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U. S. Department of Justice
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Technology Assessment Program

INFORMATION CENTER

1982 MODEL YEAR PATROL VEHICLE TESTING

A Program of the National Institute of Justice
Conducted by the
INTERNATIONAL ASSOCIATION of CHIEFS of POLICE

About the Technology Assessment Program

The Technology Assessment Program is sponsored by the Office of Development, Testing, and Dissemination of the National Institute of Justice (NIJ), U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which created NIJ and directed it to encourage research and development to improve the criminal justice system and to disseminate the results to Federal, State, and local agencies.

The Technology Assessment Program is an applied research effort that determines the technological needs of justice system agencies, sets minimum performance standards for specific devices, tests commercially available equipment against those standards, and disseminates the standards and the test results to criminal justice agencies nationwide and internationally.

The program operates through:

The **Technology Assessment Program Advisory Council (TAPAC)** consisting of nationally recognized criminal justice practitioners from Federal, State, and local agencies, which assesses technological needs and sets priorities for research programs and items to be evaluated and tested.

The **Law Enforcement Standards Laboratory (LESL)** at the National Bureau of Standards, which develops voluntary National performance standards for compliance testing to ensure that individual items of equipment are suitable for use by criminal justice agencies. The standards are based upon laboratory testing and evaluation of representative samples of each item of equipment to determine the key attributes, develop test methods, and establish minimum performance requirements for each essential attribute. In addition to the highly technical standards, LESL also produces user guides that explain in nontechnical terms the capabilities of available equipment.

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Paul Cascarano, Director
National Institute of Justice

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1982 MODEL YEAR PATROL VEHICLE TESTING

Conducted by the

MICHIGAN STATE POLICE
EAST LANSING, MICHIGAN
COLONEL GERALD L. HOUGH, DIRECTOR

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PREFACE

You will find on the following pages the data collected and the conclusions reached in our evaluation of 1982 police patrol package vehicles. It gives us a great deal of satisfaction to share this information with you because one way the ultimate value of our efforts can be measured is by the number of law enforcement agencies who find it useful.

We would encourage you to review the information contained in this document after first giving careful consideration to your own specific needs. The factors which we base our scores upon, particularly in the acceleration and top speed categories, are tailored to our needs which may be vastly different from your own. For example, a vehicle which fails to meet our 0-100 MPH acceleration requirement might be very adequate for use by a department whose need is for quick acceleration to 60 or 70 MPH.

A total of eleven police package cars were tested this year; six equipped with V8 engines, three with "6" cylinder engines, and two with "4" cylinder engines. The cars equipped with V8 engines went through the full evaluation process and included the Chevrolet Impala (350-4V), Chevrolet Malibu (305-4V), Dodge Diplomat (318-4V), Ford Fairmont (255-2V), Ford LTD (351 H.O.-VV), and Plymouth Gran Fury (318-4V). The vehicles equipped with "6" and "4" cylinder engines were tested only for acceleration and top speed. The "6" cylinder cars were the Chevrolet Malibu (229-2V), Ford Fairmont (200-1V), and the Plymouth Gran Fury (225-1V). The cars with "4" cylinder engines were the Dodge Aries (135-2V) and the Ford Fairmont (140-2V).

Because of specific interest expressed by a number of police agencies in a smaller "pursuit only" type of car, and with the cooperation of the Ford Motor Company, a twelfth car was tested for acceleration and top speed only. The car was a Ford Mustang (302 H.O.-2V) equipped with a standard 4-speed transmission. Because it was not a "police package" vehicle, and also because of its limited use in most police applications, the data is not being published. If you have a particular interest in the information, please feel free to call us for details.

As is nearly always the case in projects of this magnitude, there was one minor problem that developed during testing. The Plymouth Gran Fury developed a mechanical problem while undergoing the vehicle dynamics evaluation. It caused the carburetor air filter to become oil-soaked which resulted in air starvation and relatively poor performance. Once discovered, the air filter was changed and the car was run over again on its full 16 timed-lap sequence.

In past years we have provided our actual and adjusted bid prices at the end of the vehicle evaluation report. At the time of this writing, our bids have not been opened and in the interest of getting this report into your hands at the earliest possible time, we are not going to wait for our bid prices before going to print. The individual category scores and the final scores are provided and should be adequate to meet your needs. If you need further information, please call.

Finally, we would like to express our appreciation for the cooperation of the many law enforcement agencies who have shown continuing interest in the evaluation program; the vehicle manufacturers who have been very helpful in many ways, not the least of which is in supplying test cars; and to the Technology Assessment Program Information Center of the International Association of Chiefs of Police for their continued assistance and support. We are indeed happy to be able to share this information with you. If we can be of any further assistance to you, either in additional explanation or clarification of the program or in discussing how our data might be adaptable to your needs, please feel free to contact us by phone or by mail.

Lt. Curtis L. VanDenBerg
Sgt. David B. Storer
Sgt. William F. McFall

Michigan State Police
Executive Division
Policy Development and Evaluation Section
714 South Harrison Road
East Lansing, Michigan 48823
Phone: (517) 332-2521

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INTRODUCTION

This report, for the 1982 model year, is the fourth in a series of publications that present the results of testing police patrol vehicles. The first, which concerned the 1979 vehicle model year, was prepared as the result of recommendations of the Transportation Committee of the Technology Assessment Program Advisory Council (TAPAC--see inside front cover), which recognized that all police departments have an urgent need for valid performance data to serve as a basis for patrol vehicle procurement decisions.

The Michigan State Police (MSP) has established a procurement policy that requires manufacturers to submit sealed bids for vehicles that will meet formal vehicle specifications, following which the specific vehicles offered under that bid action are subjected to testing and the ergonomics and communications design characteristics are evaluated. Upon completion of the test program, the results are weighted to reflect the relative importance of each attribute as related to MSP operational requirements and the individual bids are adjusted to reflect overall performance. The contracts are awarded on the basis of the adjusted price.

The MSP testing program is conducted annually, and the Technology Assessment Program Information Center (TAPIC) of the International Association of Chiefs of Police has made arrangements with MSP to reproduce the test results and distribute them to all interested police departments. This year, TAPIC provided the MSP with a small contract to help defray the additional cost of testing four and six cylinder engine vehicles, which otherwise would not have been included in the test program.

This report presents most of the test results from the MSP in summary form. However, certain of the detailed data is included in appendices for those wishing to study the test results in detail. Similarly, the bid adjustment information calculated by MSP is included as one example of a method to compare bids. It should be noted, however, that the weighting factors used by MSP are unique to its needs, and other departments wishing to employ this or a similar method are urged to carefully consider their own needs and to alter the weighting factors accordingly. Also, the weighting factors must reflect changing procedures or other influencing factors; for example, during the evaluation of bids for the 1980 model year, MSP assigned a weighting factor of only 10 percent to acceleration, and ergonomics and communications were rated separately with a combined weighting factor of 15 percent.

A TAPIC staff representative was present during the MSP testing program to observe the testing, and to obtain firsthand knowledge of the detailed effort to enable TAPIC to answer questions from the reader so that MSP will not be burdened with requests for information. The MSP vehicle testing program was conducted in a professional manner and TAPIC is confident that the test data are valid and suitable for all police departments to use as a basis for procurement decisions.

BID SPECIFICATIONS

The State of Michigan, Department of Management and Budget, Purchasing Division prepares, on an annual basis, a detailed specification for police patrol cars that is used as the basis for sealed bids from the manufacturers. The Michigan specification is presented solely to identify the manner in which the 1982 model year vehicles that were tested by MSP were configured and to provide information on the various requirements established by the State of Michigan for patrol vehicles. Other police departments may find items within the Michigan specification that are inconsistent with their own operational needs, and are encouraged to develop a specification reflecting the manner in which patrol vehicles are operated in their own jurisdiction. The Michigan specification is reproduced in Appendix A.

MANUFACTURER SPECIFICATIONS

Table 1 provides a summary of the specifications for the vehicles that were tested by MSP for model year 1982, compiled from manufacturer brochures for vehicles available with police packages. Individual data sheets for each of the vehicles are presented in Appendix B.

Table 1

INFORMATIONAL HARDWARE DESCRIPTION SUMMARY

MAKE, MODEL:	Ford LTD	Chevrolet Impala	Dodge Diplomat	Ford Fairmont	Plymouth Gran Fury	Chevrolet Malibu	Ford Fairmont	Plymouth Gran Fury	Chevrolet Malibu	Ford Fairmont	Dodge Aries
ENGINE DISPLACEMENT—CU. IN.	351	350	318	255	318	305	200	225	229	140	135
ENGINE DISPLACEMENT—LITERS	5.8	5.7	5.2	4.2	5.2	5.0	3.3	3.7	3.8	2.3	2.2
CARBURETOR- BBL	2VV	4	4	2	4	4	1	1	2	2	2
HORSEPOWER (S.A.E. NET)	165	150	165	115	165	145	87	90	110	92	84
TORQUE LBS.	285	265	200	195	200	240	154	160	170	117	111
COMPRESSION RATIO	8.3	8.2	8.4	8.2	8.4	8.6	8.6	8.4	8.6	9.0	8.5
AXLE RATIO	2.73	3.08	2.94	2.73	2.94	2.73	2.73	2.94	2.41	3.08	2.78
TURNING CIRCLE (CURB TO CURB)	39.2	38.7	40.7	39.5	40.7	37.2	39.5	40.7	37.2	39.5	34.3
TRANSMISSION—MODEL NUMBER	PKAAS5	THM350	A727	PEMAL3	A727	THM350	PEN-C	A904	THM250	82DT	A413
TRANSMISSION—LOCK UP TORQUE CONVERTER	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
TRANSMISSION—OVERDRIVE	Yes	No	No	No	No	No	No	No	No	No	No
TIRE SIZE	P225/ 70R15	P225/ 70R15	P215/ 70R15	P205/ 70R14	P215/ 70R15	P205/ 70R14	P205/ 70R14	P215/ 70R15	P195/ 75R14	P205/ 70R14	P185/ 70R14
BRAKE—FRONT—TYPE	Disc	Disc	Disc	Disc	Disc	Disc	Disc	Disc	Disc	Disc	Disc
BRAKE—REAR—TYPE	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum
OVERALL LENGTH—INCHES	209.3	212.2	205.7	204.3	205.7	192.7	204.3	205.7	192.7	204.3	176.0
OVERALL HEIGHT—INCHES	54.7	56.4	55.3	55.5	55.3	55.7	55.5	55.3	55.7	55.5	52.6
WEIGHT—TEST	4086	3996	3875	3200	3863	3672	3038	3706	3376	2926	2444
WHEELBASE—INCHES	114.3	116.0	112.7	105.5	112.7	108.1	105.5	112.7	108.1	105.5	99.9
HEAD ROOM—FRONT—INCHES	37.9	39.5	39.3	39.3	39.3	38.5	39.3	39.3	38.5	39.3	38.6
HEAD ROOM—REAR—INCHES	37.2	38.2	37.7	37.7	37.7	37.6	37.7	37.7	37.6	37.7	37.8
LEG ROOM—FRONT—INCHES	42.1	42.2	42.5	42.7	42.5	42.8	42.7	42.5	42.8	42.7	42.2
LEG ROOM—REAR—INCHES	40.7	39.1	36.6	37.8	36.6	38.0	37.8	36.6	38.0	37.8	35.4
SHOULDER ROOM—FRONT—INCHES	61.7	60.5	56.0	55.7	56.0	56.7	55.7	56.0	56.7	55.7	55.4
SHOULDER ROOM—REAR—INCHES	61.7	60.5	55.9	55.7	55.9	57.1	55.7	55.9	57.1	55.7	55.9
HIP ROOM—FRONT—INCHES	61.2	55.0	53.5	57.2	53.5	52.2	57.2	53.5	52.2	57.2	55.6
HIP ROOM—REAR—INCHES	56.9	55.3	53.2	57.0	53.2	55.6	57.0	53.2	55.6	57.0	56.2
INTERIOR VOLUME—FRONT—CU. FT.	57.0	58.1	53.7	53.0	53.7	54.1	53.0	53.7	54.1	53.0	52.1
INTERIOR VOLUME—REAR—CU. FT.	54.0	52.2	44.3	43.0	44.3	47.2	43.0	44.3	47.2	43.0	43.4
INTERIOR VOLUME—COMBINED—CU. FT.	111.0	110.3	98.0	96.0	98.0	101.3	96.0	98.0	101.3	96.0	95.5
INTERIOR VOLUME—TRUNK—CU. FT.	22.4	20.9	15.6	17.0	15.6	16.6	17.0	15.6	16.6	17.0	15.0
E.P.A. MILEAGE—CITY	14	14	14	19	14	17	20	18	21	21	25
E.P.A. MILEAGE—HIGHWAY	23	20	19	25	19	23	28	23	29	30	36
E.P.A. MILEAGE—COMBINED	17	16	16	21	16	19	23	20	24	25	29

VEHICLE DYNAMICS TESTING

The performance of a vehicle during high speed pursuit is dependent upon all of its operational characteristics including, as a minimum, acceleration, braking, suspension, and steering. Further, individual differences between drivers can also influence the overall pursuit capability of a vehicle/driver system.

Because high speed pursuit handling is of major concern to the MSP, a test procedure has been developed that permits a fair evaluation of each test vehicle relative to the other vehicles in the test group. Rather than attempt to evaluate each handling charactersitic separately, each vehicle is driven at high speeds over a 1.635-mile long racing-type course containing hills, curves, and corners. The course simulates actual driving conditions encountered in pursuit situations in the field, with the exception of other traffic and provides a simultaneous evaluation of all pertinent handling characteristics. In order to accommodate variations between drivers, each vehicle is driven by three different drivers four times, resulting in twelve timed laps.

This test quickly identifies whether the manufacturer of the vehicle offers a balanced package in terms of blending the suspension components, acceleration capabilities and braking characteristics, for serious deficiencies result in greatly increased times to travel over the course. Obviously if cornering or braking are totally inadequate a vehicle could be subject to either mechanical failure or leave the course. All of the 1982 model year vehicles tested successfully completed the required twelve laps.

The vehicle dynamics test results are presented in table 2. In each case, the test driver attempted to complete the course in the minimum time possible. Thus, the figure of merit for comparison purposes is the average elapsed time, for the objective is to complete the course in the shortest possible time. While the average times for the four laps for each driver are listed in table 2, the average elapsed time for each test vehicle is calculated by averaging all twelve lap times. Since vehicle dynamics is considered by the MSP to be a critical performance characteristic, a weighting factor of 25 percent has been assigned to these test results.

Table 2

VEHICLE DYNAMICS TESTING

VEHICLES	DRIVERS	LAP 1	LAP 2	LAP 3	LAP 4	AVERAGE
FORD LTD 351-VV	RICHTER	1:31.84	1:32.36	1:32.81	1:32.55	
	PRICE	1:32.25	1:32.30	1:32.15	1:31.79	
	FLOATE	1:31.62	1:31.77	1:32.12	1:31.45	
	RING	1:32.33	1:31.49	1:31.57	1:31.51	
OVERALL AVERAGE						1:31.99
OVERALL AVERAGE						
CHEVROLET IMPALA 350-4V	RICHTER	1:31.34	1:31.38	1:31.64	1:31.94	
	PRICE	1:31.98	1:32.57	1:32.17	1:32.32	
	FLOATE	1:31.68	1:31.59	1:31.34	1:31.67	
	RING	1:32.52	1:32.96	1:33.05	1:32.51	
OVERALL AVERAGE						1:32.04
OVERALL AVERAGE						
DODGE DIPLOMAT 318-4V	RICHTER	1:31.80	1:32.11	1:32.60	1:32.68	
	PRICE	1:32.59	1:32.79	1:33.05	1:32.47	
	FLOATE	1:32.40	1:32.40	1:32.61	1:32.06	
	RING	1:31.93	1:33.08	1:33.41	1:33.07	
OVERALL AVERAGE						1:32.57
OVERALL AVERAGE						
FORD FAIRMONT 255-2V	RICHTER	1:33.52	1:34.08	1:33.13	1:33.62	
	PRICE	1:34.32	1:33.72	1:34.00	1:34.15	
	FLOATE	1:34.14	1:33.99	1:34.19	1:33.50	
	RING	1:35.16	1:35.12	1:35.19	1:34.78	
OVERALL AVERAGE						1:34.16
OVERALL AVERAGE						
PLYMOUTH GRAN FURY 318-4V	RICHTER	1:31.28	1:31.67	1:31.78	1:32.84	
	PRICE	1:32.42	1:32.23	1:32.53	1:32.46	
	FLOATE	1:32.06	1:32.62	1:32.57	1:32.45	
	RING	1:33.48	1:33.38	1:34.53	1:33.81	
OVERALL AVERAGE						1:32.63
OVERALL AVERAGE						
CHEVROLET MALIBU 305-4V	RICHTER	1:32.21	1:32.61	1:32.54	1:32.13	
	PRICE	1:32.92	1:32.88	1:32.54	1:32.93	
	FLOATE	1:31.66	1:31.37	1:32.84	1:32.41	
	RING	1:32.69	1:33.34	1:32.95	1:33.71	
OVERALL AVERAGE						1:32.61

All times in minutes, seconds, and hundredths of a second, i.e., 1.34.96 = 1 minute, 34 seconds, and 96/100 of a second.
All tests conducted on Michigan International Speedway road course.

ACCELERATION AND TOP SPEED TESTING

The acceleration and top speed of each test vehicle are determined through the use of a fifth wheel in conjunction with an electronic speed meter and a multi-function timer. Strip chart recordings of the instantaneous vehicle speed and distance traveled as a function of time are also produced during the tests.

Each vehicle is accelerated from a standing stop to 100 mph during four acceleration sequences, two northbound and two southbound, to allow for wind direction. For each of the four acceleration runs, the time is recorded at which each 10-mph increment of speed is attained, for speeds from 20 to 100 mph. The four times for each speed interval are then averaged.

Following the fourth acceleration run, the test vehicle is subjected to continued acceleration, and two additional items of data are recorded: The distance required to reach a speed of 100 mph, and the maximum speed that is attained in a distance of 14 miles from the start of the run.

Figures 1 and 2 present a plot of the speed of each test vehicle as a function of time for 8 cylinder engine and 6 and 4 cylinder engine vehicles, respectively. Note that the acceleration characteristics of the Ford LTD and the Plymouth Gran Fury in figure 1 were so similar that they cannot be distinguished on the scale of the graph.

For V-8 equipped vehicles, the average time required for each test vehicle to reach the designated speeds is presented in table 3, together with the top speed, and time required to attain a speed of 100 mph. The data in table 4 are for the 6 and 4 cylinder engines.

Tables 3 and 4 also present data for the average time to travel a quarter mile during the acceleration runs and the instantaneous speed at the quarter mile point, obtained from the strip chart recordings. In reviewing this data, it will become apparent that the time required to travel a quarter mile is not directly proportional to the instantaneous speed of the vehicle at the quarter mile point. This apparent anomaly is a consequence of the fact that a vehicle does not accelerate at a uniform rate. Consequently, a vehicle that accelerates rapidly at lower speeds with a more gradual increase in acceleration at higher speeds may not achieve as high a speed at the quarter mile distance as one that does not accelerate as rapidly at low speeds but accelerates more rapidly at higher speeds. The Ford Fairmont 140 required 21.85 seconds to attain a speed of 67.50 mph at the quarter mile. In contrast, the Chevrolet Malibu 229 took an identical 21.85 seconds but obtained a speed of only 65.25 at the end of the quarter mile.

The data obtained by the MSP during the acceleration testing is used by MSP in two ways. The minimum elapsed times required to reach speeds of 60, 80, and 100 mph from a stop are specified in the MSP purchase specification. If a test vehicle requires more time than specified to reach any of these speeds, the vehicle is eliminated from further consideration in the procurement action.

Those wishing to compare the vehicle performance with the MSP specification will find the acceleration data for each vehicle and the MSP specification requirements tabulated in Appendix C.

The second use of the acceleration data concerns the process of bid adjustment. Those vehicles that meet the minimum specification requirements for acceleration are retained in the bid, and the top speed becomes one of the factors used to compare the vehicles. A weighting factor of 15 percent has been assigned to the top speed by MSP.

Figure 1

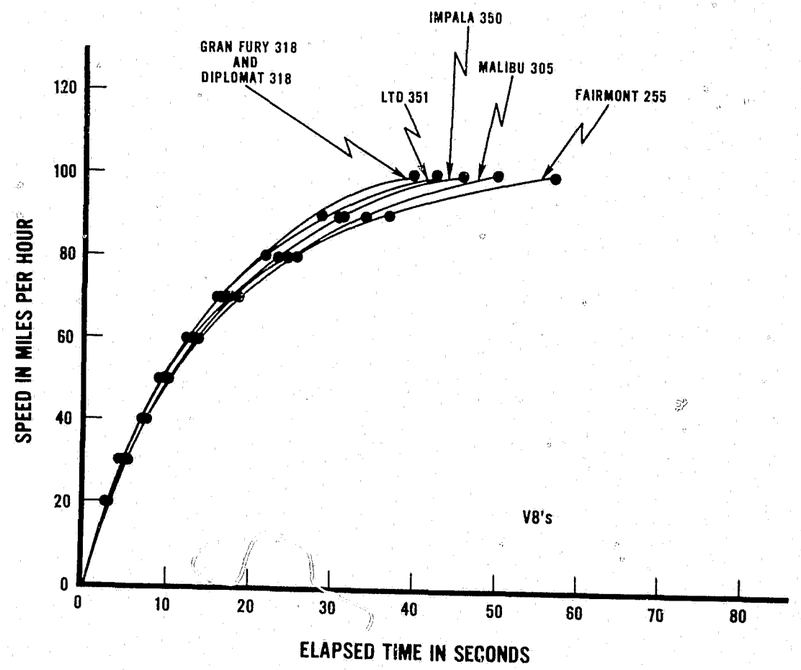


Figure 2

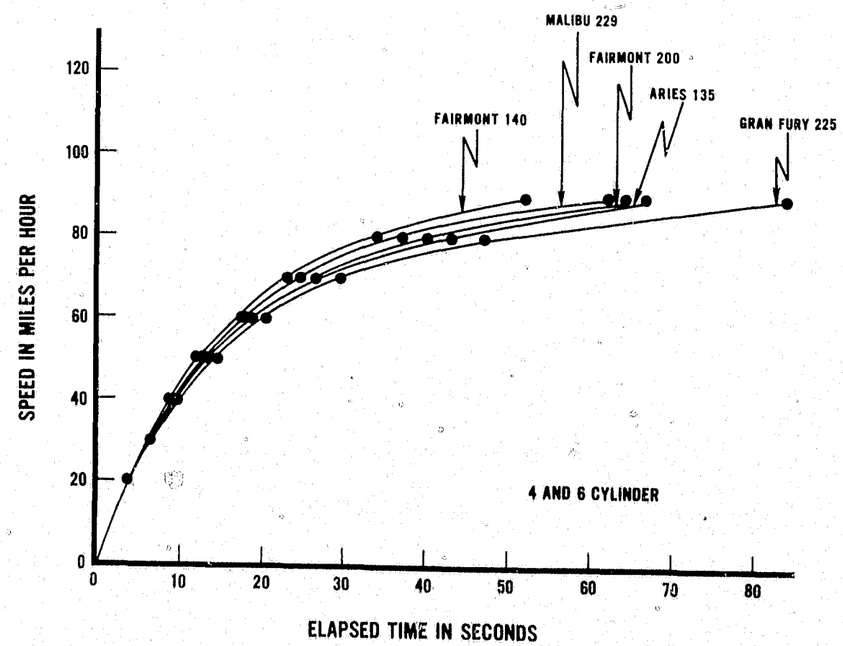


Table 3

SUMMARY OF ACCELERATION AND TOP SPEED TESTING

SPEED		FORD LTD 351-VV	CHEVROLET IMPALA 350-4V	DODGE DIPLOMAT 318-4V	FORD FAIRMONT 255-2V	PLYMOUTH GRAN FURY 318-4V	CHEVROLET MALIBU 305-4V
0-20 MPH (Sec)		3.16	2.78	3.10	3.14	3.04	2.81
0-30 MPH (Sec)		4.95	4.68	4.96	5.20	5.02	4.85
0-40 MPH (Sec)		6.96	6.73	6.78	7.32	6.80	7.02
0-50 MPH (Sec)		9.39	9.37	9.08	10.07	9.20	9.79
0-60 MPH (Sec)		12.59	12.74	12.19	13.80	12.24	13.29
0-70 MPH (Sec)		16.41	17.50	16.17	18.58	16.01	17.93
0-80 MPH (Sec)		21.82	23.31	21.65	25.55	21.19	24.62
0-90 MPH (Sec)		31.01	31.20	28.85	36.93	28.79	34.03
0-100 MPH (Sec)		42.54	45.79	39.95	57.04	39.36	49.73
Distance to reach 100 MPH	(Miles)*	.82	.91	.76	1.17	.75	.99
Top Speed	(MPH)	115.8	107.8	115.4	107.0	116.3	110.1
Quarter Mile *							
Time	(Sec)	19.15	19.40	19.20	19.88	19.08	19.53
Speed	(MPH)	75.50	73.00	75.25	72.00	76.50	72.50

Table 4

SUMMARY OF ACCELERATION AND TOP SPEED TESTING

SPEED	FORD FAIRMONT 200-1V	PLYMOUTH GRAN FURY 225-1V	CHEVROLET MALIBU 229-2V	FORD FAIRMONT 140-2V	DODGE ARIES 136-2V	
0-20 MPH (Sec)	3.78	3.74	3.80	3.68	4.02	
0-30 MPH (Sec)	6.37	6.35	6.46	6.24	6.50	
0-40 MPH (Sec)	9.27	9.69	9.26	8.93	8.98	
0-50 MPH (Sec)	13.35	14.36	13.01	12.32	12.46	
0-60 MPH (Sec)	18.72	20.36	17.99	17.26	17.58	
0-70 MPH (Sec)	26.50	29.63	24.68	22.95	24.29	
0-80 MPH (Sec)	40.06	47.00	36.85	33.99	42.85	
0-90 MPH (Sec)	1:04.02	1:23.47	1:01.80	51.76	1:16.54	
Distance to reach 90 MPH minimum (Miles)*	1.18	1.68	1.14	.88	1.15	
Top Speed (MPH)	97.3	96.2	100.6	103.4	97.5	
Quarter Mile *						
Time (Sec)	22.00	22.53	21.85	21.85	21.55	
Speed (MPH)	64.75	62.25	65.25	67.50	66.25	

*Obtained from Strip Chart Recordings of Acceleration Runs

BRAKE TESTING

The braking characteristics of vehicles are obviously important to a vehicle intended for pursuit service, and are tested to provide a basis for comparing the vehicles of different manufacturers.

The tests are conducted using a fifth wheel in conjunction with electronic digital speed and distance meters to determine the initial velocity at the beginning of the deceleration, and the distance required to come to a complete stop during an impending skid from 60 to 0 mph.

Each vehicle is subjected to eleven braking tests conducted in three phases. Phase I consists of stopping the vehicle four times with a controlled deceleration rate of 22 ft/sec^2 from 90 to 0 mph. During these stops, the driver uses a decelerometer to maintain the proper deceleration rate. These four stops are accomplished to cause the brakes to heat up. Since the stops are made at a controlled rate, the resulting data does not represent the maximum braking capability of the vehicle, and is not reported. Following the four 90 mile stops, the vehicle is stopped in an impending skid from 60 mph and the deceleration rate is calculated from the initial velocity and the stopping distance.

The brakes are allowed a period of four minutes to cool, and the procedures outlined above are repeated as phase II.

Immediately upon completion of the phase II test sequence, the vehicle is subjected to one 60-to-0 mph full four-wheel lock stop (phase III), to determine the ability of the vehicle to stop in a straight line within its lane. The phase III data is recorded as observational information only. All of the vehicles tested performed in an acceptable manner during the phase III testing.

The deceleration rates calculated for the phase I and II 60-to-0 mph stop are presented in table 5 and figure 3. The average of the two deceleration rates for each vehicle is used for comparison of the vehicles, and is assigned a weighting factor of 10 percent.

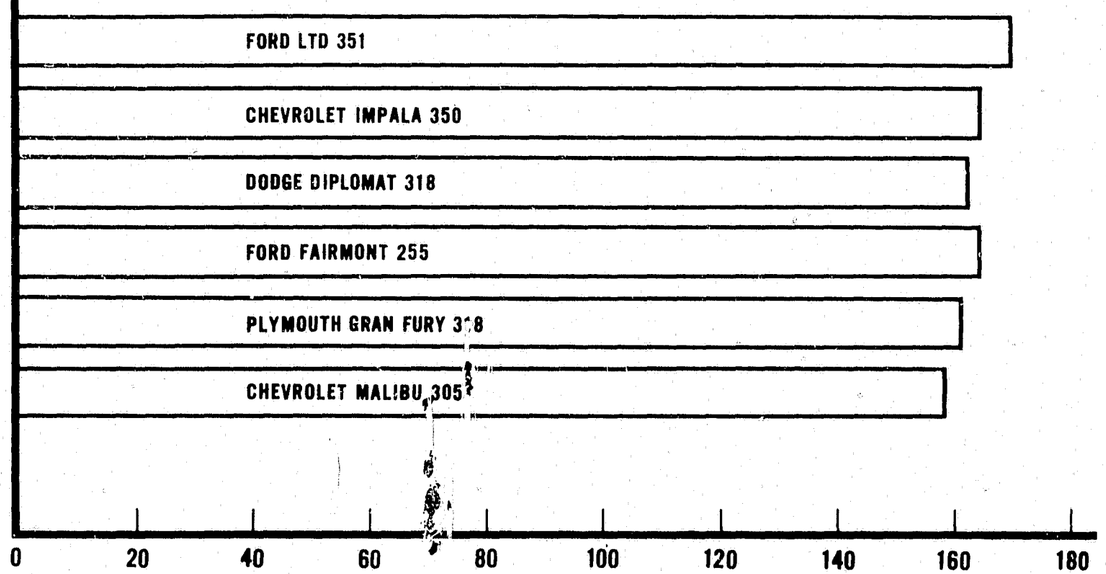
Table 5

SUMMARY OF BRAKE TESTING

BRAKING		FORD LTD 351-VV	CHEVROLET IMPALA 350-4V	DODGE DIPLOMAT 318-4V	FORD FAIRMONT 255-2V	PLYMOUTH GRAN FURY 318-4V	CHEVROLET MALIBU 305-4V
Phase I							
Initial Speed	(MPH)	61.3	60.4	60.3	60.8	61.3	60.2
Stopping Distance	(Ft)	178.4	166.4	163.5	168.6	167.7	159.3
Deceleration Rate	(Ft/Sec^2)	22.88	23.58	23.92	23.58	24.10	24.47
Phase II							
Initial Speed	(MPH)	60.5	60.1	60.3	60.2	60.5	60.6
Stopping Distance	(Ft)	175.9	159.3	166.4	171.3	160.9	159.5
Deceleration Rate	(Ft/Sec^2)	22.38	24.39	23.50	22.76	24.47	24.76
Deceleration Rate (Average)	(Ft/Sec^2)	22.63	23.99	23.71	23.17	24.29	24.62

* Obtained from Strip Chart Recordings of Acceleration Runs

Figure 3


FORD LTD 351
CHEVROLET IMPALA 350
DODGE DIPLOMAT 318
FORD FAIRMONT 255
PLYMOUTH GRAN FURY 318
CHEVROLET MALIBU 305
0
20
40
60
80
100
120
140
160
180
STOPPING DISTANCE IN FEET

ERGONOMICS AND COMMUNICATIONS

The physical design and construction of a vehicle can impact upon the ability of an officer to perform his duties, and is a major concern with respect to the installation of required communications equipment.

The MSP has designed a form that identifies 24 ergonomic characteristics of importance to the patrol officers' environment, and three items critical to the installation of communications equipment. A minimum of four officers are assigned to independently and individually score each vehicle on comfort and instrumentation by using the forms, and personnel from the departmental radio installation and garage units rate the vehicles based upon the relative difficulty of the necessary communication installation.

Each factor is graded on a scale of 1 to 10, with 1 representing "totally unacceptable," 5 representing "average," and 10 representing "superior." The scores for each factor for each vehicle are averaged to minimize personal prejudice for or against a given vehicle. The ergonomics and communications data are presented in table 6.

The average scores for each factor are totaled, and used as one of the bid adjustment factors with a weighting of 10 percent.

Table 6

ERGONOMICS AND COMMUNICATIONS

	FORD LTD 351-VV	CHEVROLET IMPALA 350-4V	DODGE DIPLOMAT 318-4V	FORD FAIRMONT 255-2V	PLYMOUTH GRAN FURY 318-4V	CHEVROLET MALIBU 305-4V
1. ERGONOMICS						
SEATS						
Front						
Padding	8.25	6.63	6.00	6.38	6.00	6.38
Depth of Bench	8.63	6.88	5.75	5.25	5.75	6.88
Angle of Back	8.50	6.63	6.63	6.38	6.63	7.00
Adjustability	7.75	6.25	6.25	4.63	6.25	6.25
Seat to Wheel Relationship	8.75	6.50	6.75	5.38	6.75	6.88
Seat to Pedal Relationship	8.13	6.88	7.13	4.63	7.13	6.50
Rear						
Leg Room	8.88	6.63	6.75	3.75	6.75	4.63
CONTROLS AND INSTRUMENTATION						
Vehicle Controls						
Pedals—Size and Relationship	8.38	8.00	7.63	4.00	7.63	7.25
Steering Wheel Position	9.25	7.13	7.50	6.50	7.50	6.88
Heater/A-C Controls Location	7.88	7.63	6.13	6.63	6.13	6.63
Instrumentation						
Clarity	8.38	7.25	6.25	7.13	6.25	8.50
Placement	7.63	6.88	5.75	6.00	5.75	9.25
VISIBILITY						
Front	8.63	7.63	7.88	7.50	7.88	7.63
Left Side	7.75	7.50	7.50	7.00	7.50	6.88
Left Rear Quarter	7.25	7.75	6.88	7.25	6.88	6.25
Right Side	7.63	6.63	6.75	7.00	6.75	6.50
Right Rear Quarter	7.00	6.25	6.13	7.00	6.13	5.38
Rear	8.38	6.88	7.13	6.75	7.13	6.13
HEATER/A-C						
Operation						
Blower Range	8.25	8.25	7.63	7.75	7.63	7.88
Temperature	7.88	7.29	6.57	7.00	6.57	6.86
Vent Placement	8.25	8.13	6.38	7.00	6.38	7.00
Vent Adjustability	8.13	7.50	6.88	7.13	6.88	6.88
WINDOWS AND DOORS						
Windows						
Seal	8.38	7.50	7.00	7.38	7.00	7.13
Position of Crank	6.38	6.57	7.13	6.25	7.13	8.00
Doors						
Ease of Entry and Exit—Front	8.63	7.50	6.88	5.13	6.88	6.63
Ease of Entry and Exit—Rear	8.00	6.75	5.50	4.13	5.50	5.00
2. COMMUNICATIONS						
DASH ACCESSIBILITY	4.75	9.50	5.00	6.75	5.00	9.75
ENGINE ACCESSIBILITY	8.20	8.50	5.60	7.60	5.60	8.20
TRUNK ACCESSIBILITY	5.50	7.25	6.00	5.00	6.00	6.75

FUEL ECONOMY

Fuel consumption is a major consideration for any police department. The MSP does not perform tests to determine fuel consumption, but rather utilizes the published EPA data. These data are valid and reliable in a comparison sense, while not necessarily being an accurate prediction of actual economy.

The EPA estimated miles-per-gallon figures (given to the nearest 0.1 mile per gallon), as presented in table 7, are used as the final factor in the bid adjustment process. A weighting factor of 25 percent has been assigned to fuel economy.

Table 7

Estimated EPA Figures

VEHICLES MAKE/MODEL		EPA Miles Per Gallon		
		CITY	HIGHWAY	COMBINED
Ford LTD	351 VV	14 (13.9)*	23	17
Chevrolet Impala	350 4V	14 (14.3)*	20	16
Dodge Diplomat	318 4V	14 (13.8)*	19	16
Ford Fairmont	255 2V	19 (18.6)*	25	21
Plymouth Gran Fury	318 4V	14 (13.8)*	19	16
Chevrolet Malibu	305 4V	17 (16.6)*	23	19
Ford Fairmont	200 1V	20 (19.7)*	28	23
Plymouth Gran Fury	225 1V	18 (17.9)*	23	20
Chevrolet Malibu	229 2V	21 (20.8)*	29	24
Ford Fairmont	140 2V	21 (20.5)*	30	25
Dodge Aries	135 2V	25 (25.0)*	36	29

*City mileage estimate developed from E.P.A. Test Car List data.

MICHIGAN STATE POLICE
PATROL VEHICLE WEIGHTING AND SCORING
FOR MODEL YEAR 1982

The MSP procedure for the final award of the contract for police vehicles involves several steps. First, any vehicle that fails to meet the minimum requirements of the purchase specification, as determined by inspection and testing, is eliminated from consideration.

For each vehicle that meets the minimum requirements, the raw data for each of the six factors tested and evaluated are entered onto a score sheet. Finally, the test/evaluation results are used to calculate an adjusted bid price that reflects the extent to which each vehicle scores above or below the average score of all of the vehicles. The contract is then awarded to the minimum bid as adjusted.

In adjusting the bid, MSP has established, by policy, the fact that as an agency, they are willing to pay as much as five percent more for a vehicle that scores well than the average price of all bids received. The bid adjustment then is simply five percent of the average. Since the bid adjustment has the net effect of reducing the bid price (i.e., superior performance is equivalent to a lower bid) the five percent adjustment factor is entered as a negative quantity (-$).

Table 8 presents the final results of the bid adjustments calculated by MSP for the 1982 model year. The score for each vehicle is entered as the top number in each column: 1) the vehicle dynamics score is the average time in seconds that the vehicle required to complete the 12 laps of the pursuit course, 2) the acceleration score is the time in seconds that the vehicle required to reach a speed of 100 mph, 3) the brake deceleration score is the average deceleration rate in ft/sec^2, 4) the top speed is the maximum speed in mph that the vehicle obtained, 5) the ergonomics and communications score is the total point value assigned to the vehicle on the score sheet, and 6) the fuel economy score is the city mileage estimate published by EPA in miles per gallon (given to the nearest 0.1 mile per gallon).

For each vehicle, the second entry in each column is the weighted Z(WTD Z) score. To calculate this the following steps are required:

1) The average score ($\overline{X}$) for all vehicles for a given factor (column such as vehicle dynamics) and the standard deviation (S) of all scores for that factor are calculated.

2) The average score for all vehicles ($\overline{X}$) is subtracted from the score of the individual vehicle (X), and the result divided by the standard deviation,

$$\left(\frac{X-\overline{X}}{S}\right)$$

3) The value calculated in step 2 above is multiplied by the weighting factor.

Once the weighted Z factor has been calculated for each of the six scores, the WTD Z for all factors are added to obtain the total score for the vehicle (total WTD Z), which is multiplied by the 5.00% bid adjustment in dollars and added to the actual bid to obtain the adjusted bid.

The procedure for making the above calculations manually, is described in Appendix D. Those wishing to make such calculations should recognize that the data presented in table 9 were processed by MSP using a computer. The processing was done using a greater number of significant figures than those reported in the publication; consequently, calculations of the bid adjustment using only three figures for the WTD Z scores will not agree precisely with the bid adjustments shown in the table.

In addition, it must be noted that the calculation of the WTD Z for the vehicle dynamics and acceleration scores requires that the sign of the value calculated using the stated formula must be reversed. This is the result of the fact that for these two vehicle scores only, the minimum time represents the best performance—unless the sign is reversed, the vehicle with the fastest speeds would receive a penalty since their speeds are less than the average speed of all of the vehicles tested.

The bid adjustment procedure, when used by MSP for the 1982 model year did not alter the vehicle selection. The bids were such that, based upon price alone, the vehicles with the lowest bid price remained the low bids after bid adjustment. This is not always the case. During the procurement of the 1980 model year vehicles, MSP purchased vehicles that were not the low bid until the bid price was adjusted to reflect the overall performance of all test vehicles.

Table 8

MICHIGAN STATE POLICE
COMPETITIVE PATROL VEHICLE EVALUATION

	25% VEHICLE DYNAMICS (secs)	15% ACCELERATION (secs)	10% BRAKING RATE (f/sec²)	15% TOP SPEED (mph)	10% ERGONOMICS & COMMUNI-CATIONS (points)	25% FUEL ECONOMY (city epa)
CAR MAKE MODEL	RAW SCORES	RAW SCORES	RAW SCORES	RAW SCORES	RAW SCORES	RAW SCORES
FORD LTD 351-VV	91.99	42.54	22.63	115.8	229.40	13.9
CHEVROLET IMPALA 350-4V	92.04	45.79	23.99	107.8	210.97	14.3
DODGE DIPLOMAT 318-4V	92.51	39.95	23.71	115.4	191.36	13.8
FORD FAIRMONT 255-2V	94.16	57.04	23.17	107.0	180.28	18.6
PLYMOUTH GRAN FURY 318-4V	92.63	39.36	24.29	116.3	191.36	13.8
CHEVROLET MALIBU 305-4V	92.61	49.73	24.62	110.1	201.88	16.6

Table 9

MICHIGAN STATE POLICE
COMPETITIVE PATROL VEHICLE EVALUATION

CAR	25% VEH DYN SEC	15% ACCEL SEC	10% BRAKE DECEL FT/S2	15% TOP SPEED MPH	10% ERGO/ COM PTS	25% FUEL ECON CITY EPA	TOTAL SCORE	BID 5.00% ADJ*	ACTUAL BID*	ADJUSTED BID*
	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	TOTAL WTD DEV			
FORD LTD 351-VV	91.99 0.270	42.54 -0.037	22.63 -0.164	115.80 0.085	229.40 0.149	13.90 -0.061	0.243			
CHEVROLET IMPALA 350-4V	92.04 0.228	45.79 -0.229	23.99 0.053	107.80 -0.259	210.97 0.033	14.30 0.424	0.251			
DODGE DIPLOMAT 318-4V	92.57 -0.223	39.95 0.116	23.71 0.009	115.40 0.068	191.36 -0.091	13.80 -0.182	-0.304			
PLYMOUTH GRAN SURY 318-4V	92.63 -0.274	39.36 0.151	24.29 0.101	116.30 0.106	191.36 -0.091	13.80 -0.182	-0.189			

*See Preface

APPENDIX A

MICHIGAN STATE VEHICLE SPECIFICATION

STATE OF MICHIGAN
DEPARTMENT OF MANAGEMENT AND BUDGET
PURCHASING DIVISION

Specifications for

Mich. 3905-0010
September 1981

POLICE CARS: PATROL
4-Door Sedan

Wheelbase 105.5" minimum

BID REQUIREMENTS:

Prior to bidding, a car dealer, manufacturer, or his representative, will be required to furnish a "police package" vehicle for test purposes. All test vehicles shall be 1982 models which are equipped with the drive train, suspension, and brake components, as well as tires and interior appointments and instrumentation as called for in the specification requirements on all vehicles in this requisition. Submitters of vehicles shall declare in writing any deviations from the specifications at the time of delivery of these test cars. Interior and exterior colors shall be the manufacturer's option. One extra set of four (4) wheels and tires shall be supplied with each car submitted for testing. Vehicles submitted shall have undergone sufficient break-in to permit extended periods of maximum acceleration and high speed driving. Brakes on the test car shall have been burnished prior to delivery.

Test cars shall be delivered to the Michigan Department of State Police Headquarters, 714 South Harrison Road, East Lansing, Michigan, no later than 5:00 PM, September 15, 1981.

These test vehicles will be subjected to a series of initial performance qualification tests. Each vehicle successfully completing these tests will then be subjected to six (6) competitive performance and acceptability tests. The State of Michigan shall not be responsible for any damage during the tests, or the condition of the vehicle when returned to the submitter after testing. Furthermore, all cars tested will be at the owner's risk for any damage occurring to the vehicles for any reason.

The test vehicles will be tested and driven under the supervision of the Michigan Department of State Police, and will be tested and driven by employees of the department or personnel designated by the department.

Vehicles used for testing will be returned to the submitter no later than one (1) month following the completion of performance testing.

SPECIFICATIONS:

Model - 1982 Current New

TO BE STANDARD FACTORY EQUIPPED INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING:

Air Conditioning: Factory installed - system must be designed to prevent component damage due to high speed driving.

Alternator System: Transistorized regulator, 80 amp minimum output capacity, minimum curb idle output of 45 amps (at manufacturer's recommended idle speed). Shall be of heavy duty design capable of surviving patrol car operation. Output ratings are for typical underhood ambient temperatures and not S.A.E. rating method.

Antenna: Standard AM type, externally mounted or in the windshield type acceptable (radio not to be included).

Armrests, Front and Rear: To be of a style without ash trays or ash tray to be made inoperable.

Battery: 12 volt; largest size available, minimum 455 cold cranking amps.

Body Side Molding: To be removed from front doors if it interferes with State Police Shield. No holes to be in doors for mouldings.

Brakes: Power assisted, low pedal position. Disc type in front; drum type in rear. Four wheel disc brakes acceptable.

Cigarette Lighter and Ash Receiver: On instrument panel.

Cooling System: Vehicle to have maximum size cooling system available; incorporating "coolant recovery" system. Factory installed.

Differential: Heavy duty, limited slip required.

Engine: Cubic inch displacement to be a manufacturer's option providing that the car will meet or exceed the vehicle performance requirements found elsewhere in this specification.

Floor Mat: Heavy duty rubber, front and rear. Trunk mat, full floor.

Gauges: To be equipped with ammeter or voltmeter, water temperature, and oil pressure gauges, located in instrument cluster. Any other installation location to be approved by the Michigan State Police.

Glass: All windows shall be heat absorbing (tinted) type.

Headlights: To be equipped with Quartz-Halogen highbeam headlights.

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Light: Combination Dome and Map, mounted on headliner on longitudinal centerline of vehicle approximately 25" from windshield garnish molding. Dome light controlled by rotating headlight switch to maximum C.C.W. position. Operation to be independent of other lights. Door jamb switches to be made inoperative. Map Lights, controlled by individual integral switches, to direct a restricted beam of light to the driver and/or to the front seat passenger. Exact mounting position to be approved by Michigan State Police.

Light: Engine and trunk compartments equipped with mercury switch.

Locks: All locks on a car to be keyed alike, 4 keys to be furnished with each car, different key for each car.

Locks: Power door locks to be standard, factory installed. Power system to be operable from front driver and front passenger position.

Mirrors, Rearview:

Inside: Day/night type.

Outside: Installed on left-hand and right-hand doors. Left side to be remote controlled type. Rectangular design approximate size 5" x 3"; minimum viewing area of 15 square inches.

Paint Color: To be same as Dulux 93-032.

Pilot Inspection: Prior to the initial delivery of patrol vehicles, the manufacturer shall schedule a pilot model inspection in order to determine compliance with the specifications. The inspection shall be conducted at the point of vehicle assembly or a location mutually agreed upon. The manufacturer shall be responsible for all costs incurred (not to exceed 6 representatives from the State of Michigan).

Radio Speaker(s): A permanent magnet speaker(s) either oval or round, to be mounted in the speaker opening(s) provided on the dash of the unit. Speaker(s) to be of a quality equal to automotive grade. Speaker leads connected to the speaker terminals, not grounded, shall be long enough to extend one foot beyond the center of the lower edge of the dash.

- One speaker installation - Voice coil impedance 8 ohms, power handling capacity 8 watts, minimum.

- Two speaker installation - Voice coil impedance 3.2 ohms, power handling capacity 8 watts, minimum.

Rear Window Defogger: Electrical grid type. Control to be within convenient reach of driver, control switch to be clearly marked as to function.

Remote Control Rear Deck Lid Release: Control to be within convenient reach of the driver; in glove box not acceptable. Electric system wired independently of ignition switch. Bowden cable system not acceptable.

Roof Top Reinforcement and Special Wiring: Install a steel plate 1/8" thick x 10" wide, to the underside of top, centered on the longitudinal centerline of the roof panel. Plate is to extend from the windshield header to the first top cross member support and is to be welded at both ends. Drill one 1/2" hole through roof panel and reinforcing plate, approximately 19" from windshield moulding on longitudinal centerline. Exact placement of hole to be approved by Michigan State Police. Feed at least three insulated stranded wires (minimum of one #12 and two #16) through hole in roof and route directly to either side of top at a right angle to the longitudinal centerline, thence to corner post and down the inside of corner post. Wires to extend 18" above roof hole and 48" beyond where they emerge at bottom of corner post. Top hole to be taped to prevent entry of water. Wires to be concealed between headlining and roof panel.

Seat Assembly, Front: Split bench type, 60-40 preferable, or 50-50 acceptable, individually adjustable fore and aft, heavy duty interior construction designed for rugged police use, comfortable foam-padded seat cushions and backs.

Seat Belts: Driver and right front passenger shoulder belt assembly to incorporate tension reliever and automatic release mechanism.

Secondary Ignition Wiring: Resistance type for radio noise suppression.

Service Manuals: Vendor to supply three (3) service manuals at time of first vehicle delivery.

Spare Tire: Tire and wheel to be mounted in trunk. Tire shall meet Michigan Specification 5260-S1, May 1980.

Special Wiring: One 14 gauge insulated wire running from center under dash to rear center trunk area, leaving 4 feet of this wire extending under the dash and 3 feet extending in the trunk for mounting rear shelf lights. Flexible conduit not acceptable.

Spotlights: Unity #225-6, 6" diameter, left- and right-hand mounted, equipped with aircraft landing lamp 4537-2. "A" Pillar or other approved mount. Left and right spotlights to be wired independent of ignition and individually fused with 10 amp capacity. Installation to be approved by Michigan State Police.

Steering: Power steering, manufacturer to provide steering gear which affords maximum firm "feel" and fast return characteristics; designed for high speed pursuit type driving.

Steering Wheel: Round with anti-slip surface.

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Suspension System, Police: To include heavy-duty springs, front and rear, in combination with heavy-duty shock absorbers, and front and rear heavy-duty stabilizer bars.

Technical Service Bulletin: Manufacturer to supply three (3) copies of all technical service bulletins covering vehicles purchased under this contract.

Tires: Tires to be Goodyear Police Radials per State of Michigan specification 5260-S1, May 1980.

- 14 inch tire - Goodyear P205/70R14 Flexten
- 15 inch tire - Goodyear P225/70R15 Rayon or P215/70R15 Rayon.

Tools: Wheel wrench and jack.

Transmission: To be 3- or 4-speed fully automatic, heaviest duty available. Must incorporate low gear lockout to prevent manual shifting.

Upholstery: Seats to be upholstered in cloth, or combination of cloth and vinyl (blue). All vinyl not acceptable.

Wheels: Heavy duty. To be equipped with sealing type metal valve caps.

15" x 6.5" minimum or
14" x 5.5" minimum

Windshield Washers: Automatic type.

Windshield Wipers: Multiple speed electric.

QUALIFICATION TESTING

In order to qualify for bidding, all vehicles submitted by manufacturers must meet each of the following performance standards:

1. ACCELERATION

   0 - 60 ---- 14.5 seconds or less
   0 - 80 ---- 26.0 seconds or less
   0 - 100 ---- 48.5 seconds or less

   Each vehicle will make four acceleration runs, and the times for the four runs will be averaged.

2. BRAKES

   a. Test vehicles will be required to make four consecutive stops from 90 mph with a constant deceleration rate of 22 ft. per sec./per sec. maintained from 90 to 0 mph. Immediately following this brake heat-up procedure, a controlled impending skid stop will be made from 60 mph.

b. After a four-minute wait, test "a" will be repeated. Immediately following, each vehicle is required to complete a panic (all wheel lock) stop from 60 mph. Evidence of brake fade and ability of the vehicle to stop in a straight line within its own lane will be evaluated.

APPENDIX B

MANUFACTURER VEHICLE SPECIFICATIONS

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD		LTD		P33
ENGINE DISPLACEMENT	351W H.O.	CU. IN.	5.8		LITERS
CARBURETOR-EXHAUST	Ford 7200 VV*		Dl. 1 Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	165 @ 3600				
TORQUE LBS. @ RPM	285 @ 2200				
COMPRESSION RATIO	8.3:1				
AXLE RATIO	2.73:1				
STEERING	Recirculating Ball - Power Steering with Integral Gear				
TURNING CIRCLE (CURB TO CURB)	39.2 ft.				
TIRE SIZE	P225/70R15				
SUSPENSION TYPE — FRONT	Independent Parallel "A" Arms With Coil Springs				
SUSPENSION TYPE — REAR	4-Bar Link With Coil Springs				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 228.7		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 157.1		SQ. IN.
OVERALL LENGTH	209.3 in.				
OVERALL HEIGHT	54.7 in.				
WEIGHT	CURB	LBS.	TEST 4086		LBS.
WHEELBASE	114.3 in.				
HEAD ROOM — FRONT	37.9 in.				
HEAD ROOM — REAR	37.2 in.				
LEG ROOM — FRONT	42.1 in.				
LEG ROOM — REAR	40.7 in.				
SHOULDER ROOM — FRONT	61.7 in.				
SHOULDER ROOM — REAR	61.7 in.				
HIP ROOM — FRONT	61.2 in.				
HIP ROOM — REAR	56.9 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 14		HIGHWAY M.P.G. 23		COMBINED M.P.G. 17

INTERIOR VOLUME

Interior

Front	57	cu ft
Rear	54	cu ft
Combined	111	cu ft
Trunk	22.4	cu ft

TRANSMISSION 4-speed Automatic Overdrive (AOD)

MODEL NUMBER PKA-AS5

LOCK UP TORQUE CONVERTER YES X NO

OVERDRIVE YES X NO

* (2) Variable Venturis

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	CHEVROLET		IMPALA		1BL69
ENGINE DISPLACEMENT	350	CU. IN.	5.7		LITERS
CARBURETOR-EXHAUST	4 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	150 @ 3600				
TORQUE LBS. @ RPM	265 @ 1600				
COMPRESSION RATIO	8.2:1				
AXLE RATIO	3.08:1				
STEERING	Power, Integral, Recirculating Ball Nut				
TURNING CIRCLE (CURB TO CURB)	38.7 ft.				
TIRE SIZE	P225/70R15				
SUSPENSION TYPE — FRONT	Independent, SLA Type With Coil Springs				
SUSPENSION TYPE — REAR	Link Type, 2 Upper and 2 Lower With Coil Springs				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 237.0		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 138.2		SQ. IN.
OVERALL LENGTH	212.2 in.				
OVERALL HEIGHT	56.4 in.				
WEIGHT	CURB	LBS.	TEST 3996		LBS.
WHEELBASE	116.0 in.				
HEAD ROOM — FRONT	39.5 in.				
HEAD ROOM — REAR	38.2 in.				
LEG ROOM — FRONT	42.2 in.				
LEG ROOM — REAR	39.1 in.				
SHOULDER ROOM — FRONT	60.5 in.				
SHOULDER ROOM — REAR	60.5 in.				
HIP ROOM — FRONT	55.0 in.				
HIP ROOM — REAR	55.3 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 14		HIGHWAY M.P.G. 20		COMBINED M.P.G. 16

INTERIOR VOLUME

Interior		
Front	58.1	cu ft
Rear	52.2	cu ft
Combined	110.3	cu ft
Trunk	20.9	cu ft

TRANSMISSION
MODEL NUMBER THM 350 C
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	DODGE		DIPLOMAT		GH-41
ENGINE DISPLACEMENT	318	CU. IN.	5.2		LITERS
CARBURETOR-EXHAUST	4 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	165 @ 4000				
TORQUE LBS. @ RPM	200 @ 2000				
COMPRESSION RATIO	8.4:1				
AXLE RATIO	2.94:1				
STEERING	Power - Firm (15.7:1 Gear Ratio)				
TURNING CIRCLE (CURB TO CURB)	40.7 ft.				
TIRE SIZE	P215/70R15				
SUSPENSION TYPE — FRONT	Independent, Lateral, Non-Parallel Control Arms With Transverse Torsion Bars, Heavy Duty Shocks				
SUSPENSION TYPE — REAR	Semi-Elliptical Leaf Springs, Heavy Duty Shocks				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 204.5		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 165.9		SQ. IN.
OVERALL LENGTH	205.7 in.				
OVERALL HEIGHT	55.3 in.				
WEIGHT	CURB	LBS.	TEST 3875		LBS.
WHEELBASE	112.7 in.				
HEAD ROOM — FRONT	39.3 in.				
HEAD ROOM — REAR	37.7 in.				
LEG ROOM — FRONT	42.5 in.				
LEG ROOM — REAR	36.6 in.				
SHOULDER ROOM — FRONT	56.0 in.				
SHOULDER ROOM — REAR	55.9 in.				
HIP ROOM — FRONT	53.5 in.				
HIP ROOM — REAR	53.2 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 14		HIGHWAY M.P.G. 19		COMBINED M.P.G. 16

INTERIOR VOLUME

Interior		
Front	53.7	cu ft
Rear	44.3	cu ft
Combined	98.0	cu ft
Trunk	15.6	cu ft

TRANSMISSION
MODEL NUMBER A727
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD	FAIRMONT	P21
ENGINE DISPLACEMENT	255 CU. IN.	4.2	LITERS
CARBURETOR-EXHAUST	2 BBL	Single Exhaust	
HORSEPOWER @ RPM (S.A.E. NET)	115 @ 3400		
TORQUE LBS. @ RPM	195 @ 2200		
COMPRESSION RATIO	8.2:1		
AXLE RATIO	2.73:1		
STEERING	Rack and Pinion		
TURNING CIRCLE (CURB TO CURB)	39.5 ft.		
TIRE SIZE	P205/70R14		
SUSPENSION TYPE — FRONT	Hybrid McPherson Strut		
SUSPENSION TYPE — REAR	4-Bar Link With Coil Spring		
BRAKE—FRONT	TYPE Disc	SWEPT AREA 176.6	SQ. IN.
BRAKE—REAR	TYPE Drum	SWEPT AREA 110.0	SQ. IN.
OVERALL LENGTH	204.3 in.		
OVERALL HEIGHT	55.5 in.		
WEIGHT	CURB LBS.	TEST 3200	LBS.
WHEELBASE	105.5 in.		
HEAD ROOM — FRONT	39.3 in.		
HEAD ROOM — REAR	37.7 in.		
LEG ROOM — FRONT	42.7 in.		
LEG ROOM — REAR	37.8 in.		
SHOULDER ROOM — FRONT	55.7 in.		
SHOULDER ROOM — REAR	55.7 in.		
HIP ROOM — FRONT	57.2 in.		
HIP ROOM — REAR	57.0 in.		
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 19	HIGHWAY M.P.G. 25	COMBINED M.P.G. 21

INTERIOR VOLUME

Interior		
Front	53	cu ft
Rear	43	cu ft
Combined	96	cu ft
Trunk	17	cu ft

TRANSMISSION 3-Speed Automatic (C512) - Locking Torque Converter
MODEL NUMBER PEM-AL3
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	PLYMOUTH	GRAN FURY	BH-41
ENGINE DISPLACEMENT	318 CU. IN.	5.2	LITERS
CARBURETOR-EXHAUST	4 BBL	Single Exhaust	
HORSEPOWER @ RPM (S.A.E. NET)	165 @ 4000		
TORQUE LBS. @ RPM	200 @ 2000		
COMPRESSION RATIO	8.4:1		
AXLE RATIO	2.94:1		
STEERING	Power - Firm (15.7:1 Gear Ratio)		
TURNING CIRCLE (CURB TO CURB)	40.7 ft.		
TIRE SIZE	P215/70R15		
SUSPENSION TYPE — FRONT	Independent, Lateral, Non-Parallel Control Arms With Transverse Torsion Bars, Heavy Duty Shocks		
SUSPENSION TYPE — REAR	Semi-Elliptical Leaf Springs, Heavy Duty Shocks		
BRAKE—FRONT	TYPE Disc	SWEPT AREA 204.5	SQ. IN.
BRAKE—REAR	TYPE Drum	SWEPT AREA 165.9	SQ. IN.
OVERALL LENGTH	205.7 in.		
OVERALL HEIGHT	55.3 in.		
WEIGHT	CURB LBS.	TEST 3863	LBS.
WHEELBASE	112.7 in.		
HEAD ROOM — FRONT	39.3 in.		
HEAD ROOM — REAR	37.7 in.		
LEG ROOM — FRONT	42.5 in.		
LEG ROOM — REAR	36.6 in.		
SHOULDER ROOM — FRONT	56.0 in.		
SHOULDER ROOM — REAR	55.9 in.		
HIP ROOM — FRONT	53.5 in.		
HIP ROOM — REAR	53.2 in.		
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 14	HIGHWAY M.P.G. 19	COMBINED M.P.G. 16

INTERIOR VOLUME

Interior		
Front	53.7	cu ft
Rear	44.3	cu ft
Combined	98.0	cu ft
Trunk	15.6	cu ft

TRANSMISSION
MODEL NUMBER A727
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	CHEVROLET	MALIBU	1GW69
ENGINE DISPLACEMENT	305 CU. IN.	5.0 LITERS	
CARBURETOR-EXHAUST	4 BBL	Single Exhaust	
HORSEPOWER @ RPM (S.A.E. NET)	145 @ 4000		
TORQUE LBS. @ RPM	240 @ 1600		
COMPRESSION RATIO	8.6:1		
AXLE RATIO	2.73:1		
STEERING	Power, Integral, Recirculating Ball Nut		
TURNING CIRCLE (CURB TO CURB)	37.2 ft.		
TIRE SIZE	P205/70R14		
SUSPENSION TYPE — FRONT	Independent, SLA With Coil Springs		
SUSPENSION TYPE — REAR	Link Type, 2 Upper and 2 Lower With Coil Springs		
BRAKE—FRONT	TYPE Disc	SWEPT AREA 191.7 SQ. IN.	
BRAKE—REAR	TYPE Drum	SWEPT AREA 116.1 SQ. IN.	
OVERALL LENGTH	192.7 in.		
OVERALL HEIGHT	55.7 in.		
WEIGHT	CURB LBS.	TEST 3672 LBS.	
WHEELBASE	108.1 in.		
HEAD ROOM — FRONT	38.5 in.		
HEAD ROOM — REAR	37.6 in.		
LEG ROOM — FRONT	42.8 in.		
LEG ROOM — REAR	38.0 in.		
SHOULDER ROOM — FRONT	56.7 in.		
SHOULDER ROOM — REAR	57.1 in.		
HIP ROOM — FRONT	52.2 in.		
HIP ROOM — REAR	55.6 in.		
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 17	HIGHWAY M.P.G. 23	COMBINED M.P.G. 19

INTERIOR VOLUME

Interior		
Front	54.1	cu ft
Rear	47.2	cu ft
Combined	101.3	cu ft
Trunk	16.6	cu ft

TRANSMISSION
MODEL NUMBER THM 350 C
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD	FAIRMONT	P21
ENGINE DISPLACEMENT	200 CU. IN.	3.3 LITERS	
CARBURETOR-EXHAUST	1 BBL	Single Exhaust	
HORSEPOWER @ RPM (S.A.E. NET)	87 @ 3800		
TORQUE LBS. @ RPM	154 @ 1400		
COMPRESSION RATIO	8.6:1		
AXLE RATIO	2.73:1		
STEERING	Rack and Pinion		
TURNING CIRCLE (CURB TO CURB)	39.5 ft.		
TIRE SIZE	P205/70R14		
SUSPENSION TYPE — FRONT	Hybrid McPherson		
SUSPENSION TYPE — REAR	4-Bar Link With Coil Spring		
BRAKE—FRONT	TYPE Disc	SWEPT AREA 176.6 SQ. IN.	
BRAKE—REAR	TYPE Drum	SWEPT AREA 110.0 SQ. IN.	
OVERALL LENGTH	204.3 in.		
OVERALL HEIGHT	55.5 in.		
WEIGHT	CURB LBS.	TEST 3038 LBS.	
WHEELBASE	105.5 in.		
HEAD ROOM — FRONT	39.3 in.		
HEAD ROOM — REAR	37.7 in.		
LEG ROOM — FRONT	42.7 in.		
LEG ROOM — REAR	37.8 in.		
SHOULDER ROOM — FRONT	55.7 in.		
SHOULDER ROOM — REAR	55.7 in.		
HIP ROOM — FRONT	57.2 in.		
HIP ROOM — REAR	57.0 in.		
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 20	HIGHWAY M.P.G. 28	COMBINED M.P.G. 23

INTERIOR VOLUME

Interior		
Front	53	cu ft
Rear	43	cu ft
Combined	96	cu ft
Trunk	17	cu ft

TRANSMISSION 3-Speed Automatic (C512) - Locking Torque Converter
MODEL NUMBER PEN-C
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	PLYMOUTH		GRAN FURY		BH-41
ENGINE DISPLACEMENT	225	CU. IN.	3.7		LITERS
CARBURETOR-EXHAUST	1 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	90 @ 3600				
TORQUE LBS. @ RPM	160 @ 1600				
COMPRESSION RATIO	8.4:1				
AXLE RATIO	2.94:1				
STEERING	Power - Firm (15.7:1 Gear Ratio)				
TURNING CIRCLE (CURB TO CURB)	40.7 ft.				
TIRE SIZE	P215/70R15				
SUSPENSION TYPE — FRONT	Independent, Lateral, Non-Parallel Control Arms With Transverse Torsion Bars, Heavy Duty Shocks				
SUSPENSION TYPE — REAR	Semi-Elliptical Leaf Sprints, Heavy Duty Shocks				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 204.5		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 165.9		SQ. IN.
OVERALL LENGTH	205.7 in.				
OVERALL HEIGHT	55.3 in.				
WEIGHT	CURB	LBS.	TEST 3706		LBS.
WHEELBASE	112.7 in.				
HEAD ROOM — FRONT	39.3 in.				
HEAD ROOM — REAR	37.7 in.				
LEG ROOM — FRONT	42.5 in.				
LEG ROOM — REAR	36.6 in.				
SHOULDER ROOM — FRONT	56.0 in.				
SHOULDER ROOM — REAR	55.9 in.				
HIP ROOM — FRONT	53.5 in.				
HIP ROOM — REAR	53.2 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 18		HIGHWAY M.P.G. 23		COMBINED M.P.G. 20

INTERIOR VOLUME

Interior		
Front	53.7	cu ft
Rear	44.3	cu ft
Combined	98.0	cu ft
Trunk	15.6	cu ft

TRANSMISSION
MODEL NUMBER A904 Wide Ratio
LOCK UP TORQUE CONVERTER YES ____ NO X
OVERDRIVE YES ____ NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	CHEVROLET		MALIBU		1GW69
ENGINE DISPLACEMENT	229	CU. IN.	3.8		LITERS
CARBURETOR-EXHAUST	2 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	110 @ 4000				
TORQUE LBS. @ RPM	170 @ 2000				
COMPRESSION RATIO	8.6:1				
AXLE RATIO	2.41:1				
STEERING	Power, Integral, Recirculating Ball Nut				
TURNING CIRCLE (CURB TO CURB)	37.2 ft.				
TIRE SIZE	P195/75R14				
SUSPENSION TYPE — FRONT	Independent, SLA With Coil Springs				
SUSPENSION TYPE — REAR	Link Type, 2 Upper and 2 Lower With Coil Springs				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 191.7		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 116.1		SQ. IN.
OVERALL LENGTH	192.7 in.				
OVERALL HEIGHT	55.7 in.				
WEIGHT	CURB	LBS.	TEST 3376		LBS.
WHEELBASE	108.1 in.				
HEAD ROOM — FRONT	38.5 in.				
HEAD ROOM — REAR	37.6 in.				
LEG ROOM — FRONT	42.8 in.				
LEG ROOM — REAR	38.0 in.				
SHOULDER ROOM — FRONT	56.7 in.				
SHOULDER ROOM — REAR	57.1 in.				
HIP ROOM — FRONT	52.2 in.				
HIP ROOM — REAR	55.6 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 21		HIGHWAY M.P.G. 29		COMBINED M.P.G. 24

INTERIOR VOLUME

Interior		
Front	54.1	cu ft
Rear	47.2	cu ft
Combined	101.3	cu ft
Trunk	16.6	cu ft

TRANSMISSION
MODEL NUMBER THM 250 C
LOCK UP TORQUE CONVERTER YES X NO ____
OVERDRIVE YES ____ NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD		FAIRMONT		P21
ENGINE DISPLACEMENT	140	CU. IN.	2.3		LITERS
CARBURETOR-EXHAUST	2 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	92 @ 4600				
TORQUE LBS. @ RPM	117 @ 2600				
COMPRESSION RATIO	9.0:1				
AXLE RATIO	3.08:1				
STEERING	Rack and Pinion				
TURNING CIRCLE (CURB TO CURB)	39.5 ft.				
TIRE SIZE	P205/70R14				
SUSPENSION TYPE — FRONT	Hybrid McPherson Strut				
SUSPENSION TYPE — REAR	4-Bar Link With Coil Spring				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 176.6		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 110.0		SQ. IN.
OVERALL LENGTH	204.3 in.				
OVERALL HEIGHT	55.5 in.				
WEIGHT	CURB	LBS.	TEST 2926		LBS.
WHEELBASE	105.5 in.				
HEAD ROOM — FRONT	39.3 in.				
HEAD ROOM — REAR	37.7 in.				
LEG ROOM — FRONT	42.7 in.				
LEG ROOM — REAR	37.8 in.				
SHOULDER ROOM — FRONT	55.7 in.				
SHOULDER ROOM — REAR	55.7 in.				
HIP ROOM — FRONT	57.2 in.				
HIP ROOM — REAR	57.0 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 21		HIGHWAY M.P.G. 30		COMBINED M.P.G. 25

INTERIOR VOLUME

Interior		
Front	53	cu ft
Rear	43	cu ft
Combined	96	cu ft
Trunk	17	cu ft

TRANSMISSION 3-Speed Automatic (C3)
MODEL NUMBER 82DT-AMA
LOCK UP TORQUE CONVERTER YES ____ NO X
OVERDRIVE YES ____ NO X

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	DODGE		ARIES		DH-41
ENGINE DISPLACEMENT	135	CU. IN.	2.2		LITERS
CARBURETOR-EXHAUST	2 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	84 @ 4800				
TORQUE LBS. @ RPM	111 @ 2400				
COMPRESSION RATIO	8.5:1				
AXLE RATIO	2.78:1				
STEERING	Power - Rack & Pinion (18:1 overall)				
TURNING CIRCLE (CURB TO CURB)	34.3 ft.				
TIRE SIZE	P185/70R14				
SUSPENSION TYPE — FRONT	Anti Sway Bar - Heavy Duty Iso-strut, Heavy Duty Shocks				
SUSPENSION TYPE — REAR	Anti Sway Bar - Heavy Duty Coil, Heavy Duty Shocks				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 157		SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA 58		SQ. IN.
OVERALL LENGTH	176.0 in.				
OVERALL HEIGHT	52.6 in.				
WEIGHT	CURB	LBS.	TEST 2444		LBS.
WHEELBASE	99.9 in.				
HEAD ROOM — FRONT	38.6 in.				
HEAD ROOM — REAR	37.8 in.				
LEG ROOM — FRONT	42.2 in.				
LEG ROOM — REAR	35.4 in.				
SHOULDER ROOM — FRONT	55.4 in.				
SHOULDER ROOM — REAR	55.9 in.				
HIP ROOM — FRONT	55.6 in.				
HIP ROOM — REAR	56.2 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 25		HIGHWAY M.P.G. 36		COMBINED M.P.G. 29

INTERIOR VOLUME

Interior		
Front	52.1	cu ft
Rear	43.4	cu ft
Combined	95.5	cu ft
Trunk	15.0	cu ft

TRANSMISSION
MODEL NUMBER A413
LOCK UP TORQUE CONVERTER YES ____ NO X
OVERDRIVE YES ____ NO X

APPENDIX C

VEHICLE ACCELERATION DATA

ACCELERATION & TOP SPEED TESTS

TEST LOCATION Chrysler Proving Grounds DATE September 19, 1981

ACCELERATION

WIND VELOCITY 6 mph WIND DIRECTION 270° TEMPERATURE 46°

MAKE & MODEL Ford LTD 351-VV BEGINNING TIME 8:34 AM AM/PM

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.65	12.47	12.88	12.35	12.59
0-80	26.0 Seconds	21.87	21.81	22.05	21.54	21.82
0-100	48.5 Seconds	44.64	40.74	42.39	42.40	42.54

TOP SPEED

DISTANCE TO REACH 100 MPH .82 mile TOP SPEED ATTAINED 115.8 MPH

ACCELERATION

WIND VELOCITY 8 mph WIND DIRECTION 270° TEMPERATURE 49°

MAKE & MODEL Chevrolet Impala 350-4V BEGINNING TIME 9:04 AM AM/PM

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.75	12.57	13.07	12.56	12.74
0-80	26.0 Seconds	22.99	22.95	24.11	23.18	23.31
0-100	48.5 Seconds	46.32	43.42	49.60	43.82	45.79

TOP SPEED

DISTANCE TO REACH 100 MPH .91 mile TOP SPEED ATTAINED 107.8 MPH

*Michigan State Police Minimum Requirements

ACCELERATION & TOP SPEED TESTS

TEST LOCATION Chrysler Proving Grounds DATE September 19, 1981

ACCELERATION

WIND VELOCITY 8 mph WIND DIRECTION 270° TEMPERATURE 54°

MAKE & MODEL Dodge Diplomat 318-4V BEGINNING TIME 9:29 AM AM/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.19	12.49	12.08	11.99	12.19
0-80	26.0 Seconds	21.85	21.65	21.81	21.27	21.65
0-100	48.5 Seconds	41.55	38.03	41.87	38.34	39.95

TOP SPEED

DISTANCE TO REACH 100 MPH .76 mile TOP SPEED ATTAINED 115.4 MPH

ACCELERATION

WIND VELOCITY 8 mph WIND DIRECTION 270° TEMPERATURE 56°

MAKE & MODEL Ford Fairmont 255-2V BEGINNING TIME 9:58 AM AM/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	13.64	13.95	13.66	13.94	13.80
0-80	26.0 Seconds	26.09	25.13	25.86	25.12	25.55
0-100	48.5 Seconds	1:03.43	51.55	1:01.50	51.66	57.04

TOP SPEED

DISTANCE TO REACH 100 MPH 1.17 miles TOP SPEED ATTAINED 107.0 MPH

*Michigan State Police Minimum Requirements

ACCELERATION & TOP SPEED TESTS

TEST LOCATION Chrysler Proving Grounds DATE September 19, 1981

ACCELERATION

WIND VELOCITY 10 mph WIND DIRECTION 270° TEMPERATURE 61°

MAKE & MODEL Plymouth Gran Fury 318-4V BEGINNING TIME 11:32 AM AM/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.35	11.98	12.43	12.18	12.24
0-80	26.0 Seconds	21.71	20.86	21.66	20.54	21.19
0-100	48.5 Seconds	39.80	38.25	41.15	38.23	39.36

TOP SPEED

DISTANCE TO REACH 100 MPH .75 mile TOP SPEED ATTAINED 116.3 MPH

ACCELERATION

WIND VELOCITY 16 mph WIND DIRECTION 270° TEMPERATURE 61°

MAKE & MODEL Chevrolet Malibu 305-4V BEGINNING TIME 11:58 AM AM/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.94	13.46	13.29	13.48	13.29
0-80	26.0 Seconds	23.88	24.51	25.38	24.70	24.62
0-100	48.5 Seconds	51.37	47.05	53.69	46.82	49.73

TOP SPEED

DISTANCE TO REACH 100 MPH .99 mile TOP SPEED ATTAINED 110.1 MPH

*Michigan State Police Minimum Requirements

ACCELERATION & TOP SPEED TESTS

TEST LOCATION Chrysler Proving Grounds DATE September 19, 1981

ACCELERATION

WIND VELOCITY 14 mph WIND DIRECTION 270° TEMPERATURE 63°

MAKE & MODEL Ford Fairmont 200-2V BEGINNING TIME 12:30 PM AM/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		19.37	18.29	19.00	18.22	18.72
0-80		42.87	39.58	40.04	37.75	40.06
0-90		1:11.00	58.94	1:08.21	57.94	1:04.02

TOP SPEED

DISTANCE TO REACH 90 MPH 1.18 miles TOP SPEED ATTAINED 97.3 MPH

ACCELERATION

WIND VELOCITY 16 mph WIND DIRECTION 270° TEMPERATURE 66°

MAKE & MODEL Plymouth Gran Fury 225-1V BEGINNING TIME 1:25 PM AM/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		20.70	20.26	20.54	19.93	20.36
0-80		53.78	43.37	49.01	41.82	47.00
0-90		1:29.52	1:28.03	1:22.42	1:13.90	1:23.47

TOP SPEED

DISTANCE TO REACH 90 MPH 1.68 miles TOP SPEED ATTAINED 96.2 MPH

ACCELERATION & TOP SPEED TESTS

TEST LOCATION Chrysler Proving Grounds DATE September 19, 1981

ACCELERATION

WIND VELOCITY 13 mph WIND DIRECTION 270° TEMPERATURE 67°

MAKE & MODEL Chevrolet Malibu 229-2V BEGINNING TIME 1:54 PM AM/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		18.04	18.05	18.05	17.83	17.99
0-80		36.85	34.05	41.27	35.22	36.85
0-90		1:09.17	54.92	1:10.19	52.90	1:01.80

TOP SPEED

DISTANCE TO REACH 90 MPH 1.14 miles TOP SPEED ATTAINED 100.6 MPH

ACCELERATION

WIND VELOCITY 12 mph WIND DIRECTION 270° TEMPERATURE 68°

MAKE & MODEL Ford Fairmont 140-2V BEGINNING TIME 2:29 PM AM/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		17.18	17.12	17.83	16.91	17.26
0-80		35.35	32.67	35.71	32.22	33.99
0-90		54.98	48.30	56.68	47.08	51.76

TOP SPEED

DISTANCE TO REACH 90 MPH .88 mile TOP SPEED ATTAINED 103.4 MPH

ACCELERATION & TOP SPEED TESTS

TEST LOCATION Chrysler Proving Grounds DATE September 19, 1981

ACCELERATION

WIND VELOCITY 13 mph WIND DIRECTION 270° TEMPERATURE 69°

MAKE & MODEL Dodge Aries 135-2V BEGINNING TIME 3:11 PM AM/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		17.75	17.38	17.67	17.53	17.58
0-80		46.70	39.39	44.17	41.15	42.85
0-90		1:19.56	1:12.59	1:17.46	N/A	1:16.54

TOP SPEED

DISTANCE TO REACH 90 MPH 1.15 miles TOP SPEED ATTAINED 97.5 MPH

ACCELERATION

WIND VELOCITY _____ WIND DIRECTION _____ TEMPERATURE _____

MAKE & MODEL _____ BEGINNING TIME _____ AM/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60						
0-80						
0-90						

TOP SPEED

DISTANCE TO REACH 90 MPH _____ TOP SPEED ATTAINED _____ MPH

APPENDIX D

BID ADJUSTMENT PROCEDURES

BID ADJUSTMENT

The Michigan State Police (MSP) Policy Development and Evaluation Section has established a formal procedure that is used to adjust the bid price of police patrol vehicles to reflect the relative performance of a given vehicle with respect to all vehicles that are tested and evaluated during the annual competitive bidding for vehicles. By policy MSP limits the amount of the adjustment of five percent of the average bid price for each type of vehicle to be purchased (full or mid size).

The bid adjustment procedure relies upon standard statistical analysis of the scores (level of performance) achieved by each vehicle during the testing and evaluation of a variety of attributes that are critical to the MSP operational use of patrol vehicles. This is accomplished by 1) calculating the "Z" value for each specified evaluation factor (attribute), and 2) multiplying that resulting Z factor by a weighting factor to obtain a weighted Z(WTD Z). Specifically:

$$Z = \frac{X_i - \overline{X}}{S}$$

where: X_i = Score of specific vehicle for a given evaluation factor

$\overline{X}$ = The mean of all vehicle scores for a given evaluation factor

and $$S = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(X_i - \overline{X})^2}$$

Given that three vehicles have scores of 363, 248, and 289 for a particular evaluation factor, the calculation of Z follows the procedure below. It is easiest to set-up the intermediate calculations using several columns.

i	X_i	$X_i - \overline{X}$	$(X_i - \overline{X})^2$	$Z = \frac{X_i - \overline{X}}{S}$
1	363	63	3969	(63÷48) = 1.31
2	248	-52	2704	(-52÷48) = -1.08
3	289	-11	121	(-11÷48) = -0.23
	$\Sigma X_i = 900$		$\frac{1}{3}\Sigma = 6794 \div 3 = 2265$	

$$\overline{X} = \frac{\Sigma X_i}{N} = 900 \div 3$$

$$\overline{X} = 300$$

$$S = \sqrt{2265} = 48$$

The value of Z for each score is then multiplied by the weighting factor, which ranges from 10 to 25%. For the weighting factor 10%, the weighted Z (WTD Z) for each of the above vehicle's scores is:

$$1.31 \times 0.10 = 0.131$$

$$-1.08 \times 0.10 = -0.108$$

$$-0.23 \times 0.10 = -0.023$$

The above process is used to calculate the WTD Z factors for each vehicle evaluation factor, which are then added together to obtain the total WTD Z. The total WTD Z is then multiplied by the five percent bid adjustment (in -$) to calculate the amount that the manufacturer's bid would be adjusted to reflect the scores of the vehicle during testing.

NOTES

END