



National Institute of Justice

TAP Alert

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TECHNOLOGY ASSESSMENT PROGRAM

Results of Michigan State Police 1987 Vehicle Tests

Every year the Michigan State Police (MSP) test more than a dozen vehicles as part of their procurement policy. This year the testing was held on September 13 to 18. Representatives from more than 50 departments and agencies in the U.S. and Canada attended. This TAP Alert contains the preliminary results of the test. The full report is expected in early November.

The vehicles are subjected to several different 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 test and point scores.

Hence, the minimum requirements this year are 10 percent greater than last year's lowest score. Second, in the top speed test, the distance vehicles were allowed to travel to reach 110 mph was tightened from 3 to 2 miles.

Table 2 lists the 1987 test vehicles. The vehicles are listed in alphabetical order without regard to their performance on the tests. The MSP had planned to evaluate the Ford Taurus, but it was unavailable for testing. It will probably be part of the 1988 tests. The Chevy Celebrity, which has been tested in the past, is no longer offered in a police package.

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 calculates each vehicle's overall score and adjusts the manufacturer's bid prices to reflect each vehicle's performance.

It should be noted that the MSP vehicle specifications, test categories, and scoring are unique to the needs of the MSP. Other departments who employ this or a similar method are urged to carefully consider their own needs and to alter the weighting factors accordingly.

With two exceptions, this year's testing was basically the same as that of previous years. First, this year the minimum acceleration criteria were tightened. Last year, the MSP found that all of the test vehicles that qualified in the acceleration test exceeded the minimum requirements for the 0-60, 0-80, and 0-100 mph acceleration.

Table 2. Vehicles Tested

Car	Engine [#]
Chevrolet Caprice	5.7L (350 cid) 4 BBL
Chevrolet Caprice	4.3L (262 cid) TBI
Chevrolet Caprice (Canadian)	5.7L (350 cid) 4 BBL
Dodge Diplomat	5.2L (318 cid) 4 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
Plymouth Reliant	2.5L (153 cid) TBI

[#]PFI = Port fuel injection
TBI = Throttle body injection
VV = Variable venturi
BBL = Barrel
H.O. = High output

Vehicle Dynamics Testing

Objective: To determine high-speed pursuit handling characteristics. The course, a 1.635-mile road racing type course, contains hills, curves, and corners. Except for the absence of traffic, the course 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 12.9 seconds, 80 mph within 23.0 seconds, and 100 mph within 42.3 seconds.

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

Methodology: Using a fifth wheel with an electronic digital speed meter and an electronic multi-function timer, 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.

Readers can note that the Dodge Diplomat did not meet the minimum 23 seconds to accelerate to 80 mph, and therefore will not be considered by the MSP.

Braking Test

Qualification Test Objective: To determine the acceptability of braking performance for pursuit service. The test evaluates brake fade and the ability of the vehicle to make a straight lock-up stop within its own lane.

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 full four-wheel lock 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.

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.

Table 6 presents the results of ergonomic testing.

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 7 shows the estimated EPA fuel economy.

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 350-4BBL	Floate	1:28.28	1:28.49	1:28.96	1:28.08	1:28.32
	Ring	1:28.14	1:28.30	1:28.51	1:28.48	
	Steendam	1:28.56	1:28.83	1:28.66	1:28.15	
	Halliday	1:28.51	1:28.66	1:28.38	1:28.01	
Dodge Diplomat 5.2 4V	Floate	1:29.14	1:29.74	1:29.74	1:30.11	1:29.95
	Ring	1:30.03	1:30.37	1:29.91	1:30.05	
	Steendam	1:30.07	1:29.97	1:30.33	1:29.99	
	Halliday	1:30.63	1:30.81	1:30.49	1:31.11	
Ford Crown Vic.	Floate	1:28.42	1:30.33	1:28.52	1:28.92	1:28.59
	Ring	1:28.16	1:28.43	1:28.33	1:28.78	
	Steendam	1:29.28	1:29.00	1:29.83	1:29.39	
	Halliday	1:28.07	1:28.59	1:28.66	1:29.15	
Ford Mustang 302-PFI (Automatic)	Floate	1:23.52	1:22.96	1:23.79	1:24.09	1:23.78
	Ring	1:22.96	1:22.84	1:23.33	1:23.99	
	Steendam	1:24.15	1:24.67	1:24.47	1:24.77	
	Halliday	1:24.55	1:25.02	1:25.02	1:25.26	
Ford Mustang 302-PFI (5-Speed)	Floate	1:21.79	1:21.70	1:21.69	1:21.83	1:22.02
	Ring	1:22.53	1:22.23	1:22.38	1:22.39	
	Steendam	1:22.89	1:22.97	1:22.79	1:22.66	
	Halliday	1:22.01	1:21.74	1:22.50	1:21.39	
Plymouth Gran Fury 318-4BBL	Floate	1:29.91	1:29.71	1:30.06	1:29.79	1:29.77
	Ring	1:29.64	1:29.87	1:30.17	1:29.81	
	Steendam	1:29.71	1:29.06	1:29.54	1:29.92	
	Halliday	1:30.59	1:30.75	1:31.50	1:31.21	
Plymouth Reliant 153-TBI	Floate	1:32.47	1:32.39	1:32.60	1:32.84	1:32.90
	Ring	1:33.40	1:33.30	1:33.29	1:32.98	
	Steendam	1:33.38	1:33.28	1:33.06	1:32.99	
	Halliday	1:33.18	1:32.88	1:33.20	1:32.98	

*Calculated from best 12 laps

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.

Table 4. Results of Acceleration and Top Speed Testing

Speed: 4-run average in seconds	Chevrolet Caprice 5.7L-4BBL	Chevrolet Caprice 4.3L-TBI	Chevrolet Caprice Canadian 5.7L-4BBL	Dodge Diplomat 5.2L-4BBL	Ford Crown Vic. 5.8L-VV	Ford Crown Vic. 5.0L-PFI	Ford Mustang (Auto) 5.0L-PFI	Ford Mustang (5-Speed) 5.0L-PFI	Plymouth Gran Fury 5.2L-2BBL	Plymouth Gran Fury 5.2L-4BBL	Plymouth Reliant 2.5L-TBI
0-20 MPH	2.15	2.78	2.10	2.93	-2.69	2.24	2.05	1.84	3.48	3.11	3.14
0-30 MPH	3.43	4.50	3.43	4.76	4.42	3.80	3.33	3.00	5.76	4.78	5.07
0-40 MPH	5.20	6.86	5.14	6.68	6.40	5.94	4.74	4.22	8.14	6.56	7.52
0-50 MPH	7.59	10.13	7.14	9.50	8.82	8.55	6.19	5.92	10.84	9.33	10.84
0-60 MPH	10.32	13.94	9.49	12.72	12.02	11.85	8.16	7.64	14.65	12.39	15.04
0-70 MPH	13.84	19.17	12.53	16.77	15.79	15.83	10.45	10.33	19.48	15.99	21.25
0-80 MPH	18.79	27.27	16.72	23.25	20.86	21.50	13.16	12.85	25.73	22.09	31.31
0-90 MPH	25.30	38.57	21.68	30.64	28.25	29.78	17.44	15.95	34.88	29.70	47.84
0-100 MPH	34.62	59.22	29.06	40.53	39.30	43.47	21.73	20.42	52.44	38.64	-----
Distance to reach:^a											
100 MPH (miles)	.67	1.34	.55	.76	.73	.86	.39	.37	1.05	.72	4.44
110 MPH (miles)	1.08	----	1.05	1.37	1.56	----	.55	.52	2.87	1.25	----
Top speed (MPH)	118.00	106.00	121.70	116.90	115.20	109.20	139.10	139.60	113.30	117.50	100.40
Quarter mile (average):^a											
Time (seconds)	17.85	19.90	17.40	19.35	18.93	18.55	16.33	16.00	20.63	19.18	20.38
Speed (MPH)	77.75	71.00	80.75	73.50	76.25	74.00	86.75	89.75	71.75	75.00	68.50

^aObtained from Strip Chart Recordings of Acceleration Runs

Table 5. Results of Braking Test

	Chevrolet Caprice 5.7L-4BBL	Dodge Diplomat 5.2L-4BBL	Ford Crown Victoria 5.8L-VV	Ford Mustang (Auto) 5.0L-PFI	Ford Mustang (5-Speed) 5.0L-PFI	Plymouth Gran Fury 5.2L-4BBL	Plymouth Reliant 2.5L-TBI
Phase I							
Initial speed (MPH)	60.0	60.1	60.2	60.7	60.8	59.7	59.8
Stopping distance (ft)	150.8	146.2	147.50	169.1	169.8	139.6	150.9
Deceleration rate (ft/sec ²)	25.68	26.57	26.43	23.44	23.42	27.46	25.49
Phase II							
Initial speed (MPH)	61.0	60.3	60.3	60.5	60.0	59.8	60.90
Stopping distance (ft)	150.7	140.2	157.1	172.3	157.7	140.3	164.4
Deceleration rate (ft/sec ²)	26.56	27.90	24.89	22.85	24.55	27.42	24.2
Average Deceleration rate (ft/sec ²)	26.12	27.24	25.66	23.14	23.99	27.44	24.88
Stopping distance from 60 MPH based on average deceleration rate (ft)							

Table 6. Ergonomics and Communications^a

	Chevrolet Caprice	Dodge Diplomat	Ford Crown Victoria	Ford Mustang	Plymouth Gran Fury	Plymouth Reliant
Ergonomics						
Front seat						
Padding	4.40	7.40	7.20	7.40	7.40	6.20
Depth of bench	7.00	6.60	7.20	6.60	6.60	5.80
Angle of back	6.60	6.20	5.80	7.40	6.20	6.00
Adjustability (front to rear)	6.80	6.00	5.80	6.40	6.00	6.00
Upholstery	6.50	7.40	7.20	6.80	7.40	7.00
Split bench design	7.00	7.20	7.80	6.80	7.20	6.40
Headroom	8.20	6.00	6.60	7.20	6.00	6.60
Seat belts	7.80	6.80	7.20	7.00	6.80	7.20
Ease of entry and exit	8.40	6.80	6.80	6.00	6.80	4.80
Rear seat						
Legroom (front seat in rearward position)	6.20	4.60	7.00	2.80	4.60	4.60
Ease of entry and exit	5.80	4.80	5.40	2.20	4.80	3.80
Instrumentation						
Clarity	7.00	7.60	7.40	8.00	7.60	6.40
Placement	7.40	7.60	6.80	7.60	7.60	6.20
Vehicle controls						
Pedals, size and position	8.00	6.40	5.80	5.80	6.40	6.60
Position of window crank	6.60	7.00	6.80	7.50	7.00	6.40
Position of inside door release	7.60	7.20	6.40	6.00	7.20	4.60
Position of automatic door lock switch	8.00	4.50	7.80	8.00	4.50	3.00
Position of outside rearview mirror controls	7.60	5.40	7.60	6.20	5.40	5.60
Steering wheel, size/tilt release/surface	8.40	8.40	6.40	7.80	8.40	7.40
Heater A-C vent placement and adjustability	6.60	7.60	6.20	6.20	7.60	6.00
Auxiliary dome/map light placement/visibility	8.00	6.50	8.70	5.20	6.50	5.80
Visibility						
Front	8.60	8.20	8.00	8.20	8.20	8.20
Rear	8.20	7.60	7.20	7.20	7.60	7.40
Left rear quarter	7.60	7.80	6.20	6.80	7.80	7.40
Right rear quarter	7.60	7.20	5.60	6.60	7.20	7.00
Outside rearview mirrors	7.40	6.80	6.40	6.40	6.80	7.60
Communications						
Dash accessibility	7.80	7.40	5.40	3.00	7.40	8.00
Trunk accessibility	9.20	8.60	6.80	1.00	8.60	5.60
Engine accessibility	9.00	8.30	3.70	1.30	8.30	6.30
Totals	215.30	199.90	193.20	175.40	199.90	179.90

^a Only one of each size vehicle was tested since the interiors are essentially the same.

Table 7. Fuel Economy

Vehicles Make/Model	EPA Miles Per Gallon		
	City*	Highway	Combined
**Chevrolet Caprice (4.3L) 262 cid TBI	18 (18.3)	27	21
**Chevrolet Caprice (5.7L) 350 cid 4V	14 (13.9)	20	16
Dodge Diplomat (5.2L) 318 cid 4V	13 (12.7)	15	14
Ford Crown Victoria (5.0L) 302 cid PFI	17 (17.5)	27	21
**Ford Crown Victoria (5.8L) 351 cid VV	13 (12.9)	18	15
Ford Mustang (Automatic) (5.0L) 302 cid PFI	18 (17.6)	27	21
**Ford Mustang (5 Speed) (5.0L) 302 cid PFI	16 (16.4)	25	19
Plymouth Gran Fury (5.2L) 318 cid 2V	15 (14.8)	17	16
Plymouth Gran Fury (5.2L) 318 cid 4V	13 (12.7)	15	14
Plymouth Reliant (2.5L) 153 cid TBI	21 (21.2)	26	23

*Scored on city mileage only to the nearest 1/10 M.P.G.

**Projected figures--not certified by E.P.A. at time of publication.

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