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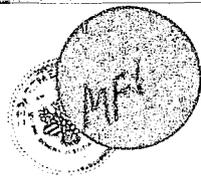
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# National Institute of Justice

# TAP Alert

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TECHNOLOGY ASSESSMENT PROGRAM

## Michigan State Police Test 1988 Patrol Vehicles

Every year the Michigan State Police (MSP) test new patrol vehicles as part of their procurement policy. This year, on September 19 and 21, the MSP tested 10 vehicles. This TAP Alert contains the preliminary results of the test. The full report is expected in November.

Each vehicle is subjected to six major types of 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 tests and point scores.

Table 1. Tests and Scoring

Test	Points
Vehicle dynamics	30
Acceleration	20
Top speed	20
Brake testing	10
Ergonomics and communication	10
Fuel economy	10
Total score	100

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

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 carefully your own needs and alter the weighting factors accordingly.

Table 2 lists the vehicles tested in alphabetical order without regard to their performance on the tests.

### Vehicle Dynamics Testing

**Objective:** To determine high-speed pursuit handling characteristics. The 1.635-mile road racing course contains hills, curves, and corners; except

Table 2. Vehicles Tested

Car	Engine*
Ch vrolet Caprice	5.7L (350 cid) 4 BBL
Chevrolet Caprice	4.3L (262 cid) TBI
Dodge Diplomat	5.2L (318 cid) 4 BBL
Dodge Diplomat	5.2L (318 cid) 2 BBL
Ford Crown Victoria	5.8L (351 cid) VV H.O.
Ford Crown Victoria	5.0L (302 cid) PFI
Ford Mustang (Automatic)	5.0L (302 cid) PFI H.O.
Ford Mustang (5-Speed)	5.0L (302 cid) PFI H.O.
Plymouth Gran Fury	5.2L (318 cid) 4 BBL
Plymouth Gran Fury	5.2L (318 cid) 2 BBL

\*PFI = Port fuel injection  
TBI = Throttle body injection  
VV = Variable venturi  
BBL = Barrel  
H.O. = High output

for the absence of traffic, it simulates actual pursuit conditions. The evaluation measures the vehicle's blending of suspension components, acceleration capabilities, and braking characteristics.

**Methodology:** Each vehicle is driven at least 15 timed laps by at least three drivers. The final score is the average of the fastest 12 timed laps.

Table 3 shows the results of the vehicle dynamics test.

### 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 13.6 seconds, 80 mph within 24.3 seconds, and 100 mph within 43.2 seconds. (The qualifying times changed this year.)

**Competitive Test Objective:** To determine acceleration time to 100 mph.

Table 3. Results of Vehicle Dynamics Testing

<u>Vehicles</u>	<u>Drivers</u>	<u>Lap 1</u>	<u>Lap 2</u>	<u>Lap 3</u>	<u>Lap 4</u>	<u>Average*</u>
Chevrolet Caprice 5.7L-4 BBL	Floate	1:28.26	1:28.14	1:28.25	1:28.74	1:28.60
	Ring	1:29.01	1:28.75	1:28.48	1:29.68	
	Steendam	1:29.70	1:29.22	1:29.56	1:29.99	
	Halliday	1:28.15	1:28.52	1:28.48	1:28.21	
Dodge Diplomat 5.2L-4 BBL	Floate	1:29.33	1:29.31	1:29.07	1:29.11	1:29.27
	Ring	1:29.27	1:29.47	1:29.91	1:29.44	
	Steendam	1:30.21	1:29.67	1:29.43	1:29.38	
	Halliday	1:29.31	1:29.12	1:28.97	1:29.65	
Ford Crown Vic. 5.8L-VV	Floate	1:28.46	1:28.43	1:28.15	1:28.39	1:28.60
	Ring	1:28.44	1:28.85	1:28.97	1:29.53	
	Steendam	1:28.96	1:28.50	1:29.17	1:29.72	
	Halliday	1:28.44	1:28.42	1:30.09	1:29.87	
Ford Mustang (Automatic) 5.0L-PFI	Floate	1:24.78	1:24.07	1:23.52	1:23.08	1:23.79
	Ring	1:24.47	1:24.19	1:23.61	1:23.67	
	Steendam	1:24.00	1:23.48	1:23.38	1:23.83	
	Halliday	1:24.46	1:25.32	1:26.23	1:24.24	
Ford Mustang (5-Speed) 5.0L-PFI	Floate	1:23.17	1:23.25	1:23.49	1:23.19	1:22.57
	Ring	1:23.39	1:22.50	1:22.63	1:22.92	
	Steendam	1:22.97	1:22.82	1:21.89	1:22.69	
	Halliday	1:22.43	1:21.79	1:22.22	1:22.83	
Plymouth Gran Fury 5.2L-4 BBL	Floate	1:29.25	1:29.00	1:29.47	1:29.39	1:29.43
	Ring	1:29.46	1:29.77	1:29.88	1:29.48	
	Steendam	1:30.04	1:29.77	1:29.85	1:29.58	
	Halliday	1:29.61	1:30.05	1:29.31	1:29.03	

\*Calculated from best 12 laps. Identical averages for the Chevrolet Caprice and Ford Crown Victoria are entirely coincidental.

All times in minutes, seconds, and hundredths of a second, i.e., 1:28.32 = 1 minute, 28 seconds, and 32/100 of a second.

**Methodology:** Using a fifth wheel in conjunction with a microprocessor and integrated printer, each vehicle is driven through four acceleration sequences--two northbound and two southbound to allow for wind direction. The average of the four times is used to derive scores on the competitive test.

#### Top Speed

**Qualification Test Objective:** To determine the vehicle's ability to reach 110 mph within 2 miles.

**Competitive Test Objective:** To determine the actual top speed obtained 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 summarizes the acceleration and top speed tests.

#### Braking Test

**Qualification Test Objective:** To determine the ability of the vehicle to make a panic stop within its own lane and to evaluate brake fade.

**Competitive Test Objective:** To determine the deceleration rate on two 60 to 0 mph impending skid stops. Vehicles are scored on their average deceleration rate attained in comparison with the other vehicles in the test group.

**Methodology:** Each vehicle is first required to make four decelerations at 22 feet per second using a deceleration rate formula from 90 to 0 mph, with the driver using a decelerometer to maintain the deceleration rate. The vehicle then makes a 60 to 0 mph impending skid. The exact initial velocity at the beginning of the deceleration and the exact distance required to make the stop are recorded by means of a fifth wheel with electronic digital speed and distance meters. From these figures, the average deceleration rate for the stops is calculated. Following a 4-minute cooling period, this sequence is repeated. The second sequence is followed by one 60 to 0 mph panic stop to determine both the ability of the brakes to lock and the ability of the vehicle to

stop in a straight line within its lane and to detect evidence of brake fade.

Table 5 shows the results of the braking test.

#### Ergonomics and Communications

**Objective:** 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 the Radio Installation and Garage Units conduct the communications portion of the evaluation based on the relative difficulty of the necessary installations. Only one of each size vehicle is tested since the interior dimensions are essentially the same.

Each factor is graded on a one-to-ten scale with one representing totally unacceptable and ten representing superior. The scores are averaged to minimize personal prejudice.

The results of the ergonomics and communications testing were not available at the time of publication. They will be included in the full report, which is expected in November.

#### Fuel Economy

**Objective:** To determine fuel economy potential. The scoring data are valid and reliable for comparison but may not necessarily accurately predict the car's actual fuel economy.

**Methodology:** The vehicles will be scored based on estimates for city fuel economy to the nearest 1/10th mile per gallon developed from data supplied by the vehicle manufacturers.

Table 6 shows the estimated EPA fuel economy.

If you would like a copy of the full report when it is available in November, write or call the Technology Assessment Program Information Center, Box 6000, Rockville, MD 20850, 800-248-2742 (301-251-5060 in Maryland and Metropolitan Washington, D.C.).

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Table 4. Results of Acceleration and Top Speed Testing

Speed:	Chevrolet	Chevrolet	Dodge	Dodge	Ford	Ford	Ford	Ford	Plymouth	Plymouth
4-run average	Caprice	Caprice	Diplomat	Diplomat	Crown Vic.	Crown Vic.	Mustang	Mustang	Gran Fury	Gran Fury
in seconds	5.7L-4 BBL	4.3L-TBI	5.2L-4 BBL	5.2L-2 BBL	5.8L-VV	5.0L-PFI	(Auto) 5.0L-PFI	(5-Speed) 5.0L-PFI	5.2L-4 BEL	5.2L-2 BBL
0-20 MPH	2.21	2.79	2.54	3.10	2.62	2.04	1.80	1.81	2.80	3.11
0-30 MPH	3.68	4.59	4.20	5.28	4.46	3.74	3.13	2.60	4.51	5.38
0-40 MPH	5.59	7.02	5.98	7.61	6.46	5.66	4.48	3.89	6.41	7.69
0-50 MPH	7.84	10.18	8.56	10.34	8.74	8.22	5.96	5.33	9.01	10.44
0-60 MPH	10.59	13.76	11.55	14.05	11.90	11.41	7.99	6.90	12.14	14.22
0-70 MPH	14.37	19.21	15.13	18.91	15.64	15.59	10.36	9.28	15.94	19.05
0-80 MPH	19.32	26.89	21.91	25.19	20.65	20.96	13.03	11.70	22.21	25.12
0-90 MPH	25.47	37.35	28.86	36.30	27.74	28.21	17.02	14.81	29.56	35.16
0-100 MPH	34.91	52.44	38.76	57.21	37.67	40.62	21.78	19.07	40.13	57.84
<b>Distance to reach:*</b>										
100 MPH (miles)	.67	1.04	.75	1.17	.72	.81	.40	.35	.77	1.17
110 MPH (miles)	1.25	----	1.25	4.44	1.23	----	.56	.49	1.35	5.73
Top speed (MPH)	116.00	109.00	117.00	110.00	117.00	108.00	135.00	134.00	117.00	110.00
<b>Quarter mile (average):*</b>										
Time (seconds)	18.03	19.90	18.59	20.08	18.84	18.35	16.16	15.48	19.01	20.18
Speed (MPH)	77.55	70.35	75.43	71.85	76.43	75.25	87.78	91.10	74.80	71.83

\*Obtained from Strip Chart Recordings of Acceleration Runs

Table 5. Results of Braking Test

	Chevrolet Caprice 5.7L-4 BBL	Dodge Diplomat 5.2L-4 BBL	Ford Crown Victoria 5.8L-VV	Ford Mustang (5-Speed) 5.0L-PFI	Plymouth Gran Fury 5.2L-4 BBL
<b>Phase I</b>					
Initial speed (MPH)	60.2	60.9	60.6	59.9	60.7
Stopping distance (ft)	150.3	160.0	144.6	152.5	168.3
Deceleration rate (ft/sec <sup>2</sup> )	25.94	24.93	27.32	25.31	23.55
<b>Phase II</b>					
Initial speed (MPH)	60.8	60.4	60.5	59.8	60.0
Stopping distance (ft)	158.1	157.5	149.9	147.6	161.9
Deceleration rate (ft/sec <sup>2</sup> )	25.15	24.91	26.26	26.06	23.92
<b>Average</b>					
Deceleration rate (ft/sec <sup>2</sup> )	25.55	24.92	26.79	25.69	23.74
Stopping distance from 60 MPH based on average deceleration rate (ft)					

Table 6. Fuel Economy

Vehicle Make/Model	EPA Miles Per Gallon		
	City*	Highway	Combined
Chevrolet Caprice 5.7L (350 cid) 4 BBL	13 (13.5)	20	16
Chevrolet Caprice 4.3L (262 cid) TBI	19 (19.0)	27	22
Dodge Diplomat 5.2L (318 cid) 4 BBL	13 (12.7)	15	14
Dodge Diplomat 5.2L (318 cid) 2 BBL	15 (14.6)	19	16
Ford Crown Victoria 5.8L (351 cid) VV	12 (12.4)	17	14
Ford Crown Victoria 5.0L (302 cid) PFI	17 (17.3)	24	20
Ford Mustang (Automatic) 5.0L (302 cid) PFI	18 (18.2)	27	21
Ford Mustang (5-speed) 5.0L (302 cid) PFI	16 (16.5)	24	19
Plymouth Gran Fury 5.2L (318 cid) 4 BBL	13 (12.7)	15	14
Plymouth Gran Fury 5.2L (318 cid) 2 BBL	15 (14.6)	19	16

\*Scored on city mileage only to the nearest 1/10 mpg.