit 2 **Vehicles tested**

Category	Vehicle	Engine
Police	Chevrolet Impala	3.8L (231 cid) SPFI
Special Service	Chevrolet Tahoe (2-wheel drive)	5.3L (327 cid) SPFI
Special Service	Chevrolet Tahoe (4-wheel drive)	5.3L (327 cid) SPFI
Police	DaimlerChrysler Dodge Intrepid	3.5L (214 cid) SPFI
Police	Ford Police Interceptor (3.27 axle ratio)	4.6L (281 cid) SPFI
Police	Ford Police Interceptor (3.55 axle ratio)	4.6L (281 cid) SPFI
Special Service	Ford Expedition (2-wheel drive)	5.4L (330 cid) SMPI
Special Service	Ford Explorer (2-wheel drive)	4.6L (281 cid) SPFI

cid = cubic inch displacement
MPFI = multiport fuel injection
L = liter
SPFI = sequential port fuel injection
SMPI = sequential multiport fuel injection

vehicle acceleration times, although it will reduce the maximum top speed of the vehicle to 119 mph. A new high-output generator, rated at 200 amp maximum, is now standard, as is a trunk-mounted power distribution box, which provides electrical power for accessories and equipment installed in the trunk.

New interior safety features for 2004 include stand-alone side air bags, which can be ordered as a separate option (previously only available in conjunction with the optional power seat package), and optional laminated security side glass. Also new for 2004 is Ford's Trunk Pack™, a drop-in high-density polyethylene plastic shell with DuPont™ KEVLAR® lining on the forward side, which Ford representatives state will reduce the risk of police equipment mounted in the trunk from penetrating into the back seat or fuel tank in high-speed rear impacts.

A compressed natural gas (CNG) version of the Police Interceptor will be available in January 2004. However, Ford indicates that this will be the final year of production for the CNG version. The Explorer, Expedition, and Excursion sport utility vehicles (SUVs) are again available as special-service packages in a wide array of trim and equipment levels. Available options include 4WD or all-wheel-drive systems, a variety of gasoline and diesel engines, and several new exterior color options on each vehicle. The 2004 model year will be the final year of production for the Excursion SUV.

Vehicle Dynamics Testing

Objective: To determine high-speed pursuit handling characteristics. The 2-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: All vehicles are driven over the course a total of 32 timed laps by four separate drivers, each driving an 8-lap series. The final score for the vehicle is the combined average of the 5 fastest laps of each of the four drivers.

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

Acceleration and Top-Speed Testing

Acceleration

Objective: To determine the time required for each test vehicle to accelerate from a standing start to 60 mph, 80 mph, and 100 mph.

Methodology: Using a Datron Non-Contact 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.

Exhibit 3 **Results of vehicle dynamics testing**

Make/Model	Average*
Chevrolet Impala 3.8L SPFI	01:44.70
Chevrolet Tahoe (2-wheel drive) 5.3L SPFI	**
Chevrolet Tahoe (4-wheel drive) 5.3L SPFI	**
DaimlerChrysler Dodge Intrepid 3.5L SPFI	01:42.02
Ford Police Interceptor (3.27 axle ratio) 4.6L SPFI	01:42.09
Ford Police Interceptor (3.55 axle ratio) 4.6L SPFI	01:41.98
Ford Expedition (2-wheel drive) 5.4L SMPI	**
Ford Explorer (2-wheel drive) 4.6L SPFI	**

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

* Average of the 20 fastest laps out of 32 total laps (the overall average of the 5 fastest laps for each of the four test drivers).

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

Exhibit 4 **Results of acceleration and top-speed testing**

Speed (mph)	Chevrolet Impala	Chevrolet Tahoe (2WD)	Chevrolet Tahoe (4WD)	Daimler-Chrysler Dodge Intrepid	Ford Police Interceptor (3.27 axle ratio)	Ford Police Interceptor (3.55 axle ratio)	Ford Expedition (2WD)	Ford Explorer (2WD)
0–20	2.00	1.88	2.02	1.91	1.78	1.78	1.96	1.72
0–30	3.20	3.13	3.33	3.13	3.09	2.99	3.40	2.93
0–40	4.58	4.43	4.71	4.50	4.47	4.42	5.00	4.41
0–50	6.51	4.36	6.76	6.37	6.20	6.15	7.44	6.30
0–60	9.00	8.58	9.20	8.56	8.44	8.25	10.11	8.90
0–70	11.76	10.97	11.81	11.21	10.89	10.63	13.24	11.79
0–80	15.24	14.72	16.00	14.15	13.88	13.74	17.64	15.54
0–90	20.31	19.50	21.46	18.40	18.15	17.90	23.67	21.10
0–100	26.42	N/A	N/A	23.56	23.30	22.52	N/A	28.25
Top speed	**123**	**99**	**99**	**135**	**128**	**118**	**100**	**107**

Note: Figures represent the average of four runs. All vehicles are equipped with electronic speed limiters.

N/A = Vehicle did not achieve or exceed 100 mph.

Top Speed

Objective: To determine each vehicle's speed at a distance of 1 mile and 2 miles and the actual top speed attainable within a distance of 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.

Exhibit 4 summarizes the acceleration and top-speed test results.

Braking Testing

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.

Photo courtesy of Michigan State Police.

DaimlerChrysler submitted the Dodge Intrepid sedan for testing. This will be the last year of production for the Intrepid police-package vehicle.

Methodology: Each vehicle makes two decelerations at specific, predetermined points on the test road from 90 to 0 mph at 22 ft/sec^2, with the driver using a decelerometer to maintain the deceleration rate. Immediately after these heat-up stops are completed, the vehicle is turned around and makes 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 is 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 are recorded by means of a Datron Non-Contact Optical Sensor in conjunction with a personal computer. 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. Exhibit 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.

Methodology: A minimum of four officers independently and individually score each vehicle on comfort and instrumentation. Personnel from MSP's Communications 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. Exhibit 6 shows a comparison of the exterior and interior

Exhibit 5 **Results of braking test**

Phase I	Chevrolet Impala	Chevrolet Tahoe (2WD)	Chevrolet Tahoe (4WD)	Daimler-Chrysler Dodge Intrepid	Ford Police Interceptor (3.27 axle ratio)	Ford Police Interceptor (3.55 axle ratio)	Ford Expedition (2WD)	Ford Explorer (2WD)
Avg. initial speed (mph)*	59.8	60.0	60.1	59.8	59.8	60.1	60.1	60.3
Avg. stopping dist. (ft)*	133.02	142.25	146.40	138.25	150.95	151.35	143.37	143.13
Avg. deceleration rate (ft/sec^2)*	28.9	27.2	26.5	27.8	25.5	25.7	27.1	27.3
Phase II								
Avg. initial speed (mph)*	59.9	59.4	59.9	59.8	59.7	60.1	59.8	60.1
Avg. stopping dist. (ft)*	133.83	139.47	144.53	134.53	146.12	150.92	141.88	142.38
Avg. deceleration rate (ft/sec^2)*	28.8	27.2	26.7	28.5	26.3	25.8	27.1	27.3
Avg. Deceleration Rate (ft/sec^2)**	28.85	27.19	26.61	28.18	25.89	25.74	27.09	27.3
Projected stopping distance from 60 mph based on average deceleration rate (ft)	**134.2**	**142.4**	**145.5**	**137.4**	**149.6**	**150.4**	**142.9**	**141.8**

Note: All vehicles have antilocking braking systems.

* Figures represent the average of six measured stops.

** Calculated from the average deceleration rate (ft/sec^2) of 12 measured stops.

Exhibit 6 **Summary of exterior and interior dimensions**

Manufacturer/Model	Length (inches)	Height (inches)	Wheelbase (inches)	Weight (lbs)	Head Room (front)	Head Room (rear)	Leg Room (front)	Leg Room (rear)
Chevrolet Impala	200.1	57.3	110.5	3,583	39.2	36.8	42.2	38.4
Chevrolet Tahoe	198.9	76.3	116.0	5,046/5,370 (a)	40.7	39.4	41.3	38.6
DaimlerChrysler								
Dodge Intrepid	203.7	55.9	113.0	3,567	38.3	37.5	42.2	39.1
Ford Police Interceptor	212.0	58.5	114.7	4,200/4,185 (b)	39.4	38.0	42.5	39.6
Ford Expedition	205.8	77.4	119.0	5,444	39.7	39.8	41.2	38.7
Ford Explorer (2WD)	189.5	71.4	114.0	4,421	39.9	38.9	42.4	37.2

Manufacturer/Model	Shoulder Room (front)	Shoulder Room (rear)	Hip Room (front)	Hip Room (rear)	Interior, Front (cubic feet)	Interior, Rear (cubic feet)	Interior, Combined (cubic feet)	Trunk Capacity/ Max. Cargo* (cubic feet)	Fuel Capacity (gallons)
Chevrolet Impala	59.0	58.9	56.5	55.7	56.5	48.2	104.7	18.6 (c)	17.0
Chevrolet Tahoe	65.2	65.1	61.4	61.3	94.3	57.3	151.6	57.3	26.0
DaimlerChrysler									
Dodge Intrepid	59.0	58.1	56.3	56.6	55.0	49.5	104.5	18.4	17.0
Ford Police Interceptor	60.8	60.3	57.1	59.0	58.2	51.1	109.3	20.6	19.0
Ford Expedition	63.4	64.3	63.0	62.4	93.2	55.8	149.0	106.1	28.0
Ford Explorer (2WD)	59.1	58.9	55.0	54.2	81.8	44.5	126.3	88.0	22.5

* Sedans are measured for trunk capacity; SUVs and special-service vehicles are measured for maximum cargo (rear seats folded down).

(a) 2-wheel drive/4-wheel drive.

(b) 3.27 axle ratio/3.55 axle ratio.

(c) With compact spare tire.

Photo courtesy of Michigan State Police.

Ford Motor Company submitted the Police Interceptor (front), the Expedition (left rear), and the Explorer (right rear) for testing.

dimensions of the vehicles evaluated. Exhibit 7 shows the results of the ergonomics and communications test.

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 1/10 of a mile per gallon from data supplied by the vehicle manufacturers. Exhibit 8 shows the estimated Environmental Protection Agency (EPA) fuel economy ratings, rounded to the nearest whole number, for city, highway, and combined driving conditions.

Exhibit 7 **Results of ergonomics and communications test**

Manufacturer/Model	Score
Chevrolet Impala	206.78
Chevrolet Tahoe (2WD)	217.40
Chevrolet Tahoe (4WD)	217.40
DaimlerChrysler Dodge Intrepid	196.70
Ford Police Interceptor	199.50
Ford Expedition (2WD)	187.67
Ford Explorer (2WD)	210.98

Note: Scores are the total points the automobile received for each of the 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.

Photo courtesy of Michigan State Police.

Chevrolet Motor Division of General Motors Corporation submitted (from left to right) the Tahoe (4WD and 2WD) and the Impala for testing.

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Exhibit 8 **Fuel economy**

Manufacturer/Model	EPA Miles Per Gallon City	Highway	Combined
Chevrolet Impala 3.8L (231 cid) SPFI	20	29	23
Chevrolet Tahoe (2-wheel drive) 5.3L (327 cid) SPFI	15	20	16.5
Chevrolet Tahoe (4-wheel drive) 5.3L (327 cid) SPFI	14	18	16.5
DaimlerChrysler Dodge Intrepid 3.5L (214 cid) SPFI	19	27	22
Ford Police Interceptor 4.6L (281 cid) SPFI	16	21	18
Ford Expedition (2-wheel drive) 5.4L (330 cid) SMPI	13	17	15
Ford Explorer (2-wheel drive) 4.6L (281 cid) SPFI	15	20	17

If you would like a copy of the full report, write or call the National Law Enforcement and Corrections Technology Center, 2277 Research Boulevard, Mail Stop 8J, Rockville, MD 20850, 800–248–2742, or 301–519–5060; or download it from JUSTNET, www.justnet.org.

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