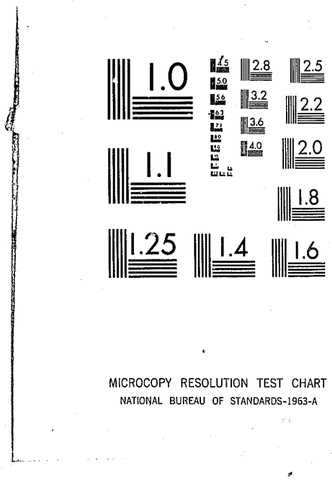

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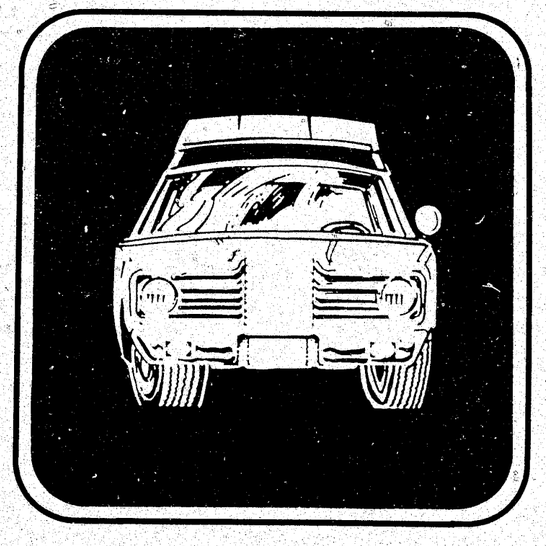
1981 MODEL YEAR PATROL VEHICLE TESTING



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 non-technical terms the capabilities of available equipment.

The Technology Assessment Program Information Center (TAPIC) operated by the International Association of Chiefs of Police (IACP), which supervises a national compliance testing program conducted by independent agencies. The standards developed by LESL serve as performance bench marks against which commercial equipment is measured. The facilities, personnel, and testing capabilities of the independent laboratories are evaluated by LESL prior to testing each item of equipment, and LESL helps the Information Center staff review and analyze data. Test results are published in Consumer Product Reports designed to help justice system procurement officials make informed purchasing decisions.

All publications issued by the National Institute of Justice, including those of the Technology Assessment Program, are available from the National Criminal Justice Reference Service (NCJRS), which serves as a central information and reference source for the nation's criminal justice community. For further information, or to register with NCJRS, write to the National Institute of Justice, National Criminal Justice Reference Service, Washington, DC 20531.

Paul Cascarano, Director
Office of Development, Testing,
and Dissemination
National Institute of Justice

TAPIC

1981 MODEL YEAR PATROL VEHICLE TESTING

Conducted by the

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

Reprinted by the
TECHNOLOGY ASSESSMENT PROGRAM INFORMATION CENTER
(TAPIC)
RESEARCH DIVISION
INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE
Gaithersburg, Maryland 20760

under

Supporting Grant Number 77NI-99-001(S-2)
awarded by the
National Institute of Justice
U.S. Department of Justice

November 1980

Test results and analyses contained herein do not represent product approval or endorsement by the National Institute of Justice, the U.S. Department of Justice, or the IACP.

PREFACE

We are happy for the opportunity to share with you the results of our evaluation of 1981 police patrol vehicles. The evaluation program was originally developed to enable us to identify what vehicles offered by the manufacturers as "police package" vehicles were best suited to the needs of the Michigan State Police.

In your review of the data developed on the vehicles tested this year, we encourage you to consider your own department's patrol vehicle requirements with regard to size and performance. Having assessed our needs, we have developed our own patrol vehicle requirements which are included in this report. We fully expect that your needs might differ from ours, particularly in acceleration and top speed. Consequently, we have expanded the acceleration data in the hope that it will be more useful to you in determining what car best meets your needs.

We once again evaluated both full and mid size cars. The full size cars were the Buick LeSabre (252-4V), Chevrolet Impala (350-4V), Dodge St. Regis (318-4V), Ford LTD (351 H.O.-VV), and Plymouth Gran Fury (318-4V). The mid size cars tested were the Chevrolet Malibu (350-4V), Chrysler LeBaron (318-4V), Dodge Diplomat (318-4V), and the Ford Fairmont (255-2V). In addition to the above V-8 equipped mid size cars, two mid size cars equipped with 6 cylinder engines were also evaluated. They were the Chrysler LeBaron (225-1V) and the Ford Fairmont (200-1V).

Two things about this year's testing should be pointed out. First, all of the acceleration/top speed tests on the mid size cars were run on a wet track. We do not believe that this makes a significant difference when using the scores either as predictive estimates or as a means of comparison.

Second, the Chevrolet Malibu submitted for testing was actually a 1979 model which had the drive train and suspension updated to 1981 Malibu as compared to the 1979, specific ally in the roofline shape. Whether this will affect the aerodynamics of the 1981 model positively or negatively is unknown at this time. We offer the information and suggest that you use your own judgment in determining whether the car tested is representative of the actual 1981 model.

Once again, we are happy to be able to share this information and sincerely hope that the data will be useful to you. If we can be of any further assistance to you either in additional explanation 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.

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INTRODUCTION

This report, for the 1981 model year, is the third 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 six-cylinder 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.

The TAPIC looks forward to working with the MSP on 1982 vehicle testing and would like to thank Colonel Gerald R. Hough, Director, MSP, for his department's cooperation and professionalism in getting this year's testing program accomplished in a timely manner.

BID SPECIFICATIONS

The State of Michigan, Department of Management and Budget Purchasing Department prepares, on an annual basis, a detailed specification for police patrol cars that is used as the basis for sealed bids from the manufacturers. Separate specifications are issued for full-size and mid-size vehicles. The majority of the items within the two specifications are identical. For the purposes of this report, the Michigan specification for full-size vehicles is reproduced in Appendix A. Those items that are different in the mid-size vehicle specification have been entered on the full-size vehicle specification in italics.

The Michigan specification is presented solely to identify the manner in which the 1981 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.

MANUFACTURER SPECIFICATIONS

Table 1 provides a summary of the specifications for the vehicles that were tested by MSP for model year 1981, 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

	FULL SIZE VEHICLES					MID-SIZE VEHICLES					
MAKE, MODEL:	Buick Le Sabre	Chevrolet Impala	Dodge St. Regis	Ford LTD	Plymouth Gran Fury	Chevrolet Malibu	Chrysler Le Baron	Chrysler Le Baron	Dodge Diplomat	Ford Fairmont	Ford Fairmont
ENGINE DISPLACEMENT—CU. IN.	252	350	318	351	318	350	318	225	318	255	200
ENGINE DISPLACEMENT—LITERS	4.1	5.7	5.2	5.8	5.2	5.7	5.2	3.7	5.2	4.2	3.3
CARBURETOR- BBL	4	4	4	2VV	4	4	4	1	4	2	1
HORSEPOWER (S.A.E. NET)	125	165	165	165	165	165	165	85	165	115	88
TORQUE LBS.	205	260	240	285	240	260	240	165	240	195	154
COMPRESSION RATIO	8.0	8.2	8.4	8.3	8.4	8.2	8.4	8.4	8.4	8.2	8.6
AXLE RATIO	3.23	3.08	2.94	2.73	2.94	2.73	2.94	2.94	2.94	2.73	2.73
TURNING CIRCLE (CURB TO CURB)	39.3	38.7	42.4	39.2	42.4	37.2	40.7	40.7	40.7	39.5	39.5
TRANSMISSION—MODEL NUMBER	350C	THM350	A727	PKA-AS	A727	THM350	A727	A904	A727	PEMAL	PEBN10
TRANSMISSION—LOCK UP TORQUE CONVERTER	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
TRANSMISSION—OVERDRIVE	No	No	No	Yes	No	No	No	No	No	No	No
TIRE SIZE	P225/ 70R15	P225/ 70R15	P225/ 70R15	P225/ 70R15	P225/ 70R15	P205/ 70R14	P215/ 70R15	P215/ 70R15	P215/ 70R15	P205/ 70R14	P205/ 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	216.6	212.1	220.2	209.3	220.2	192.7	205.7	205.7	205.7	204.3	204.3
OVERALL HEIGHT—INCHES	55.2	55.2	54.5	54.7	54.5	55.7	55.3	55.3	55.3	55.5	55.5
WEIGHT—CURB	3627	3488	3644	3602	3595	3125	3395	3395	3395	2724	2724
WEIGHT—TEST	3834	3927	4086	4060	4090	3579	3856	3694	3851	3156	2944
WHEELBASE—INCHES	116.6	116.0	118.5	114.3	118.5	108.1	112.7	112.7	112.7	105.5	105.5
HEAD ROOM—FRONT—INCHES	39.5	39.5	38.2	37.9	38.2	38.7	39.3	39.3	39.3	38.3	38.3
HEAD ROOM—REAR—INCHES	38.2	38.2	37.4	37.2	37.4	37.7	37.7	37.7	37.7	37.4	37.4
LEG ROOM—FRONT—INCHES	42.2	42.2	42.3	42.1	42.3	42.8	42.5	42.5	42.5	41.7	41.7
LEG ROOM—REAR—INCHES	38.9	39.1	38.3	40.6	38.3	38.0	36.6	36.6	36.6	35.3	35.3
SHOULDER ROOM—FRONT—INCHES	60.3	60.5	61.0	61.7	61.0	57.2	56.0	56.0	55.6	56.7	56.7
SHOULDER ROOM—REAR—INCHES	61.0	60.5	61.0	61.7	61.0	57.1	55.9	55.9	55.5	55.7	55.7
HIP ROOM—FRONT—INCHES	55.0	55.0	57.4	61.2	57.4	55.2	56.9	56.9	56.9	56.2	56.2
HIP ROOM—REAR—INCHES	55.3	55.3	57.4	56.9	57.4	55.6	57.0	57.0	57.0	53.7	53.7
INTERIOR VOLUME—FRONT—CU. FT.	57.0	58.1	57.0	57.0	57.0	54.8	54.1	54.1	53.7	53.0	53.0
INTERIOR VOLUME—REAR—CU. FT.	53.0	52.2	50.6	54.0	50.6	47.3	44.6	44.6	44.3	43.0	43.0
INTERIOR VOLUME—COMBINED—CU. FT.	110.0	110.3	107.6	111.0	107.6	102.1	98.7	98.7	98.0	96.0	96.0
INTERIOR VOLUME—TRUNK—CU. FT.	21.0	20.9	21.3	22.4	21.3	16.6	15.6	15.6	15.6	16.8	16.8
E.P.A. MILEAGE—CITY	18	15	16	15	16	15	16	18	16	18	20
E.P.A. MILEAGE—HIGHWAY	25	21	23	25	23	21	23	23	23	25	28
E.P.A. MILEAGE—COMBINED	21	17	18	18	18	17	18	20	18	21	23

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, indiviudal 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 characteristic 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 1981 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 Test Results

VEHICLES	DRIVERS	ELAPSED TIME* LAP 1	LAP 2	LAP 3	LAP 4	AVERAGE
BUICK LE SABRE (252-4V)	FLOATE	1:38.49	1:38.65	1:38.31	1:37.92	1:38.34
	RICHTER	1:37.41	1:37.92	1:37.34	1:37.46	1:37.53
	PRICE	1:39.76	1:39.50	1:39.47	1:39.51	1:39.56
OVERALL AVERAGE						1:38.48
CHEVROLET IMPALA (350-4V)	FLOATE	1:29.71	1:29.71	1:29.82	1:30.57	1:29.95
	RICHTER	1:31.27	1:31.02	1:31.22	1:30.97	1:31.12
	PRICE	1:31.17	1:31.24	1:30.70	1:31.24	1:31.09
OVERALL AVERAGE						1:30.72
DODGE ST.REGIS (318-4V)	FLOATE	1:32.61	1:32.81	1:33.64	1:33.12	1:33.05
	RICHTER	1:34.08	1:33.63	1:34.30	1:34.58	1:34.15
	PRICE	1:34.18	1:34.64	1:3[illegible].74	1:34.84	1:34.60
OVERALL AVERAGE						1:33.93
FORD LTD (351-VV)	FLOATE	1:32.92	1:31.58	1:32.02	1:31.64	1:32.04
	RICHTER	1:32.37	1:32.54	1:32.53	1:33.29	1:32.68
	PRICE	1:32.56	1:32.41	1:32.33	1:32.57	1:32.47
OVERALL AVERAGE						1:32.40
PLYMOUTH GRAN FURY (318-4V)	FLOATE	1:33.33	1:33.40	1:33.82	1:33.16	1:33.18
	RICHTER	1:33.51	1:33.75	1:33.54	1:33.44	1:33.56
	PRICE	1:33.51	1:33.76	1:34.70	1:34.22	1:34.05
OVERALL AVERAGE						1:33.60
CHEVROLET MALIBU (350-4V)	FLOATE	1:29.61	1:29.81	1:30.58	1:30.63	1:30.16
	RICHTER	1:30.33	1:30.03	1:30.21	1:30.50	1:30.27
	PRICE	1:30.46	1:30.58	1:30.71	1:31.04	1:30.70
OVERALL AVERAGE						1:30.37
CHRYSLER LE BARON (318-4V)	FLOATE	1:32.10	1:32.80	1:32.08	1:32.62	1:32.40
	RICHTER	1:31.93	1:32.42	1:32.37	1:32.79	1:32.38
	PRICE	1:33.04	1:33.47	1:32.66	1:32.22	1:32.85
OVERALL AVERAGE						1:32.54
DODGE DIPLOMAT (318-4V)	FLOATE	1:31.49	1:31.70	1:32.33	1:31.96	1:31.87
	RICHTER	1:31.32	1:31.34	1:31.39	1:31.27	1:31.33
	PRICE	1:32.77	1:32.69	1:32.56	1:32.96	1:32.75
OVERALL AVERAGE						1:31.98
FORD FAIRMONT (255-2V)	FLOATE	1:32.93	1:33.36	1:33.37	1:33.71	1:33.34
	RICHTER	1:32.83	1:32.88	1:32.56	1:32.88	1:32.79
	PRICE	1:33.97	1:34.31	1:34.67	1:34.52	1:34.37
OVERALL AVERAGE						1:33.50
OVERALL AVERAGE						
OVERALL AVERAGE						

*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 105 mph, and the maximum speed that is attained in a distance of 15 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 full-size and mid-size 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 full-size 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 105 mph. The data in table 4 is for the mid-size vehicles.

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 255 requires 18.61 seconds to attain a speed of 70 mph, during which time it has transversed nearly 1200 feet, and only requires 1.07 seconds to finish traveling the quarter mile, reaching a speed of 71 mph. In contrast, the Dodge 318 reaches a speed of 70 mph in 16.68 seconds. However, it has only traveled slightly more than 1000 feet in reaching that speed. Thus, it continues to accelerate during the next 2.7 seconds that it requires to travel the quarter mile, and at the end of that time, achieves a speed of 75.5 mph.

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. Similarly, the MSP specification requires that a vehicle attain a speed of 105 mph within a distance of 3 miles. Again, a vehicle not meeting this requirement would not be considered for purchase.

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.

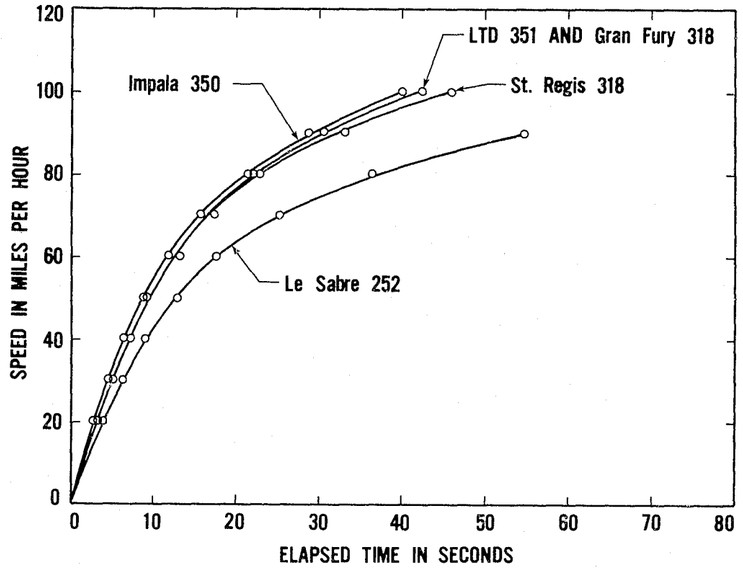

Figure 1. Full size vehicle acceleration

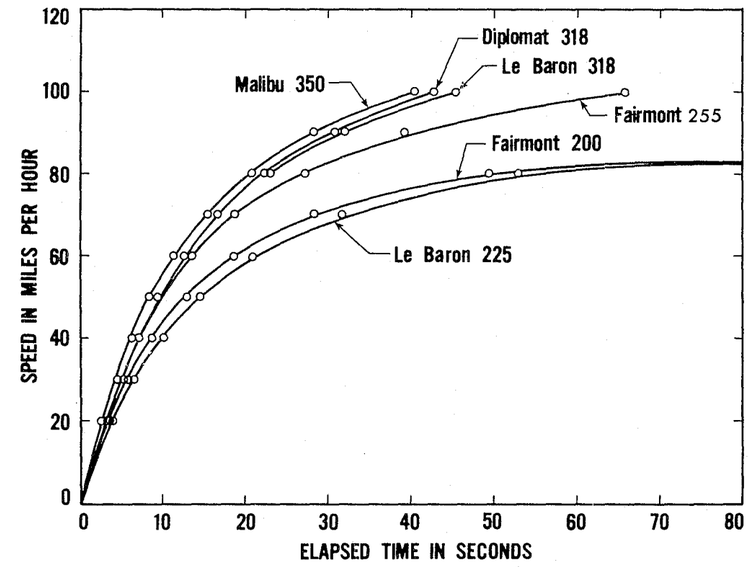

Figure 2. Mid-size vehicle acceleration

SUMMARY OF ACCELERATION AND TOP SPEED

Table 3. Full Size Vehicles

SPEED	Buick Le Sabre-252	Chevrolet Impala-350	Dodge St. Regis-318	Ford LTD-351	Plymouth Gran Fury-318
0-20 MPH (Sec)	3.76	2.60	3.16	2.93	3.16
0-30 MPH (Sec)	6.11	4.34	5.13	4.78	5.06
0-40 MPH (Sec)	8.94	6.21	7.19	6.77	7.11
0-50 MPH (Sec)	12.81	8.71	9.72	9.46	9.48
0-60 MPH (Sec)	17.51	11.93	13.14	12.76	12.76
0-70 MPH (Sec)	25.10	15.68	17.24	16.77	16.72
0-80 MPH (Sec)	36.26	21.35	22.83	22.24	21.77
0-90 MPH (Sec)	54.69	28.74	32.79	30.32	30.30
0-100 MPH (Sec)	--	39.98	45.72	42.16	42.22
Top Speed	97.1	113.8	114.7	116.4	115.1
Distance to reach 105 MPH (Miles)	NA	.99	1.08	1.00	.98
Quarter Mile (average)*					
Time	21.88	18.95	19.63	19.35	19.40
Speed	66.25	75.00	74.50	74.75	75.25

Table 4. Mid Size Vehicles

SPEED	Chevrolet Malibu-350	Chrysler Le Baron-318	Dodge Diplomat-318	Ford Fairmount-255	Chrysler Le Baron-225	Ford Fairmont-200
0-20 MPH (Sec)	2.54	3.11	3.15	3.03	3.99	3.42
0-30 MPH (Sec)	4.41	5.01	5.14	4.97	6.50	5.84
0-40 MPH (Sec)	6.11	6.92	7.08	7.12	10.04	8.71
0-50 MPH (Sec)	8.40	9.32	9.42	9.94	14.69	13.00
0-60 MPH (Sec)	11.42	12.86	12.84	13.63	21.06	18.77
0-70 MPH (Sec)	15.28	16.71	16.68	18.61	31.68	28.25
0-80 MPH (Sec)	20.86	23.07	22.38	27.15	52.80	49.30
0-90 MPH (Sec)	28.19	31.98	30.74	39.09	2:56.75	2:30.90
0-100 MPH (Sec)	40.27	45.24	42.71	1:05.79	--	--
Top Speed	111.9	114.7	116.3	106.4	92.5	92.3
Distance to reach 105 MPH (Miles)	1.19	1.11	1.10	4.60	NA	NA
Quarter Mile (average)*						
Time	18.15	18.90	19.38	19.68	22.80	21.78
Speed	74.75	73.50	75.50	71.00	61.75	63.50

*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 this stop, 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 test 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 stops are presented in tables 5 and 6. 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. Brake Testing, Full-Size Vehicles

		Buick Le Sabre-252	Chevrolet Impala-350	Dodge St. Regis-318	Ford LTD-351	Plymouth Gran Fury-318
Phase I						
Initial Speed	(MPH)	59.9	61.0	60.2	60.6	61.5
Stopping Distance	(Ft)	161.9	148.6	165.5	172.2	160.9
Deceleration Rate	(Ft/Sec²)	23.84	26.93	23.55	22.94	25.28
Phase II						
Initial Speed	(MPH)	60.7	60.3	60.9	60.6	61.2
Stopping Distance	(Ft)	165.8	148.7	167.7	166.2	161.0
Deceleration Rate	(Ft/Sec²)	23.90	26.30	23.79	23.77	25.02
Deceleration Rate (Average)	(Ft/Sec²)	23.87	26.62	23.67	23.35	25.15

Table 6. Brake Testing, Mid-Size Vehicles

		Chevrolet Malibu-350	Chrysler Le Baron-318	Dodge Diplomat-318	Ford Fairmount-255	Chrysler Le Baron-255	Ford Fairmont-200
Phase I							
Initial Speed	(MPH)	60.3	61.1	60.0	59.5		
Stopping Distance	(Ft)	148.2	152.5	160.2	146.1		
Deceleration Rate	(Ft/Sec²)	26.39	26.33	24.17	26.06		
Phase II							
Initial Speed	(MPH)	60.4	60.7	60.2	60.6		
Stopping Distance	(Ft)	156.8	154.1	155.4	164.8		
Deceleration Rate	(Ft/Sec²)	25.03	25.72	25.08	23.97		
Deceleration Rate (Average)	(Ft/Sec²)	25.71	26.02	24.63	25.02		

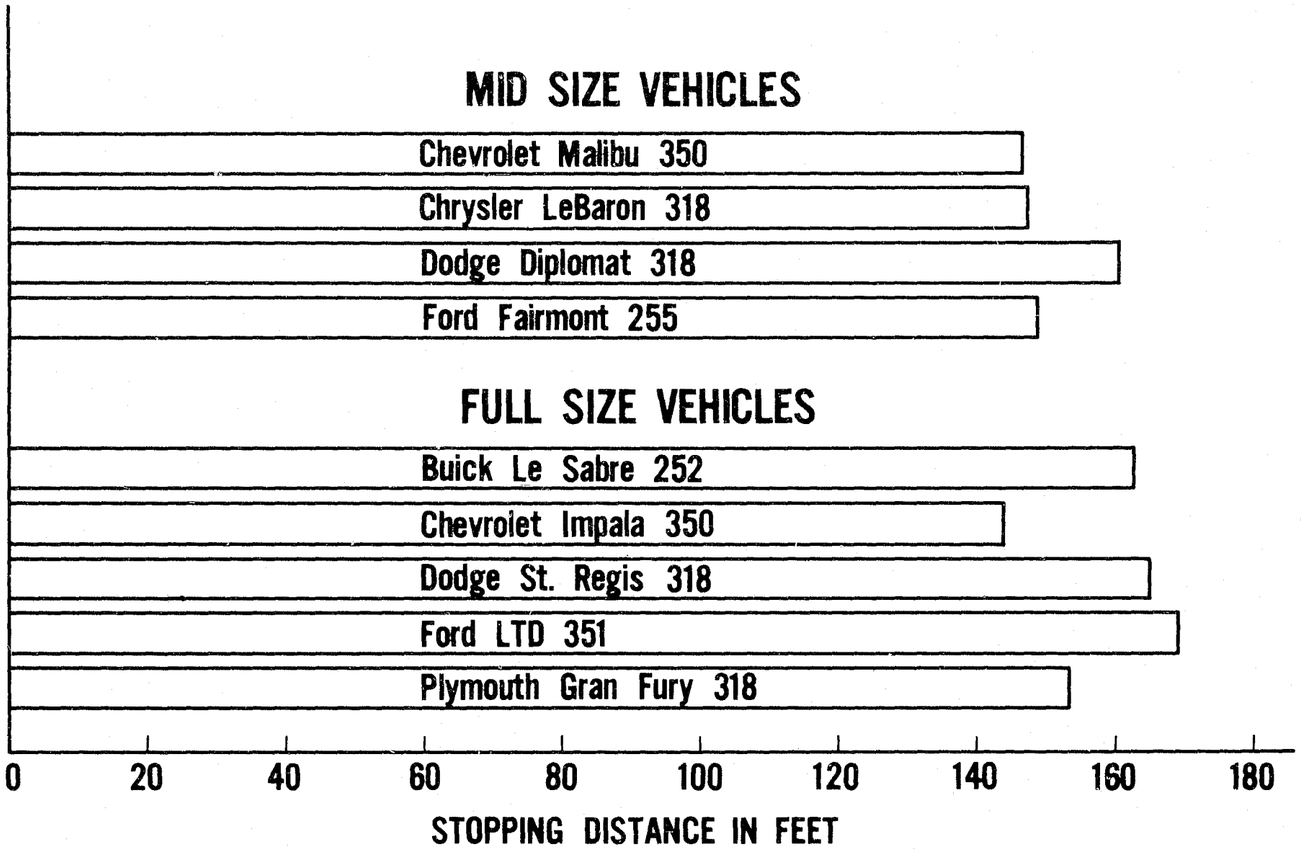

Figure 3. Vehicle stopping distances from 60 miles per hour.

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 tables 7 and 8.

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

Table 7

ERGONOMICS AND COMMUNICATIONS EVALUATION—FULL SIZE

	Buick Le Sabre	Chevrolet Impala	Dodge St. Regis	Ford LTD	Plymouth Gran Fury
1. ERGONOMICS					
SEATS					
Front					
Padding	7.50	6.63	6.63	5.88	6.63
Depth of Bench	6.88	6.00	5.88	7.38	5.88
Angle of Back	6.63	6.63	7.50	7.38	7.50
Adjustability	7.00	7.00	7.38	7.13	7.38
Seat to Wheel Relationship	7.38	7.13	8.00	7.63	8.00
Seat to Pedal Relationship	7.25	7.25	6.63	7.38	6.63
Rear					
Leg Room	6.88	6.50	7.13	7.88	7.13
CONTROLS AND INSTRUMENTATION					
Vehicle Controls					
Pedals—Size and Relationship	7.75	7.75	6.13	6.50	6.13
Steering Wheel Position	7.25	7.13	6.63	6.63	6.63
Heater/A-C Controls Location	4.63	4.00	3.88	4.00	3.88
Instrumentation					
Clarity	3.63	7.13	6.13	7.25	6.13
Placement	3.25	6.75	5.00	3.25	5.00
VISIBILITY					
Front	6.38	6.75	7.38	7.38	7.38
Left Side	5.63	6.38	7.00	6.50	7.00
Left Rear Quarter	6.50	6.38	6.38	7.25	6.38
Right Side	6.88	6.50	6.63	6.63	6.63
Right Rear Quarter	6.00	5.88	6.38	7.00	6.38
Rear	6.00	6.13	6.50	6.88	6.50
HEATER/A-C					
Operation					
Blower Range	7.88	7.88	7.75	7.75	7.75
Temperature	7.38	7.50	7.38	7.63	7.38
Vent Placement	7.63	7.13	8.13	6.50	8.13
Vent Adjustability	8.25	7.50	7.50	7.50	7.50
WINDOWS AND DOORS					
Windows					
Seal	7.63	7.13	2.88	8.00	2.88
Position of Crank	5.63	5.13	7.25	5.88	7.25
Doors					
Ease of Entry and Exit—Front	7.00	6.50	6.75	7.75	6.75
Ease of Entry and Exit—Rear	6.75	5.75	7.00	7.25	7.00
2. COMMUNICATIONS					
DASH ACCESSIBILITY	6.50	8.00	6.50	3.00	6.50
ENGINE ACCESSIBILITY	2.00	5.50	7.25	2.25	7.50
TRUNK ACCESSIBILITY	6.80	8.00	8.00	5.80	8.00
TOTALS	186.87	193.94	193.58	189.24	193.83

Table 8

ERGONOMICS AND COMMUNICATIONS EVALUATION—MID SIZE

	Chevrolet Malibu	Chrysler Le Baron	Dodge Diplomat	Ford Fairmont	
1. ERGONOMICS					
SEATS					
Front					
Padding	6.63	7.88	7.88	4.25	
Depth of Bench	6.50	7.00	7.00	5.88	
Angle of Back	6.25	6.13	6.13	6.38	
Adjustability	6.25	6.63	6.63	5.38	
Seat to Wheel Relationship	6.88	6.75	6.75	6.50	
Seat to Pedal Relationship	6.88	7.00	7.00	5.63	
Rear					
Leg Room	4.13	7.38	7.38	4.25	
CONTROLS AND INSTRUMENTATION					
Vehicle Controls					
Pedals—Size and Relationship	6.38	7.00	7.00	4.38	
Steering Wheel Position	7.13	6.50	6.50	5.88	
Heater/A-C Controls Location	4.13	7.25	7.25	4.50	
Instrumentation					
Clarity	8.13	6.38	6.38	6.00	
Placement	8.63	4.75	4.75	4.00	
VISIBILITY					
Front	7.00	7.38	7.38	6.63	
Left Side	7.00	6.63	6.63	6.75	
Left Rear Quarter	6.50	6.88	6.88	6.63	
Right Side	7.00	6.75	6.75	7.13	
Right Rear Quarter	7.25	6.63	6.63	7.38	
Rear	6.63	7.38	7.38	6.13	
HEATER/A-C					
Operation					
Blower Range	7.75	7.88	7.88	7.50	
Temperature	7.63	7.50	7.50	7.63	
Vent Placement	6.88	6.88	6.88	7.00	
Vent Adjustability	7.13	6.88	6.88	7.00	
WINDOWS AND DOORS					
Windows					
Seal	7.25	6.25	6.25	6.50	
Position of Crank	7.88	7.50	7.50	6.13	
Doors					
Ease of Entry and Exit—Front	6.25	6.88	6.88	5.00	
Ease of Entry and Exit—Rear	4.38	6.63	6.63	4.50	
2. COMMUNICATIONS					
DASH ACCESSIBILITY	3.50	4.75	4.75	1.75	
ENGINE ACCESSIBILITY	3.00	4.25	4.25	2.00	
TRUNK ACCESSIBILITY	6.60	4.60	4.60	4.40	
TOTALS	187.55	192.30	192.30	163.09	

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 9, are used as the final factor in the bid adjustment process. A weighting factor of 25 percent has been assigned to fuel economy.

Table 9. Fuel Economy

VEHICLES MAKE/MODEL — FULL SIZE	EPA Miles Per Gallon		
	CITY*	HIGHWAY	COMBINED
Buick Le Sabre—252-4V	18 (18.5)	25	21
Chevrolet Impala—350-4V	15 (14.7)**	21**	17**
Dodge St.Regis—318-4V	16 (15.5)	23	18
Ford LTD—351-VV	15 (15.3)**	25**	18**
Plymouth Gran Fury—318-4V	16 (15.5)	23	18
MAKE/MODEL — MID-SIZE			
Chevrolet Malibu—350-4V	15 (14.7)**	21**	17**
Chrylser Le Baron—318-4V	16 (15.5)	23	18
Dodge Diplomat—318-4V	16 (15.5)	23	18
Ford Fairmont—255-2V	18 (18.1)	25	21
MAKE/MODEL — MID-SIZE (Six Cylinder)			
Chrylser Le Baron—225-1V	18 (17.9)	23	20
Ford Fairmont—200-1V	20 (19.8)	28	23

* EPA Published Estimate (EPA Estimate to 1/10 MPG)
**Manufacturer's Figures as Submitted to EPA - EPA Figures Unavailable at Time of Printing

MICHIGAN STATE POLICE
PATROL VEHICLE WEIGHTING AND SCORING
FOR MODEL YEAR 1981

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 (-$).

Tables 10 and 11 present the final results of the bid adjustments calculated by MSP for the 1981 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 tables 10 and 11 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 tables.

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 1981 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 10

MICHIGAN STATE POLICE
COMPETITIVE PATROL VEHICLE EVALUATION
FULL SIZE VEHICLES

EVALUATION FACTORS	VEH DYN	ACCEL	BRAKE DECEL	TOP SPEED	ERGO/ COM	FUEL ECON
UNITS	SEC	SEC	FT/S^2	MPH	PTS	UR EPA
WEIGHT	25%	15%	10%	15%	10%	25%

CAR	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	TOTAL WTD Z	BID ADJ*	ACTUAL BID**	ADJUSTED BID
CHEVROLET IMPALA	90.72 0.386	39.98 0.185	26.62 0.148	113.80 -0.192	193.94 0.066	14.70 -0.419	0.173	$ - 65.78	$7,626.68	$7,560.90
DODGE ST. REGIS	93.93 -0.252	45.72 -0.233	23.67 -0.079	114.70 -0.048	193.58 0.047	15.50 0.191	-0.375	$ +142.49	$7,591.05	$7,733.54
FORD LTD	92.40 0.052	42.16 0.026	23.35 -0.104	116.40 0.224	189.24 -0.173	15.30 0.038	0.065	$ - 24.61	$8,342.66	$8,318.05
PLYMOUTH GRAN FURY	93.60 -0.186	42.22 0.022	25.15 0.035	115.10 0.016	193.83 0.060	15.50 0.191	0.137	$ - 52.10	$7,568.84	$7,516.74

*5.00% bid adjustment = -$380.44
**Marked Units (F.O.B. East Lansing, Michigan) Median Bid $7,670.10

Table 11

MICHIGAN STATE POLICE
COMPETITIVE PATROL VEHICLE EVALUATION
MID-SIZE VEHICLES

EVALUATION FACTORS	VEH DYN	ACCEL	BRAKE DECEL	TOP SPEED	ERGO/ COM	FUEL ECON
UNITS	SEC	SEC	FT/S	MPH	PTS	UR EPA
WEIGHT	25%	15%	10%	15%	10%	25%

CAR	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	SCORE & WTD Z	TOTAL WTD Z	BID ADJ*	ACTUAL BID**	ADJUSTED BID
CHEVROLET	90.37	40.27	25.71	111.90	187.55	14.70				
MALIBU	0.342	0.183	0.043	-0.198	-0.141	-0.354	-0.125	$ + 47.87	$7,483.61	$7,531.48
CHRYSLER	92.54	45.24	26.02	114.70	192.30	15.0				
LEBARON	-0.247	-0.185	0.095	0.033	0.071	0.177	-0.057	$ + 21.69	$7,670.10	$7,691.79
DODGE	91.98	42.71	24.63	116.30	192.30	15.50				
DIPLOMAT	-0.095	0.002	-0.138	0.165	0.071	0.177	0.181	$ - 69.55	$7,693.10	$7,623.55

*5.00% bid adjustment = -$383.51
**Marked units (F.O.B. East Lansing, Michigan) Median Bid $7,670.10

APPENDIX A

MICHIGAN STATE
VEHICLE SPECIFICATION

STATE OF MICHIGAN
DEPARTMENT OF MANAGEMENT AND BUDGET
PURCHASING DIVISION

Specification for
POLICE CARS: PATROL
4-Door Sedan

Mich. 3905-0010a
Mid-Size Vehicles
Wheelbase 105.5 to 112.7

September 1, 1980

Mich. 3905-0010
Full-Size Vehicles
Wheelbase 114.4 to 119.9

September 1, 1980

BID REQUIREMENTS:

Prior to bidding, a car dealer, manufacturer, or his representative, will be required to furnish a vehicle for test purposes. All test vehicles shall be 1981 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, October 20, 1980.

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 seven (7) 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 December 1, 1980.

Mich. 3905-0010
September 1, 1980

SPECIFICATIONS:

Model - 1981 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; 465 cold cranking amps, minimum

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

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 at 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, preferably located in instrument cluster, or under dash convenient to driver.

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

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

Mich. 3905-0010a
September 1, 1980

Mich. 3905-0010
September 1, 1980

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.

Mirrors, Rearview:

Inside: Day/night type.

Outside: Installed on left-hand and right-hand doors, 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 and 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, preferred. Bowden cable system not acceptable.

Mich. 3905-0010
September 1, 1980

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 5/8" 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.

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 21, 1979.

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.

Speedometer: Shall be calibrated to within ± 3 mph accuracy. Scale graduations to be linear and of 2 mph increments. 0-120 mph scale minimum.

Spotlights: Unity #225-6, 6" diameter, left- and right-hand mounted, equipped with aircraft landing lamp 4537-2. Pillar or other approved mount. Left and right spotlights to be 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 or oval with anti-slip surface.

Mich. 3905-0010a
September 1, 1980

Mich. 3905-0010
September 1, 1980

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 Rayon P205/70R14 (Mid Size) and P225/70R15 (Full Size) Police Radials per State of Michigan specification 5260-S1, May 21, 1979.

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, 15" x 5.5" (Mid Size) and 15" x 6.5" (Full Size) minimum. To be equipped with metal clamp in valve stems and sealed type metal valve caps.

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. TOP SPEED

   A speed of 105 mph must be attained within a 3-mile distance. For purposes to be explained in another section of this report, the vehicles will, after attaining the 105 mph minimum, be accelerated to the maximum speed attainable within 15 miles.

3. 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.	BUICK		LeSABRE		BN69	
ENGINE DISPLACEMENT	252	CU. IN.	4.1	LITERS		
CARBURETOR-EXHAUST	4 BBL Rochester		Single Exhaust			
HORSEPOWER @ RPM (S.A.E. NET)	125 @ 4000 RPM					
TORQUE LBS. @ RPM	205 @ 2000 RPM					
COMPRESSION RATIO	8.0:1					
AXLE RATIO	3.23:1					
STEERING	Recirculating Ball - Power - Fast Ratio					
TURNING CIRCLE (CURB TO CURB)	39.49 FT-L	39.30 FT-R				
TIRE SIZE	P225/70R15					
SUSPENSION TYPE — FRONT	Independent - Coil Springs					
SUSPENSION TYPE — REAR	Coil With Stabilizer Bar					
BRAKE—FRONT	TYPE	Disc	SWEPT AREA	397	SQ. IN.	
BRAKE—REAR	TYPE	Drum	(Combined)			
OVERALL LENGTH	216.6 in.					
OVERALL HEIGHT	55.2 in.					
WEIGHT	CURB	3627 LBS.	TEST	3834	LBS.	
WHEELBASE	116.6 in.					
HEAD ROOM — FRONT	39.5 in.					
HEAD ROOM — REAR	38.2 in.					
LEG ROOM — FRONT	42.2 in.					
LEG ROOM — REAR	38.9 in.					
SHOULDER ROOM — FRONT	60.3 in.					
SHOULDER ROOM — REAR	61.0 in.					
HIP ROOM — FRONT	55.0 in.					
HIP ROOM — REAR	55.3 in.					
E.P.A. MILEAGE ESTIMATE	CITY M.P.G.	18	HIGHWAY M.P.G.	25	COMBINED M.P.G.	21

INTERIOR VOLUME		
Interior		
Front	57.0	cu ft
Rear	53.0	cu ft
Combined	110.0	cu ft
Trunk	21.0	cu ft

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

Table B-2

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)	NA - Est. Based on 1980 is 165 @ 3800 RPM				
TORQUE LBS. @ RPM	NA - Est. Based on 1980 is 260 @ 2400 RPM				
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	212.1 in.				
OVERALL HEIGHT	55.2 in.				
WEIGHT	CURB 3488	LBS.	TEST	3927	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. 15		HIGHWAY M.P.G. 21	COMBINED M.P.G. 17	

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 350C
LOCK UP TORQUE CONVERTER	YES X NO
OVERDRIVE	YES NO X

Table B-3

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	DODGE		ST. REGIS	EH-42	
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	240 @ 2000				
COMPRESSION RATIO	8.4:1				
AXLE RATIO	2.94:1				
STEERING	Power - Firm (15.7:1 Gear Ratio)				
TURNING CIRCLE (CURB TO CURB)	42.4 FT				
TIRE SIZE	P225/70R15				
SUSPENSION TYPE — FRONT	Independent - Lateral - Nonparallel Control Arms With Torsion Bars				
SUSPENSION TYPE — REAR	Parallel Longitudinal Leaf				
BRAKE—FRONT	TYPE Disc		SWEPT AREA	224.0	SQ. IN.
BRAKE—REAR	TYPE Drum		SWEPT AREA	165.9	SQ. IN.
OVERALL LENGTH	220.2 in.				
OVERALL HEIGHT	54.5 in.				
WEIGHT	CURB 3644	LBS.	TEST	4086	LBS.
WHEELBASE	118.5 in.				
HEAD ROOM — FRONT	38.2 in.				
HEAD ROOM — REAR	37.4 in.				
LEG ROOM — FRONT	42.3 in.				
LEG ROOM — REAR	38.3 in.				
SHOULDER ROOM — FRONT	61.0 in.				
SHOULDER ROOM — REAR	61.0 in.				
HIP ROOM — FRONT	57.4 in.				
HIP ROOM — REAR	57.4 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 16		HIGHWAY M.P.G. 23	COMBINED M.P.G. 18	

INTERIOR VOLUME

Interior		
Front	57.0	cu ft
Rear	50.6	cu ft
Combined	107.6	cu ft
Trunk	21.3	cu ft

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

Table B-4

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD		LTD "S"	61	
ENGINE DISPLACEMENT	351W H.O.	CU. IN.	5.8	LITERS	
CARBURETOR-EXHAUST	Ford 7200 VV*		Dual Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	165 @ 3600 RPM				
TORQUE LBS. @ RPM	285 @ 2200 RPM				
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 3602	LBS.	TEST 4060	LBS.	
WHEELBASE	114.3 in.				
HEAD ROOM — FRONT	37.9 in.		INTERIOR VOLUME		
HEAD ROOM — REAR	37.2 in.		Interior		
LEG ROOM — FRONT	42.1 in.		Front 57	cu ft	
LEG ROOM — REAR	40.6 in.		Rear 54	cu ft	
SHOULDER ROOM — FRONT	61.7 in.		Combined 111	cu ft	
SHOULDER ROOM — REAR	61.7 in.		Trunk 22.4	cu ft	
HIP ROOM — FRONT	61.2 in.				
HIP ROOM — REAR	56.9 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 15		HIGHWAY M.P.G. 25	COMBINED M.P.G. 18	

TRANSMISSION 4-Speed Automatic Overdrive (AOD)
MODEL NUMBER PKA-AS
LOCK UP TORQUE CONVERTER YES X NO
OVERDRIVE YES X NO

*2 Variable Venturis

Table B-5

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	PLYMOUTH		GRAN FURY	JL-42	
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	240 @ 2000				
COMPRESSION RATIO	8.4:1				
AXLE RATIO	2.94:1				
STEERING	Power Firm (15.7:1 Gear Ratio)				
TURNING CIRCLE (CURB TO CURB)	42.4 FT				
TIRE SIZE	P225/70R15				
SUSPENSION TYPE — FRONT	Independent - Lateral - Nonparallel Control Arms With Torsion Bars				
SUSPENSION TYPE — REAR	Parallel Longitudinal Leaf				
BRAKE—FRONT	TYPE Disc		SWEPT AREA 224.0	SQ. IN.	
BRAKE—REAR	TYPE Drum		SWEPT AREA 165.9	SQ. IN.	
OVERALL LENGTH	220.2 in.				
OVERALL HEIGHT	54.5 in.				
WEIGHT	CURB 3595	LBS.	TEST 4090	LBS.	
WHEELBASE	118.5 in.				
HEAD ROOM — FRONT	38.2 in.		INTERIOR VOLUME		
HEAD ROOM — REAR	37.4 in.		Interior		
LEG ROOM — FRONT	42.3 in.		Front 57.0	cu ft	
LEG ROOM — REAR	38.3 in.		Rear 50.6	cu ft	
SHOULDER ROOM — FRONT	61.0 in.		Combined 107.6	cu ft	
SHOULDER ROOM — REAR	61.0 in.		Trunk 21.3	cu ft	
HIP ROOM — FRONT	57.4 in.				
HIP ROOM — REAR	57.4 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 16		HIGHWAY M.P.G. 23	COMBINED M.P.G. 18	

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

Table B-6

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	CHEVROLET		MALIBU		1AT19	
ENGINE DISPLACEMENT	350	CU. IN.	5.7	LITERS		
CARBURETOR-EXHAUST	4 BBL		Single Exhaust			
HORSEPOWER @ RPM (S.A.E. NET)	NA - Est. Based on 1980 is 165 @ 3800 RPM					
TORQUE LBS. @ RPM	NA - Est. Based on 1980 is 260 @ 2400 RPM					
COMPRESSION RATIO	8.2:1					
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 Type 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	3125 LBS.	TEST	3579	LBS.	
WHEELBASE	108.1 in.					
HEAD ROOM — FRONT	38.7 in.					
HEAD ROOM — REAR	37.7 in.					
LEG ROOM — FRONT	42.8 in.					
LEG ROOM — REAR	38.0 in.					
SHOULDER ROOM — FRONT	57.2 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. 15		HIGHWAY M.P.G. 21		COMBINED M.P.G. 17	

INTERIOR VOLUME

Interior		
Front	54.8	cu ft
Rear	47.3	cu ft
Combined	102.1	cu ft
Trunk	16.6	cu ft

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

Table B-7

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	CHRYSLER		LeBARON		FH-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	240 @ 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 - Nonparallel Control Arms With Transverse Torsion Bars					
SUSPENSION TYPE — REAR	Semi-Elliptical Leaf Springs					
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	3395 LBS.	TEST	3856	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	56.9 in.					
HIP ROOM — REAR	57.0 in.					
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 16		HIGHWAY M.P.G. 23		COMBINED M.P.G. 18	

INTERIOR VOLUME

Interior		
Front	54.1	cu ft
Rear	44.6	cu ft
Combined	98.7	cu ft
Trunk	15.6	cu ft

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

Table B-8

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	CHRYSLER	LeBARON	FH-41	
ENGINE DISPLACEMENT	225 CU. IN.	3.7 LITERS		
CARBURETOR-EXHAUST	1 BBL	Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	85 @ 3600			
TORQUE LBS. @ RPM	165 @ 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 - Nonparallel Control Arms With Transverse Torsion Bars			
SUSPENSION TYPE — REAR	Semi-Elliptical Leaf Springs			
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 3395 LBS.	TEST 3694 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	56.9 in.			
HIP ROOM — REAR	57.0			
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 18	HIGHWAY M.P.G. 23	COMBINED M.P.G. 20	

INTERIOR VOLUME

Interior		
Front	54.1	cu ft
Rear	44.6	cu ft
Combined	98.7	cu ft
Trunk	15.6	cu ft

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

Table B-9

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	240 @ 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 - Nonparallel Control Arms With Transverse Torsion Bars			
SUSPENSION TYPE — REAR	Semi-Elliptical Leaf Springs			
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 3395 LBS.	TEST 3851 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	55.6 in.			
SHOULDER ROOM — REAR	55.5 in.			
HIP ROOM — FRONT	56.9 in.			
HIP ROOM — REAR	57.0 in.			
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 16	HIGHWAY M.P.G. 23	COMBINED M.P.G. 18	

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

Table B-10

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD		FAIRMONT	92	
ENGINE DISPLACEMENT	255	CU. IN.	4.2		LITERS
CARBURETOR-EXHAUST	2 BBL Ford 2150		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	115 @ 3400 RPM				
TORQUE LBS. @ RPM	195 @ 2200 RPM				
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 2724	LBS.	TEST 3156		LBS.
WHEELBASE	105.5 in.				
HEAD ROOM — FRONT	38.3 in.				
HEAD ROOM — REAR	37.4 in.				
LEG ROOM — FRONT	41.7 in.				
LEG ROOM — REAR	35.3 in.				
SHOULDER ROOM — FRONT	56.7 in.				
SHOULDER ROOM — REAR	55.7 in.				
HIP ROOM — FRONT	56.2 in.				
HIP ROOM — REAR	53.7 in.				
E.P.A. MILEAGE ESTIMATE	CITY M.P.G. 18		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	16.8	cu ft

TRANSMISSION 3-Speed Automatic (C412)
MODEL NUMBER PEM-AL
LOCK UP TORQUE CONVERTER YES____ NO X
OVERDRIVE YES____ NO X

Table B-11

INFORMATIONAL HARDWARE DESCRIPTION

MAKE, MODEL, & SALES CODE NO.	FORD		FAIRMONT	92	
ENGINE DISPLACEMENT	200	CU. IN.	3.3		LITERS
CARBURETOR-EXHAUST	1 BBL		Single Exhaust		
HORSEPOWER @ RPM (S.A.E. NET)	88 @ 3800 RPM				
TORQUE LBS. @ RPM	154 @ 1400 RPM				
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 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 2724	LBS.	TEST 2944		LBS.
WHEELBASE	105.5 in.				
HEAD ROOM — FRONT	38.3 in.				
HEAD ROOM — REAR	37.4 in.				
LEG ROOM — FRONT	41.7 in.				
LEG ROOM — REAR	35.3 in.				
SHOULDER ROOM — FRONT	56.7 in.				
SHOULDER ROOM — REAR	55.7 in.				
HIP ROOM — FRONT	56.2 in.				
HIP ROOM — REAR	53.7 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	16.8	cu ft

TRANSMISSION 3-Speed Automatic (C412)
MODEL NUMBER PEB-N10
LOCK UP TORQUE CONVERTER YES____ NO X
OVERDRIVE YES____ NO X

APPENDIX C

VEHICLE ACCELERATION DATA

TABLE C-1

FULL SIZE VEHICLE ACCELERATION
AND TOP SPEED TEST RESULTS

TEST LOCATION Chrysler Proving Grounds DATE October 25, 1980

ACCELERATION

WIND VELOCITY 11 mph WIND DIRECTION NW-300° TEMPERATURE 38°F

MAKE & MODEL Buick LeSabre BEGINNING TIME 10:31 AM/[redacted]

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	17.76	17.35	17.58	17.35	17.51
0-80	26.0 Seconds	36.13	36.60	36.18	36.11	36.26
0-100	48.5 Seconds	--	--	--	--	--

TOP SPEED

DISTANCE TO REACH 105 MPH N/A TOP SPEED ATTAINED 97.1 MPH

ACCELERATION

WIND VELOCITY 13 mph WIND DIRECTION SW-260° TEMPERATURE 38°F

MAKE & MODEL Chevrolet Impala BEGINNING TIME 9:42 AM/[redacted]

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.08	11.93	11.81	11.90	11.93
0-80	26.0 Seconds	21.07	21.24	21.77	21.33	21.35
0-100	48.5 Seconds	40.38	40.12	40.19	39.24	39.98

TOP SPEED

DISTANCE TO REACH 105 MPH .99 mile TOP SPEED ATTAINED 113.8 MPH

*Michigan State Police Minimum Requirements

TEST LOCATION Chrysler Proving Grounds DATE October 25, 1980

ACCELERATION

WIND VELOCITY 11 mph WIND DIRECTION W-270° TEMPERATURE 38°F

MAKE & MODEL Dodge St. Regis BEGINNING TIME 11:09 AM/[redacted]

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	13.09	13.28	12.89	13.28	13.14
0-80	26.0 Seconds	23.09	22.91	22.13	23.19	22.83
0-100	48.5 Seconds	46.15	46.64	43.82	46.25	45.72

TOP SPEED

DISTANCE TO REACH 105 MPH 1.08 miles TOP SPEED ATTAINED 114.7 MPH

ACCELERATION

WIND VELOCITY 8 mph WIND DIRECTION W-270° TEMPERATURE 37°

MAKE & MODEL Ford LTD BEGINNING TIME 9:06 AM/[redacted]

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.98	12.78	12.55	12.71	12.76
0-80	26.0 Seconds	23.22	22.53	21.65	21.55	22.24
0-100	48.5 Seconds	44.13	42.14	41.72	40.65	42.16

TOP SPEED

DISTANCE TO REACH 105 MPH 1.00 mile TOP SPEED ATTAINED 116.4 MPH

TABLE C-1 CONTINUED

TEST LOCATION Chrysler Proving Grounds DATE October 25, 1980

ACCELERATION

WIND VELOCITY 3 mph WIND DIRECTION SW-250° TEMPERATURE 37°F

MAKE & MODEL Plymouth Gran Fury BEGINNING TIME 8:35 AM/■

SPEEDS	TIME REQUIREMENT*	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.72	12.91	12.70	12.70	12.76
0-80	26.0 Seconds	21.78	21.55	21.76	21.97	21.77
0-100	48.5 Seconds	43.00	41.77	42.34	41.76	42.22

TOP SPEED

DISTANCE TO REACH 105 MPH .98 mile TOP SPEED ATTAINED 115.1 MPH

C2

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	14.5 Seconds					
0-80	26.0 Seconds					
0-100	48.5 Seconds					

TOP SPEED

DISTANCE TO REACH 105 MPH _____ TOP SPEED ATTAINED _____ MPH

*Michigan State Police Minimum Requirements

TABLE C-2

MID SIZE VEHICLE ACCELERATION AND TOP SPEED TEST RESULTS

TEST LOCATION Chrysler Proving Grounds DATE October 25, 1980

ACCELERATION

WIND VELOCITY 13 mph WIND DIRECTION SW-250° TEMPERATURE 38°F

MAKE & MODEL Chevrolet Malibu BEGINNING TIME 12:41 [redacted]/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	11.42	11.33	11.38	11.54	11.42
0-80	26.0 Seconds	21.11	20.58	20.94	20.79	20.86
0-100	48.5 Seconds	41.80	40.38	39.79	39.11	40.27

TOP SPEED

DISTANCE TO REACH 105 MPH 1.19 miles TOP SPEED ATTAINED 111.9 MPH

TEST LOCATION Chrysler Proving Grounds DATE October 25, 1980

ACCELERATION

WIND VELOCITY 18 mph WIND DIRECTION SW-216° TEMPERATURE 36°F

MAKE & MODEL Dodge Diplomat BEGINNING TIME 1:53 [redacted]/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	13.38	12.64	12.63	12.69	12.84
0-80	26.0 Seconds	22.99	22.30	21.88	22.36	22.38
0-100	48.5 Seconds	44.51	42.37	41.81	42.15	42.71

TOP SPEED

DISTANCE TO REACH 105 MPH 1.10 miles TOP SPEED ATTAINED 116.3 MPH

ACCELERATION

WIND VELOCITY 15 mph WIND DIRECTION NW-280° TEMPERATURE 38°F

MAKE & MODEL Chrysler LeBaron BEGINNING TIME 11:45 AM/[redacted]

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	12.86	12.93	12.79	12.84	12.86
0-80	26.0 Seconds	22.98	23.31	23.19	22.81	23.07
0-100	48.5 Seconds	44.71	46.68	44.47	45.10	45.24

TOP SPEED

DISTANCE TO REACH 105 MPH 1.11 miles TOP SPEED ATTAINED 114.7 MPH

ACCELERATION

WIND VELOCITY 10 mph WIND DIRECTION SW-250° TEMPERATURE 37°F

MAKE & MODEL Ford Fairmont BEGINNING TIME 1:14 [redacted]/PM

SPEEDS	TIME REQUIREMENT *	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60	14.5 Seconds	13.99	13.55	13.49	13.50	13.63
0-80	26.0 Seconds	28.96	26.41	27.04	26.20	27.15
0-100	48.5 Seconds	1:13.75	1:05.16	1:03.32	1:00.94	1:05.79

TOP SPEED

DISTANCE TO REACH 105 MPH 4.60 miles TOP SPEED ATTAINED 106.4 MPH

*Michigan State Police Minimum Requirements

TABLE C-2 CONTINUED

TEST LOCATION Chrysler Proving Grounds DATE October 25, 1980

ACCELERATION

WIND VELOCITY 11 mph WIND DIRECTION W-270° TEMPERATURE 35°F

MAKE & MODEL Chrysler LeBaron BEGINNING TIME 2:31 [redacted]/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		21.76	21.31	20.69	20.48	21.06
0-80		53.86	53.97	51.28	52.08	52.80
0-100		--	--	--	--	--

TOP SPEED

DISTANCE TO REACH 105 MPH N/A TOP SPEED ATTAINED 92.5 MPH

ACCELERATION

WIND VELOCITY 15 mph WIND DIRECTION W-270° TEMPERATURE 34°F

MAKE & MODEL Ford Fairmont BEGINNING TIME 3:16 [redacted]/PM

SPEEDS	TIME REQUIREMENT	RUN #1	RUN #2	RUN #3	RUN #4	AVERAGE
0-60		19.96	18.54	18.44	18.12	18.77
0-80		53.17	49.68	48.49	45.84	49.30
0-100		--	--	--	--	--

TOP SPEED

DISTANCE TO REACH 105 MPH N/A TOP SPEED ATTAINED 92.3 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:

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

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

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

and

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

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

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

$$\bar{X} = 300$$

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

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 vehicles' scores is:

1.31 x 0.10 = 0.131

-1.08 x 0.10 = -0.108

-0.23 x 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.

INTERNATIONAL ASSOCIATION
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END