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REPORT

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LIGHT VEHICLE NOISE: VOLUME II – IMPLEMENTATION AND EVALUATION OF A TEST PROCEDURE TO MEASURE THE NOISE EMISSIONS OF LIGHT VEHICLES OPERATING IN URBAN AREAS

REPORT

For

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Noise Abatement and Control
Arlington, Virginia 22202

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1.0 INTRODUCTION

In considering whether federal action is required to protect the public health and welfare against a possible increase in sound levels resulting from the introduction of more fuel-efficient light vehicles, EPA has found it necessary to obtain baseline noise data on 1977 model year vehicles. The development of a test procedure to measure the noise emissions of light vehicles as they are operated under typical urban acceleration conditions has been described in a previous report.[1] The current report describes the application of this and other relevant test procedures to 66 light vehicles that are representative of the makes and models entering the market in 1977 (Chapter 2.0), and presents the required baseline noise data in terms of recommended vehicle categories (Chapter 3.0 and Appendix C).

The results presented in this report represent the first full-scale application of the EPA Urban Noise Test Procedure that was developed earlier in 1977. In the development process, a limited evaluation of this test procedure was conducted with encouraging results, but the results were not conclusive due to the small sample of vehicles listed. The data obtained from the tests on 66 vehicles are therefore used in this report to provide a comprehensive evaluation of the test procedure (Chapter 4.0).

Finally, a further evaluation of the proposed CCMC interpolation procedure is given in Chapter 5.0.

It should be noted that vehicle parameters and distances were measured and printed out in English units (feet, pounds, seconds) during the test program. Therefore, in accordance with EPA's request to reduce the data reduction and analysis effort, English units are also used throughout this report.

2.0 DESCRIPTION OF VEHICLE TESTS

2.1 Test Facilities and Instrumentation

The light vehicle noise measurements were conducted at the Marana Air Park, located approximately 30 miles northwest of Tucson, Arizona. The Air Park was originally a military air base and is now privately operated as an aircraft storage and maintenance facility. Accordingly, many of the facilities required for vehicle testing were readily available. An abandoned runway was used as the test site. A garage space was available which was used for vehicle tuning and instrumenting prior to testing. In addition to these facilities, the Air Park also afforded support by the availability of personnel, shop facilities, and specialized equipment.

In addition to the facilities available at the Marana site, several other aspects of the location were conducive to vehicle noise tests. The prevailing weather conditions were quite favorable for outdoor sound measurement. During the evening hours in the Summer of 1977, when the testing was conducted, temperatures were quite moderate, ranging from 16°C to 32°C, and the wind speed was generally below 5 mph. There was also very little precipitation during the testing period. Another favorable aspect of the site was the low ambient sound level, which was typically below 40 dBA. Because the Air Park is used primarily for aircraft storage and maintenance, the noise intrusions usually associated with aircraft facilities did not occur. A final aspect of the site was its proximity to metropolitan Tucson. This afforded a good local selection of test vehicles and an availability of auxiliary equipment and supplies required to support the test program.

To provide a surface suitable for light vehicle noise measurements, an asphalt test section was constructed as an overlay to the existing runway. The test pad was 200 x 120 feet, built and sealed to the same specifications as the test pad used for vehicular testing at the EPA Noise Enforcement Facility in Sandusky, Ohio (see Appendix A). The area surrounding the test pad and runway was clear for distances over 300 feet of all objects which might act as reflecting surfaces. A trailer was installed in the vicinity of the test pad to house the data collection instrumentation and act as a test control room. The trailer was positioned approximately 300 feet away from the center of the test pad, thus assuring that any sound reflections would be typically at least 20 dB less than the direct sound from the vehicle as measured at the microphone positions. Power was supplied

to the trailer by two diesel generator sets which were partially enclosed so that the ambient sound level measured on the test pad was approximately 40 to 45 dBA.

During the pass-by tests, the exterior vehicle sound level was monitored by an array of microphones. Vehicle parameters were monitored and transmitted to the control room in the trailer by means of a telemetry system. The parameters measured were as follows:

Vehicle Speed — from a fifth wheel attached to the rear bumper of the vehicle. A standard Nucleus, Inc., fifth wheel assembly was used with a precision rotary shaft encoder installed in place of the standard unit to provide an extremely stable and consistent output of 100 pulses per revolution, providing an accuracy of ±0.1 mph.

Vehicle Position — by counting the number of pulses from the fifth wheel shaft encoder. The accuracy was measured at ±0.2 percent.

Engine Speed — by means of a capacitative pickup attached to the secondary wire of the ignition coil for spark-ignition engines. For diesels, a magnetic pickup was used to sense the rotational speed of the crankshaft pulley. Accuracy ±25 RPM.

Acceleration — by means of a strain-gage accelerometer hard-mounted to a bracket on the floor of the vehicle. Accuracy ±0.002g.

Interior Sound Level — by means of General Radio 1933 Sound Level Meter. The microphone was located approximately 6 inches to the right of, and in the same horizontal and vertical plane as, the driver's right ear, as specified in the SAE J336 procedure for the measurement of sound levels in truck cabs.[2]

The signals from each transducer (except the microphone and sound level meter) were filtered to eliminate high frequencies, using filters with a time constant of 100msecs., which is approximately equal to the time constant in the acoustic system. In this way, the measured acoustic and vehicle parameter data were time compatible.

A block diagram of the instrumentation system is shown in Figure 2.1. The four vehicle parameters and the broadband sound levels from the microphone channels were recorded together with a time code on FM tape using a Honeywell 5600C tape recorder operating at a tape speed of 30 ips. The signals from each microphone were also filtered

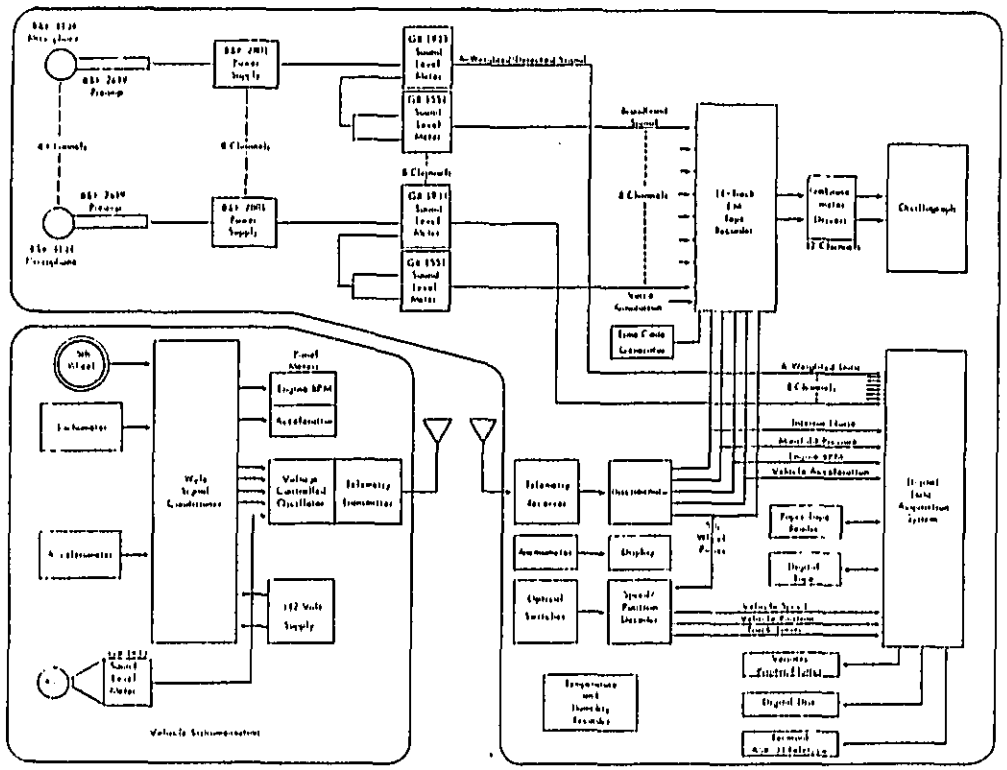

Figure 2.1. Block Diagram of Instrumentation System

using an A-weighting network, detected using the "fast" response characteristic, and input together with the vehicle parameters to a Varian Data Machine Model 620 minicomputer via a 16-channel differential multiplexer and an analog-to-digital converter. The data acquisition was initiated and ended by the test vehicle activating infra-red switches suitably placed alongside the track. Additional switches were used to identify the end-zone limits on the computer print-out. In test operation, the data were acquired, digitized and stored on a cartridge-type disc as it was received. At the completion of each test, the data were run through various analysis and plot programs and the results displayed on a printer/plotter within two minutes. Upon examination, the digital data were stored on magnetic tape for subsequent analysis.

Individual items of equipment were calibrated in the Wyle test facilities before use in the field to check the sensitivity, linearity and frequency response. All laboratory calibrations were performed using equipment with standards traceable to the National Bureau of Standards. Field calibrations were conducted and recorded before and after each vehicle test sequence.

Throughout the test program, wind speed, air temperature and relative humidity were monitored. The wind speed was measured at a height of 5 feet above the surface of the test track and 60 feet from the vehicle path using a cup anemometer providing a visual readout in the control trailer. Test runs were performed only when the measured wind speed was less than 10 mph. The air temperature and relative humidity were monitored continuously over the asphalt test track by means of a chart recorder. Data from the three meteorological sensors were manually entered into the computer immediately prior to each test run and appear on the printout sheets together with the vehicle parameter and sound level data.

It should be noted that the instrumentation system described in this section far exceeded the requirements of the test procedure. It was used because of its availability without modification at the completion of the previous study in which the EPA Urban Noise Test Procedure was developed.[1] In addition, it was necessary to obtain full details of the vehicle parameters during the tests to document the repeatability and applicability of the test procedure. In fact, the EPA test does not require the use of a telemetry system or a computer to measure vehicle sound levels and operating parameters. A strip-chart recorder can be used with equal effectiveness, as was demonstrated in the previous study.[1]

2.2 Vehicle Selection

The development of a data base for noise emissions of 1977 model vehicles required the testing of as many vehicles as possible, including all available vehicle types and engine/transmission combinations. Limitations on the availability of certain vehicles and in the overall testing time period, however, restricted the number of vehicles that could be tested. The criteria used to select these vehicles were as follows:

- All vehicles were required to be from the 1977 model year.
- Models with high sales volume were required so that the data base would be truly representative of the numbers of vehicles entering the fleet in 1977.
- A range of available engine and transmission types was required to examine the different noise characteristics, review the applicability of the test procedure, and identify possible classification of vehicles into categories.
- The vehicles selected were to include types equipped with the smaller capacity engines introduced in recent years to obtain increased fuel economy.
- Selected vehicles were required to have been operated for at least 500 miles, so that engine and transmission parts would exhibit operational tolerances, but not more than 12,000 miles, so that all equipment would still be in good working condition and not require replacement.
- The majority of vehicles were to be acquired from the Tucson area.

Using these criteria, 66 vehicles were selected for testing. The complete specifications for these vehicles are given in Table 2.1. A breakdown of the vehicles according to engine type and size and type of transmission is given in Table 2.2.

The test vehicles were obtained largely from local rental agencies and dealers. However, many of the less common models were provided by domestic and foreign manufacturers, whose assistance is gratefully acknowledged. Upon receipt, each vehicle was fully documented to ensure compliance with the required specifications. They were then tuned according to manufacturer's specifications as indicated by the vehicle performance chart in Figure 2.2. Finally, the instrumentation was installed and calibrated, and the vehicle brought to its normal operating temperature in readiness for the test sequence.

Table 2.1

Test Vehicle Specifications

Veh. No.	Manufacturer	Model	Size	Curb Weight	Mileage	Eng.	CID	Carb.	BHP @ RPM	Fuel Economy C	H	CH	Trans.	BHP/lb.	CID/lb.	A/C	Fan Drive	Exhaust Outlet
001	General Motors	Oldsmobile Cutlass	MS	3696	8,855	V8	350	4V	170 @ 3800	16	21	18	3A	0.043	0.088	Yes	Clutch	Right
002	Chrysler	Dodge Royal Monaco	LS	4265	4,499	V8	360	2V	155 @ 3600	12	18	14	3A	0.034	0.079	Yes	Clutch	Right
003	Ford	Lincoln Continental	LS	5077	5,964	V8	460	4V	208 @ 4000	11	16	13	3A	0.039	0.086	Yes	Clutch	Right
004	Toyota	Corolla	SC	2225	4,600	L4	97	2V	75 @ 5800	25	31	27	3A	0.030	0.038	Yes	Clutch	Left
005	Toyota	Corolla	SW	2325	4,955	L4	97	2V	75 @ 5800	28	39	32	5M	0.029	0.037	No	Clutch	Left
007	Mazda	RX-4	SC	2780	906	Rotary	80	4V	110 @ 6000	20	32	25	5M	0.036	0.026	Yes	Clutch	Center
009	Mercedes-Benz	240D	C	3210	2,379	L4	147	FI	62 @ 4000	26	30	28	4A	0.018	0.042	Yes	Direct	Left
010	Ford	Granada	C	3410	1,056	L6	250	1V	98 @ 3400	21	28	24	4M	0.026	0.067	Yes	Direct	Center
011	General Motors	Chevrolet Chevette	SC	1958	850	L4	85	1V	57 @ 5200	28	42	33	4M	0.025	0.038	No	Direct	Right
013	General Motors	Pontiac Firebird	SC	3459	6,130	V8	301	2V	135 @ 4000	15	23	18	4M	0.036	0.080	Yes	Clutch	Left
014	Ford	Van E-350	LT	4486	11,044	V8	351	2V	168 @ 3800	14	20	16	3A	0.034	0.073	No	Direct	Right
015	Ford	Pickup F-150	LT	4590	4,485	V8	351	2V	168 @ 3800	14	20	16	4M	0.044	0.072	No	Direct	Right
016	General Motors	Chevrolet Pickup C-10	LT	3313	2,478	V8	350	4V	165 @ 3800	14	19	16	3A	0.046	0.097	No	Direct	Left
018	General Motors	Buick Skylark	C	3394	3,743	V6	231	2V	105 @ 3200	18	25	20	3A	0.028	0.063	Yes	Clutch	Left
019	General Motors	Chevrolet Chevette	SC	1958	8,455	L4	97	1V	63 @ 4800	26	36	30	3A	0.028	0.043	Yes	Clutch	Left
020	Volkswagon	Rabbit	SC	1860	7,770	L4	97	FI	78 @ 5500	24	37	28	4M	0.036	0.045	Yes	Electric	Left
022	Fiat	X-1/9	TS	2050	1,433	L4	79	2V	62 @ 5800	23	35	27	4M	0.028	0.034	Yes	Electric	Left
023	Fiat	128	SC	1990	662	L4	79	2V	62 @ 6000	23	35	27	4M	0.027	0.034	No	Electric	Right
024	Peugeot	504 (D)	C	3260	7,392	L4	141	FI	71 @ 4500	28	35	30	4M	0.020	0.040	Yes	El./Cl.	Right
025	British Leyland	Triumph TR-7	TS	2371	986	L4	122	2V	86 @ 5500	22	29	24	4M	0.040	0.046	Yes	El./Cl.	Left
026	British Leyland	Jaguar XJ-12L	C	4300	3,004	V12	326	FI	244 @ 5250	10	14	11	3A	0.053	0.071	Yes	El./Cl.	Dual
027	Ford	Mercury Cougar	MS	4028	8,155	V8	302	2V	130 @ 3400	15	19	17	3A	0.030	0.070	Yes	Direct	Right
028	Mercedes-Benz	450 SEL	MS	4080	5,736	V8	276	FI	180 @ 4750	13	18	15	3A	0.041	0.063	Yes	Clutch	Left
029	Chrysler	Dodge Aspen	C	3275	13,526	L6	225	2V	100 @ 3600	18	24	20	3A	0.028	0.063	Yes	Direct	Right
030	Chrysler	Cordoba	MS	4180	8,213	V8	400	4V	190 @ 3600	11	19	14	3A	0.042	0.089	Yes	Clutch	Right
031	American Motors	Gremlin	SC	2806	8,580	L6	232	1V	88 @ 3400	18	24	20	3A	0.028	0.075	Yes	Direct	Left
032	Chrysler	Plymouth Fury	MS	4250	9,631	V8	318	2V	145 @ 4000	13	18	15	3A	0.032	0.070	Yes	Direct	Right
033	Rolls Royce	Silver Shadow II	LS	4995	2,538	V8	412	2V	240 @ 4000	11	14	12	3A	0.045	0.078	Yes	Clutch	Left
034	Renault	12 SW	SW	2299	6,847	L4	101	2V	72 @ 5500	20	26	22	4M	0.028	0.039	No	Elec.	Left
035	General Motors	Chevrolet Caprice	LS	3771	802	V8	305	2V	145 @ 3800	16	21	18	3A	0.036	0.075	Yes	Clutch	Right
036	Ford	Granada	C	3512	1,632	V8	302	2V	122 @ 3200	16	22	18	3A	0.032	0.079	Yes	Direct	Right
037	General Motors	Pontiac Astre	SC	2560	9,770	L4	151	2V	88 @ 4400	24	32	27	3A	0.031	0.053	Yes	Clutch	Left
038	Ford	Pinto	SW	2642	11,905	L4	140	2V	89 @ 4800	21	29	24	3A	0.030	0.048	Yes	Direct	Right
039	American Motors	Pacer	C	3166	12,568	L6	258	2V	120 @ 3600	17	23	19	3A	0.035	0.074	Yes	Direct	Left
040	BMW	320i	SC	2650	956	L4	121	FI	110 @ 5800	20	29	23	4M	0.037	0.041	Yes	Direct	Center

Table 2.1 (Continued)

Veh. No.	Manufacturer	Model	Size	Curb Weight	Mileage	Eng.	CID	Carb.	BHP @ RPM	Fuel Economy C	H	CH	Trans.	BHP/lb.	CID/lb.	A/C	Fan Drive	Exhaust Outlet
041	BMW	530i	C	3440	786	L6	182	FI	176 @ 5500	14	23	17	4M	0.047	0.049	Yes	Clutch	Left
042	Ford	LTD SW	MSW	4741	1,750	V8	400	2V	173 @ 3800	13	18	15	3A	0.034	0.079	Yes	Direct	Left
044	General Motors	Chevrolet Nova	C	3397	6,507	V8	305	2V	145 @ 3800	16	21	18	3A	0.039	0.083	Yes	Direct	Left
045	General Motors	Cadillac DeVille	LS	4354	7,100	V8	425	4V	180 @ 4000	14	18	16	3A	0.039	0.091	Yes	Clutch	Right
046	Ford	Mercury Marquis SW	LW	4759	12,947	V8	400	2V	173 @ 3800	13	18	15	3A	0.034	0.079	Yes	Direct	Right
047	Ford	Pinto	SC	2477	8,284	V6	171	2V	93 @ 4200	18	23	20	3A	0.033	0.062	Yes	Direct	Right
048	Ford	Granada	C	3410	10,897	L6	250	1V	98 @ 3400	18	23	20	3A	0.026	0.067	Yes	Direct	Right
050	Subaru	4WD SW	SW	2145	6,057	H4	97	2V	65 @ 5200	28	38	32	4M	0.027	0.040	Yes	Dir./El.	Left
051	Chrysler	Town&Country SW	LW	5150	11,570	V8	440	4V	195 @ 3600	10	16	12	3A	0.036	0.081	Yes	Clutch	Right
052	Ford	LTD	LS	4506	14,917	V8	351	2V	161 @ 3600	13	19	15	3A	0.033	0.073	Yes	Direct	Right
053	General Motors	Oldsmobile Delta 88(D)	LS	3613	20,553	V8	350	FI	120 @ 3600	21	30	24	3A	0.031	0.089	Yes	Clutch	Right
054	Honda	Civic	SC	1801	7,765	L4	91	3V	60 @ 5000	32	37	34	2A	0.029	0.043	Yes	Elec.	Right
055	American Motors	Jeep Wagoneer	LT	4345	1,357	V8	360	4V	129 @ 3700	--	--	--	3A	0.028	0.078	Yes	Clutch	Right
056	SAAB	99	SC	2530	10,251	L4	121	FI	115 @ 5500	21	27	23	4M	0.041	0.043	Yes	Elec.	Right
057	General Motors	Oldsmobile Omega	C	3454	11,312	V8	260	2V	110 @ 3400	17	23	19	3A	0.029	0.069	Yes	Clutch	Right
058	Chrysler	Dodge Van B-200	LT	3525	6,960	V8	360	2V	175 @ 4000	11	20	16	3A	0.046	0.094	Yes	Clutch	Left
059	International Harvester	Scout Terra (D)	LT	3598	260	L6	198	FI	92 @ 4000	--	--	--	3A	0.024	0.051	Yes	Direct	Right
060	Volkswagon	Rabbit (D)	SC	1974	12,490	L4	90	FI	48 @ 5000	39	52	44	4M	0.021	0.040	No	Direct	Left
061	American Motors	CJ-5	LT	2641	108	L6	232	1V	90 @ 3050	17	21	18	3M	0.031	0.079	No	Direct	Left
062	American Motors	Matador	LS	3931	147	V8	304	2V	126 @ 3600	13	17	15	3A	0.030	0.072	Yes	Direct	Left
063	General Motors	Chevrolet Nova	C	3284	7,694	L6	250	1V	110 @ 3900	18	23	20	3A	0.031	0.070	Yes	Clutch	Left
064	Datsun	620 Pickup	LT	2395	4,749	L4	119	2V	97 @ 5600	22	32	25	4M	0.036	0.044	Yes	Clutch	Left
065	General Motors	Cadillac Seville	C	4300	21,245	V8	350	FI	180 @ 4400	14	19	16	3A	0.039	0.076	Yes	Clutch	Left
066	General Motors	Chevrolet Blazer	LT	3300	10,807	V8	400	4V	175 @ 3600	13	17	15	3A	0.049	0.111	Yes	Direct	Dual
067	General Motors	Oldsmobile Delta 88	LS	3606	13,034	V6	231	2V	105 @ 3400	17	25	20	3A	0.027	0.059	Yes	Clutch	Right
068	Volkswagon	Bus	LT	3042	185	H4	102	FI	67 @ 4200	20	28	23	4M	0.020	0.031	Yes	Direct	Right
069	Ford	F-100 Pickup	LT	3547	13,137	L6	300	1V	122 @ 3200	19	26	22	3M	0.031	0.078	No	Direct	Right
070	Ford	Box Van	LT	5300	3,030	V8	460	4V	245 @ 4200	--	--	--	3A	0.044	0.082	Yes	Direct	Right
071	Porsche	911S	TS	2558	4,128	H6	164	FI	157 @ 5800	15	24	18	5M	0.055	0.057	No	Direct	Left
072	General Motors	Pontiac Ventura	C	3277	6,425	L4	151	2V	88 @ 4400	21	29	24	3A	0.025	0.042	Yes	Direct	Left
073	General Motors	Pontiac Sunbird	SC	2742	4,052	L4	151	2V	88 @ 4400	26	37	30	5M	0.029	0.050	Yes	Clutch	Left

Table 2.2

Breakdown of Vehicle Types Included
in the Noise Tests

	V12, V8		L6	V6	L4		Rotary	Total
	>351 CID	<351 CID			>100 CID	<100 CID		
Automatic	11	16	6	3	4	3	0	43
Manual	0	2	5	0	8	7	1	23
Two Seater (TS)	-		1		2		-	3
Subcompact (SC)	1		2		11 (1D)		1	15
Compact (C)	5		7		3 (2D)		-	15
Mid-Size (MS)	5		-		-		-	5
Large-Size (LS)	8 (1D)		1		-		-	9
Station Wagon (SW)	3		-		4		-	7
Light Truck	7		3 (1D)		2		-	12
Percentage	17	27	17	5	18	15	2	
	44		22		33		2	

D signifies diesel.

Complete Engine Performance

ALL VEHICLE INSPECTION
TEST PROCEDURE

IDENTIFICATION NUMBER TC 31203144 DATE 3/15/77

MAKE-YEAR-MODEL TOYOTA 1977 COROLLA MILEAGE 2b24

	TEST PROCEDURE	READ	SPECS	RESULTS	GOOD	BAD
IDLE	Idle Speed	Tachometer	850	850	x	
	Dwell	Dwell - Meter	52^0	52^0	x	
	Initial Timing	Timing Advance Unit	10^0	10^0	x	
	PCV Test	Tachometer			x	
	Manifold Vacuum	Vacuum Gauge	16.5	16.5	x	
CRUISE	Dwell Variation	Dwell Meter	1^0	1^0	x	
	Coil Polarity	Scope (Display)	- GRD	ND	x	
	Spark Plug Firing Voltage	Scope (Display)	9KV	9KV	x	
	Maximum Coil Output	Scope (Display)	22Kv-24	22Kv	x	
	Secondary Circuit Insulation	Scope (Display)			x	
	Secondary Circuit Condition	Scope (Raster)			x	
	Coil and Condenser Condition	Scope (Raster)			x	
	Breaker Point Condition	Scope (Raster)			x	
	Cam Lobe Accuracy	Scope (Superimposed)	4^0	4^0	x	
	Cylinder Power Balance	Tachometer			x	
	Record R.P.M.	1700 / 2 700 / 3 700 / 4 700 / 5 / 6 / 7 / 8				
ACCEL ERATION	Spark Plugs Under Load	Scope (Display)	1/3 coil output	8Kv		
HIGH SPEED	Timing Advance	Timing Advance Unit	10^0	10^0	x	
	Charging Voltage	Voltmeter	13.8v	14.v	x	
	Exhaust Restriction	Vacuum Gauge	none		x	
VISUAL	Record Carb type & Model	aisan 2 brl			x	
	Inspect Air Cleaner				x	
	Inspect Exhaust				x	
	Inspect Undercarriage				x	
	Note Optional Equipment	AC			x	
ROAD TEST	Check for rattles				x	
	Check normal driving resp.				x	

COMMENTS:

TIRE SIZE 165SR13
PRESSURE FRONT 24
REAR 24
HYDRO C 75 parts
Co .3 parts
REPLACED PLUGS

Figure 2.2. Vehicle Performance Chart

2.3 Test Procedures

The major objective of the test program was to develop baseline data for the noise emissions of 1977 model light vehicles using the EPA Urban Acceleration Noise Test Procedure previously developed for EPA and described in Reference 1. The performance of these tests on a large number of vehicles also allowed a further evaluation of the repeatability of the test procedure, with the possibility of some simplifications. Full details of the EPA test procedure are given in Appendix B; a brief summary is as follows:

- For vehicles equipped with automatic transmissions, there are potentially two test conditions. Condition 1 requires a constant-throttle operation to achieve an acceleration of 0.15g just prior to the first to second gear shift point or at 22 mph, whichever occurs first, with the vehicle initially at rest and the transmission in Drive. If during this test, the 1-2 shift occurs at a vehicle speed of less than 22 mph,* then it is also necessary to test under Condition 2, which requires a constant-throttle operation in second gear to achieve an acceleration of 0.12g at 25 mph.
- For vehicles equipped with manual transmissions, the test consists of a constant-throttle operation to achieve an operating condition of 0.15g at 70 percent maximum rated engine speed or 22 mph, whichever occurs first, with the transmission in the lowest gear (highest numerical ratio) normally used for acceleration from rest.

The tests were performed with the vehicles in their standard operating condition, namely, at normal operating temperature and with all accessory equipment turned off. In this condition, demand cooling fans (activated by a thermostatic control) were deactivated, and hence, operated at a speed significantly less than the engine speed. Under more severe operating conditions, such as those involving high ambient temperatures, extended periods at low speed, or hauling heavy loads, the fan becomes activated to provide the necessary additional cooling, and higher vehicle sound levels can be generated. To determine the

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* Subsequently changed to 19 mph as a result of the data collected in this study.

magnitude of this potential increase in sound level, the demand fans in some test vehicles were artificially activated prior to the test by rotating the bi-metallic strip or spring to open the clutch valve.

According to the available data on typical driving habits,[1] the sound levels generated under the EPA noise test procedure are representative of the levels to which urban and suburban communities are exposed as a result of light vehicles operating in an acceleration mode. To provide data on vehicle noise characteristics under other modes of operation, additional tests were conducted as described below.

- Full-Throttle Operation — as specified in the Society of Automotive Engineers Standard, SAE J986a,[3] under which near maximum sound levels are measured. The SAE J986a procedure has been the standard test for light vehicles noise emissions in the United States for many years, and is similar in operation to the European procedure as specified in ISO R362.[4]
- Coast Operation — with the transmission in neutral and the engine switched off, to identify the contribution of tire noise to the overall vehicle sound levels. These tests were conducted at 25, 35, 45, and 55 mph.
- Cruise at Constant Speed — to provide data for future use in estimating community noise exposure from operations other than acceleration. Tests were conducted at 35 and 55 mph. For vehicles equipped with automatic transmissions, the transmission was placed in Drive; for manuals the transmission was placed in the gear with the lowest numerical ratio consistent with an engine speed greater than 25 percent rated speed.

Although the EPA Urban Noise Test Procedure may be considered suitable for the testing of light vehicles by manufacturers, the requirement for a pass-by operation renders it less suitable for enforcement actions by state and local authorities. For this reason, there has been a considerable demand for an equivalent test that can be conducted with the vehicle at rest. Accordingly, sound level measurements were conducted with the vehicles stationary and the transmission in neutral. The tests were conducted at stabilized engine speeds of 50, 60, 70, 80, and 90 percent of the rated engine speed, as well as at 3000 RPM as specified in a procedure proposed by SAE.[5]

2.4 Microphone Locations

The vehicle sound levels were monitored continuously throughout the test by an array of microphones located in the vicinity of the end zone where the required vehicle end condition was achieved. Initially, six microphones were used to monitor sound levels in the pass-by tests. These were located 50 feet from either side of the vehicle centerline as shown in Figure 2.3. This number was selected to provide the data necessary for the identification of a single microphone location at which the maximum sound level would be approximated. Two additional microphones were used in the stationary tests. One of these was located 5 feet directly in front of the front bumper of the vehicle at a height of 4 feet above the ground, and the other was located 20 inches from, and in the same horizontal plane as the exhaust outlet, in a direction 45° to the axis of the exhaust pipe at the outlet. The sound levels generated in the stationary test were also measured by a microphone located 25 feet from the centerline of the vehicle, in a vertical plane passing through the geometric center of the vehicle and perpendicular to the direction of travel. Nineteen vehicles were tested using this microphone array*.

At this point in the test program, inputs from foreign light vehicle manufacturers indicated a concern that additional measurements should be taken at a distance of 25 feet from the vehicle centerline, as is common in their own countries. The reason behind this request was a desire to measure higher sound levels (approximately 6 dB higher than those measured at 50 feet) and hence be able to perform the tests in areas with higher ambient sound levels. To accommodate this request, the number of exterior microphones was increased from 8 to 10, the locations being as shown in Figure 2.4. Earlier data[1] had indicated that the microphone locations selected for the 50-foot distance were the most likely to measure the maximum pass-by sound level. The array shown in Figure 2.4 was used for the remainder of the test program.

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* Vehicle Nos. 001, 002, 004, 007, 010, 011, 013 through 016, 018, 019, 020, 022, 023, 029, 030, 034, and 035.

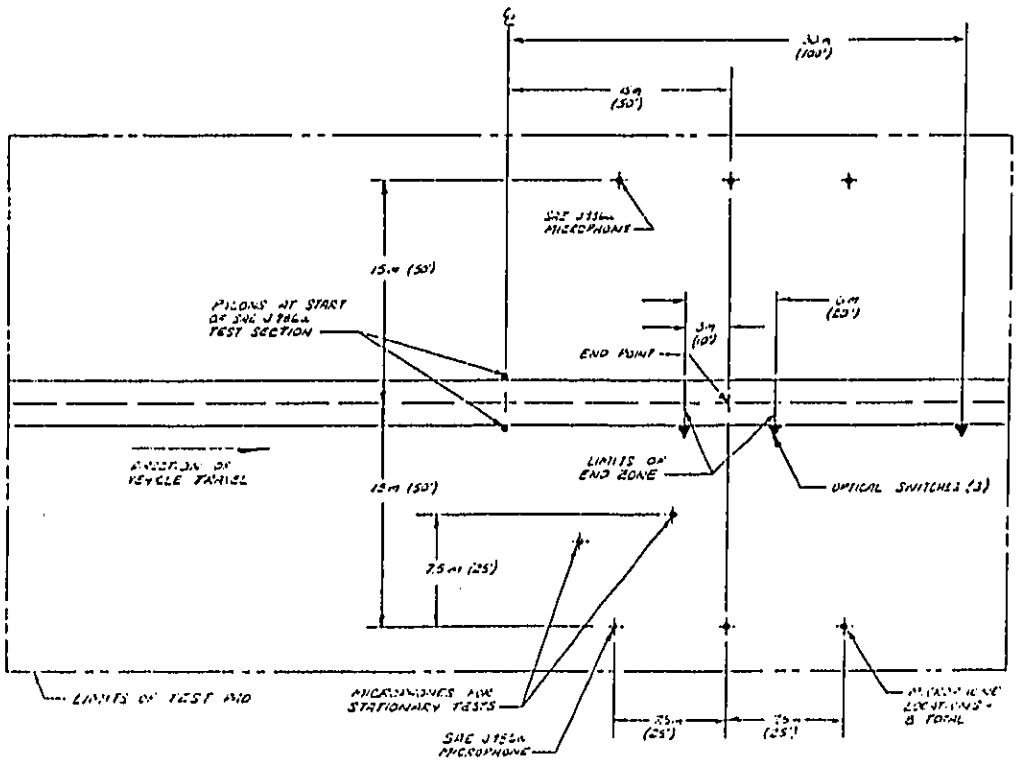

Figure 2.3. Microphone Locations for Initial 19 Vehicle Tests.

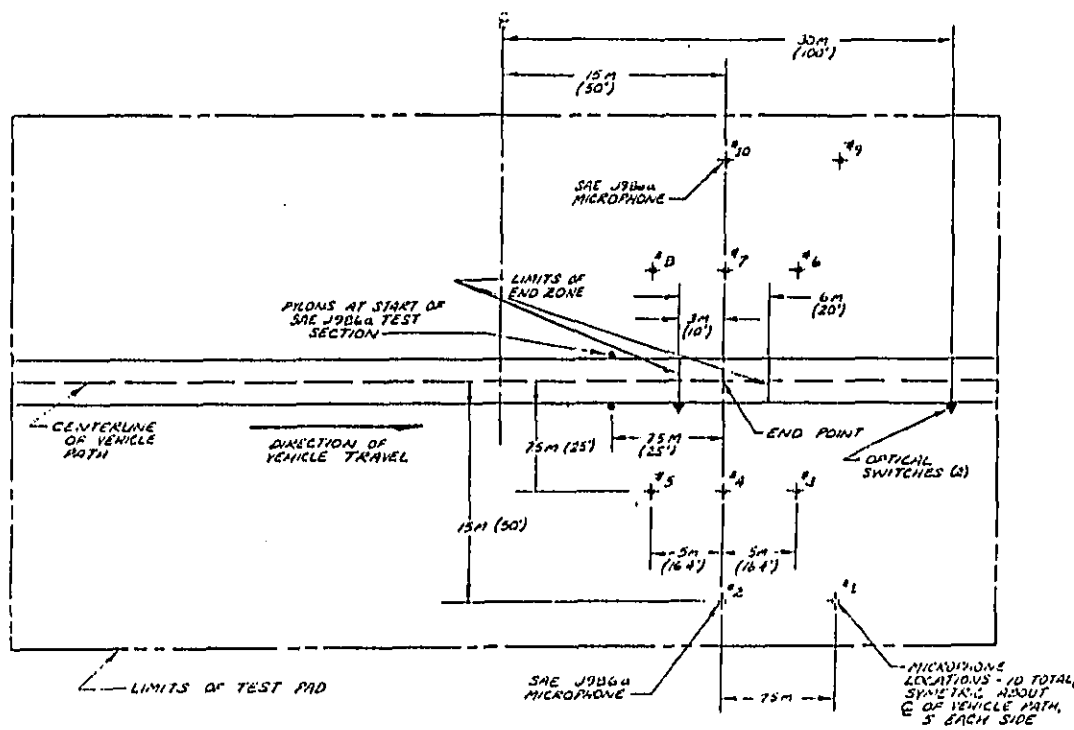

Figure 2.4. Microphone Locations for 47 Vehicle Tests.

3.0 NOISE EMISSION DATA FOR 1977 MODEL LIGHT VEHICLES

The results of the test series previously described are presented in this chapter. A summary of the noise emission data for a total of 66 light vehicles operating under partial-throttle (EPA test procedure), full-throttle (SAE test procedure), coast and cruise conditions is given in Table 3.1, together with a description of the engine and transmission type. Complete data sheets describing the vehicle parameters and ranges at the end condition for the EPA test procedure are given in Appendix C. The data for all test conditions are reviewed in the following sections.

3.1 EPA Urban Acceleration Noise Test Procedure

The EPA partial-throttle acceleration test procedure was developed[1] in an attempt to measure the maximum sound levels produced by light vehicles under the typical acceleration conditions exhibited in normal driving. In this study, a major objective was to implement this procedure on a wide variety of vehicle types to identify increases in sound level that might be associated with the introduction of the more fuel-efficient vehicles. The sound levels produced by the light vehicles tested according to the EPA test procedure are displayed in terms of vehicle fuel economy as measured by the EPA City Test Procedure in Figure 3.1, the engine and transmission type being identified for each vehicle. It will be noticed that, while the statistical correlation between the two quantities is not high — indeed it would be surprising if it was, considering the wide range of vehicle types and components included in the test sample — there is a strong trend towards increasing sound levels with increasing fuel economy. This is particularly true for the data points lying within the area bounded by the dashed lines that are associated with the more common highway vehicles. The data points lying outside this area are generally representative of high-performance vehicles and some light trucks.

To predict the increase in light vehicle fleet sound levels that might result from the introduction of more fuel-efficient vehicles, it is necessary to relate vehicle noise to fundamental vehicle design parameters which are well defined in the current fleet and which can be projected for future year fleets. The objective is to establish vehicle categories into which all vehicles can be classified unambiguously. The most suitable fundamental parameters for this purpose can be selected by considering the relationships between engine design and vehicle sound level.

Table 3.1

Summary of Vehicle Sound Level Data

Veh. No.	Vehicle	Engine Type	Trans.	SOUND LEVELS dB(A) @ 50 FEET								INTERIOR LEVELS, dBA		
				EPA Urban Test	SAE Test	COAST[1]				CRUISE		EPA Urban Test	CRUISE	
						25 mph	35 mph	45 mph	55 mph	35 mph	55 mph		35 mph	55 mph
001	Oldsmobile Cutlass	V8	3A	62.9	73.7	59.4	64.4	68.1	71.1	--	--	63.4	--	--
002	Dodge Royal Monaco	V8	3A	63.6	73.7	--	--	--	--	--	--	63.3	--	--
003	Lincoln Continental	V8	3A	61.1	73.0	58.9	63.9	67.7	70.6	62.6	--	61.5	--	--
004	Toyota Corolla	L4	3A	65.4	75.7	57.9	62.9	66.7	69.7	--	--	71.7	--	--
005	Toyota Corolla SW	L4	5M	67.5	72.4	57.2	61.1	65.9	69.2	66.5	71.2	79.5	80.4	82.5
007	Mazda RX-4	Rotary	5M	69.4	73.8	57.9	63.6	67.9	71.4	--	--	61.7	--	--
009	Mercedes Benz 240(D)	L4	4A	69.9	74.9	58.2	62.5	66.0	68.9	65.8	70.5	70.2	64.5	69.9
010	Ford Granada	L6	4M	67.0	69.5	59.0	62.6	65.3	67.5	--	--	63.9	--	--
011	Chevrolet Chevette	L4	4M	67.9	73.2	59.3	63.7	67.0	69.6	--	--	77.9	--	--
013	Pontiac Firebird	V8	4M	65.8	71.8	--	--	--	--	--	--	70.0	--	--
014	Ford Van E-350	V8	3A	68.4	78.0	63.4	69.3	73.7	77.2	--	--	--	--	--
015	Ford Pickup	V8	4M	70.7	74.3	--	--	--	--	--	--	72.6	--	--
016	Chevrolet Pickup	V8	3A	65.8	75.0	58.0	63.2	67.0	70.1	--	--	67.5	--	--
018	Buick Skylark	V6	3A	62.8	71.0	57.0	61.7	65.3	68.1	--	--	64.5	--	--
019	Chevrolet Chevette	L4	3A	69.1	--	59.3	63.7	67.0	69.6	--	--	73.2	--	--
020	VW Rabbit	L4	4M	69.3	72.7	57.1	61.4	64.6	67.2	--	--	69.4	--	--
022	Fiat X 1/9	L4	4M	67.7	74.9	55.6	60.6	64.4	67.4	--	--	78.1	--	--
023	Fiat 128	L4	4M	71.2	74.6	54.8	60.5	64.7	68.1	--	--	63.9	--	--
024	Peugot 504 (D)	L4	4M	71.9	78.1	--	--	--	--	67.3	73.7	69.1	64.5	73.5
025	Triumph TR-7	L4	5M	67.6	76.5	58.6	63.3	66.8	69.7	65.2	71.3	--	--	--
026	Jaguar XJ12L	V12	3A	65.2	77.0	55.2	60.7	64.8	68.1	62.7	69.0	--	--	--
027	Mercury Cougar	V8	3A	61.8	78.3	56.0	61.0	64.7	67.7	62.1	71.9	--	--	--
028	Mercedes Benz 450 SEL	V8	3A	65.8	--	--	--	--	--	66.3	72.9	--	--	--

1. Coast sound levels calculated from regression equations developed from data taken at nominal speeds of 25, 35, 45, and 55 mph.

Table 3.1 (Continued)

Veh. No.	Vehicle	Engine Type	Trans.	SOUND LEVELS dB(A) @ 50 FEET								INTERIOR LEVELS, dBA		
				EPA Urban Test	SAE Test	COAST[1]				CRUISE		EPA Urban Test	CRUISE	
						25 mph	35 mph	45 mph	55 mph	35 mph	55 mph		35 mph	55 mph
029	Dodge Aspen	L6	3A	63.8	73.5	57.2	62.2	65.9	68.8	--	--	63.6	--	--
030	Chrysler Cordoba	V8	3A	64.7	74.6	57.3	63.0	67.2	70.6	--	--	63.2	--	--
031	AMC Gremlin	L6	3A	63.7	74.8	56.7	61.9	65.9	69.1	63.4	70.7	68.1	64.7	76.2
032	Plymouth Fury	V8	3A	62.9	74.0	56.6	61.5	65.1	68.0	64.2	69.6	65.4	--	70.2
033	Rolls Royce Silver Shadow	V8	3A	62.6	74.6	57.0	62.0	65.8	68.8	62.5	69.2	64.5	64.4	65.0
034	Renault 12 SW	L4	4M	68.5	74.6	55.0	60.9	69.5	73.1	--	--	75.5	--	--
035	Chevrolet Caprice	V8	3A	64.1	72.9	56.6	62.1	66.2	69.4	--	--	63.1	--	--
036	Ford Granada	V8	3A	60.3	--	57.0	61.7	65.2	68.0	62.2	68.1	--	--	--
037	Pontiac Astre	L4	3A	68.0	73.6	57.0	62.1	65.9	69.0	63.6	69.6	--	--	--
038	Ford Pinto SW	L4	3A	64.2	77.0	58.0	63.4	67.4	70.7	64.9	70.5	71.3	67.8	74.8
039	AMC Pacer	L6	3A	63.4	75.7	56.7	62.0	65.6	68.5	63.3	70.1	67.6	65.7	72.5
040	BMW 320i	L4	4M	72.8	--	58.0	63.7	67.9	71.3	64.8	72.1	81.3	--	--
041	BMW 530i	L6	4M	68.3	73.4	59.4	64.0	67.3	70.7	69.4	71.5	67.6	62.5	63.0
042	Ford LTD SW	V8	3A	61.3	72.7	56.4	61.6	65.5	68.6	63.4	70.5	--	--	--
044	Chevrolet Nova	V8	3A	64.4	72.9	55.5	60.7	65.0	67.9	63.5	69.0	67.9	65.1	68.9
045	Cadillac DeVille	V8	3A	65.7	76.8	55.8	61.0	64.5	67.6	61.1	69.1	61.9	57.2	64.7
046	Mercury Marquis SW	V8	3A	62.4	72.2	57.1	62.0	65.7	68.6	62.6	68.2	--	--	--
047	Ford Pinto	V6	3A	68.6	78.1	55.1	60.1	63.9	66.9	62.6	68.5	--	--	--
048	Ford Granada	L6	3A	65.2	70.4	56.0	60.5	63.9	66.5	62.8	68.8	--	--	--
050	Subaru 4WD SW	H4	4M	63.8	73.8	58.8	63.5	67.0	69.8	65.0	71.2	77.5	69.8	77.1
051	Chrysler T&C SW	V8	3A	64.6	--	--	--	--	--	64.5	69.5	--	--	--
052	Ford LTD	V8	3A	62.8	69.5	58.6	63.0	66.3	68.9	62.6	69.8	--	--	--
053	Oldsmobile Delta 88 (D)	V8	3A	69.7	74.5	56.8	61.6	65.2	68.1	66.0	70.4	--	--	--

1. Coast sound levels calculated from regression equations developed from data taken at nominal speeds of 25, 35, 45, and 55 mph.

Table 3.1 (Concluded)

Veh. No.	Vehicle	Engine Type	Trans.	SOUND LEVELS dB(A) @ 50 FEET								INTERIOR LEVELS, dBA		
				EPA Urban Test	SAE Test	COAST[1]				CRUISE		EPA Urban Test	CRUISE	
						25 mph	35 mph	45 mph	55 mph	35 mph	55 mph		35 mph	55 mph
054	Honda Civic CVCC	L4	3A	62.8	70.8	56.9	61.6	65.2	68.1	62.5	68.2	--	--	--
055	Jeep Wagoneer 4WD	V8	3A	64.1	80.1	57.2	62.0	65.6	68.5	63.8	70.3	--	--	--
056	Saab 99	L4	4M	68.6	71.2	55.9	61.1	65.0	68.1	63.5	69.3	--	--	--
057	Oldsmobile Omega	V8	3A	63.8	71.2	56.1	61.3	65.2	68.4	63.3	70.2	--	--	--
058	Dodge B200 Van	V8	3A	62.3	73.7	59.7	63.8	66.8	69.3	63.5	70.3	--	--	--
059	InternationalScoutTerra(D)	L6	3A	76.0	80.3	55.6	60.2	63.6	66.4	67.9	73.7	--	--	--
060	VW Rabbit (D)	L4	4M	69.2	74.3	55.8	60.6	64.1	66.9	64.3	70.3	--	--	--
061	AMC Jeep CJ-5	L6	3M	64.0	75.3	61.2	66.7	70.8	74.1	68.6	76.7	--	--	--
062	AMC Matador SW	V8	3A	66.4	74.0	55.6	60.3	63.9	66.8	63.9	69.3	--	--	--
063	Chevrolet Nova	L6	3A	73.2[2]	71.8	56.4	61.1	64.5	67.3	63.5	69.9	69.3	64.1	71.0
064	Datsun 620 Pickup	L4	4M	70.3	74.9	58.7	62.7	65.8	68.2	64.9	69.6	78.4	68.4	76.6
065	Cadillac Seville	V8	3A	62.3	72.1	55.2	60.0	63.6	66.5	61.0	67.6	64.0	61.4	65.6
066	Chevrolet K-5 Blazer	V8	3A	66.7	68.9	56.9	62.4	66.5	69.8	63.4	70.2	70.9	64.5	69.5
067	Oldsmobile Delta 88	V6	3A	63.7	68.9	54.9	59.8	63.4	68.8	61.1	68.5	62.9	59.7	67.4
068	VW Bus	L4	4M	66.9	74.5	56.1	61.5	65.4	68.6	63.6	71.2	75.4	71.7	77.6
069	Ford Pickup F100	L6	3M	68.2	72.9	59.7	63.6	67.1	69.7	63.6	70.3	72.2	65.6	72.7
070	Ford Box Van	V8	3A	68.9	75.0	60.8	67.0	71.6	76.2	68.4	76.4	--	--	--
071	Porsche 911S	H6	5M	74.2	76.4	56.7	62.2	66.3	69.6	66.6	--	--	--	--
072	Pontiac Ventura	L4	3A	66.5	75.3	55.8	61.2	65.3	68.5	62.5	69.8	--	--	--
073	Pontiac Sunbird	L4	5M	68.7	71.9	58.1	63.1	66.8	69.8	63.8	70.6	--	--	--

1. Coast sound levels calculated from regression equations developed from data taken at nominal speeds of 25, 35, 45, and 55 mph.
2. Sound level affected by vehicle resonances. Data for vehicle #063 is not included in the following graphs.

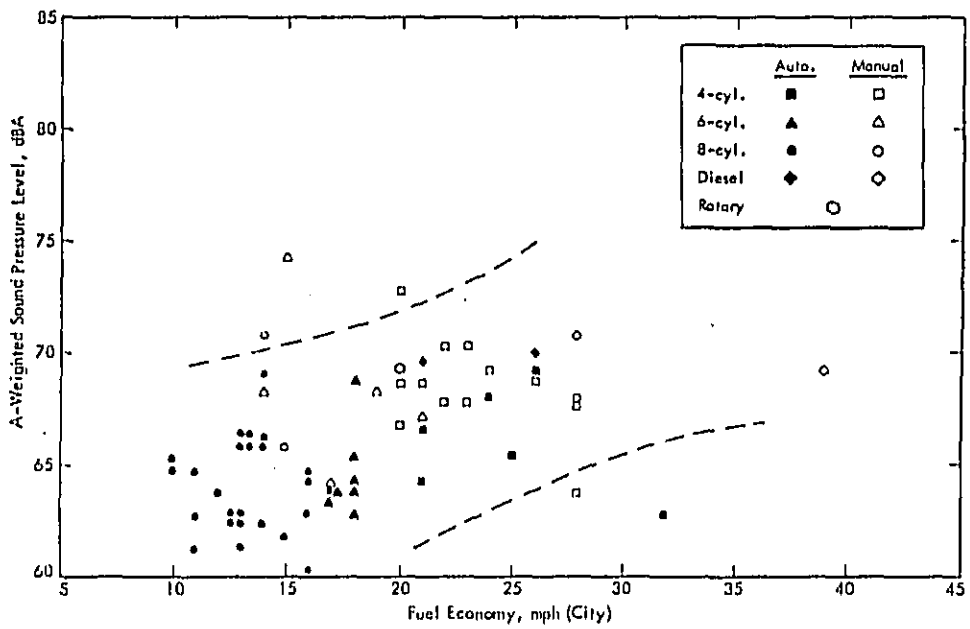

Figure 3.1. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of Fuel Economy.

The sound level produced by a given vehicle under any given operating condition is largely dependent on two operating parameters, namely, the engine speed and the throttle setting. Of these, the engine speed is the most dominant parameter, as can be seen from the engine performance and sound level curves shown in Figures 5.20 and 5.21 of Reference 1, and in the typical curves shown in Figure 5.2 of this report. Thus the sound level measured in the EPA Acceleration Noise Test will be strongly dependent on the maximum engine speed achieved in satisfying the performance requirements of the test.

The basic, simplified, relationship between the engine performance in terms of rated horsepower (BHP) and the engine speed is as follows:

$$BHP \propto CID \times (\text{Rated Engine Speed}) \times MEP$$

where CID is the cubic-inch displacement of the engine, the rated engine speed is the engine speed at the rated engine horsepower, and MEP is the mean effective pressure in the engine cylinders during the power stroke which is related to the throttle setting. The performance of a vehicle under acceleration is characterized by the horsepower-to-weight ratio (BHP/LB) given by the relationship:

$$\frac{BHP}{LB} \propto \frac{CID}{LB} \times (\text{Rated Engine Speed}) \times MEP$$

Reviewing the specification data given in Table 2.1 for the 66 vehicles tested in this program, shows that the horsepower-to-weight ratio varies from an average of 0.030 for vehicles with 4-cylinder engines to 0.035 for those with 8-cylinder engines. In other words, the majority of vehicles are designed to operate within a fairly limited range of performance. The average value of the engine displacement per unit weight ratio (CID/LB), however, varies from 0.042 to 0.078, respectively, for the two types of engine. Therefore, to satisfy the relationship shown above, 4-cylinder engines must be rated at a higher engine speed than 8-cylinder engines, and must be operated with greater relative throttle openings at higher engine speeds during acceleration to provide similar levels of performance. This trend is clearly shown in Figure 3.2. Since vehicle sound levels are largely dependent on engine speed, it is to be expected that vehicles with small 4-cylinder engines will exhibit higher levels than those with the larger 8-cylinder engines when operated under the typical acceleration conditions specified in the EPA Urban Acceleration Noise Test Procedure.

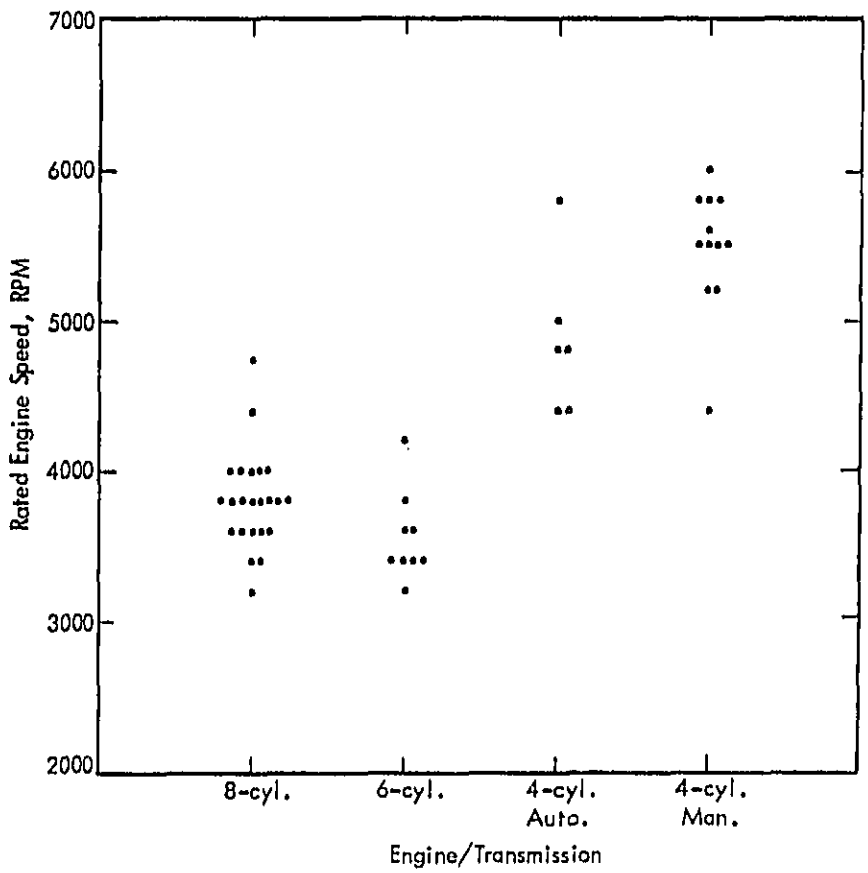

Figure 3.2. Rated Engine Speed as a Function of Engine and Transmission.

With this background, suitable engine parameters for vehicle classification are as follows:

- Engine capacity (CID)
- Engine capacity per unit weight (CID/LB)
- Rated engine horsepower (BHP)
- Horsepower-to-weight ratio (BHP/LB)
- Vehicle weight (LB)
- Engine speed (RPM)

Plots of the vehicle sound level, measured according to the EPA Urban Acceleration Noise Test Procedure, against each of the above design parameters are shown in Figures 3.3 through 3.8. The first graph, Figure 3.3, indicates a dividing line at an engine capacity of 200 CID, above which vehicles with lower sound levels are grouped. At the time of writing, several manufacturers are introducing vehicles equipped with 6-cylinder engines of size approximately 200 CID. The sound levels generated by these newer vehicles are unknown, and it is not certain whether they would be grouped into the <200 CID of ≥200 CID categories. Accordingly, classification by engine capacity is not feasible at this time. A similar argument can be made against using the parameter CID/LB for a classification scheme — see Figure 3.4.

The plot of vehicle sound level against engine horsepower in Figure 3.5 shows a trend towards increasing sound levels with a lowering of rated engine power. This could be predicted from the data shown in Figure 3.1 since engine power is generally inversely related to fuel economy. From Figure 3.6 it is evident that no convenient grouping is possible with the horsepower-to-weight ratio, because the overall range of this parameter is quite limited. If high-performance vehicles and diesels are excluded, the range is from 0.025 to 0.040. Within the range, the spread of values for the different engine and transmission types is greater than the difference in mean values for each type. As mentioned previously, this indicates that the majority of light vehicles are designed to operate within the same limited performance range.

The relationship between the EPA test sound level and the vehicle curb weight is shown in Figure 3.7. As before, the data points lying outside the dashed lines represent

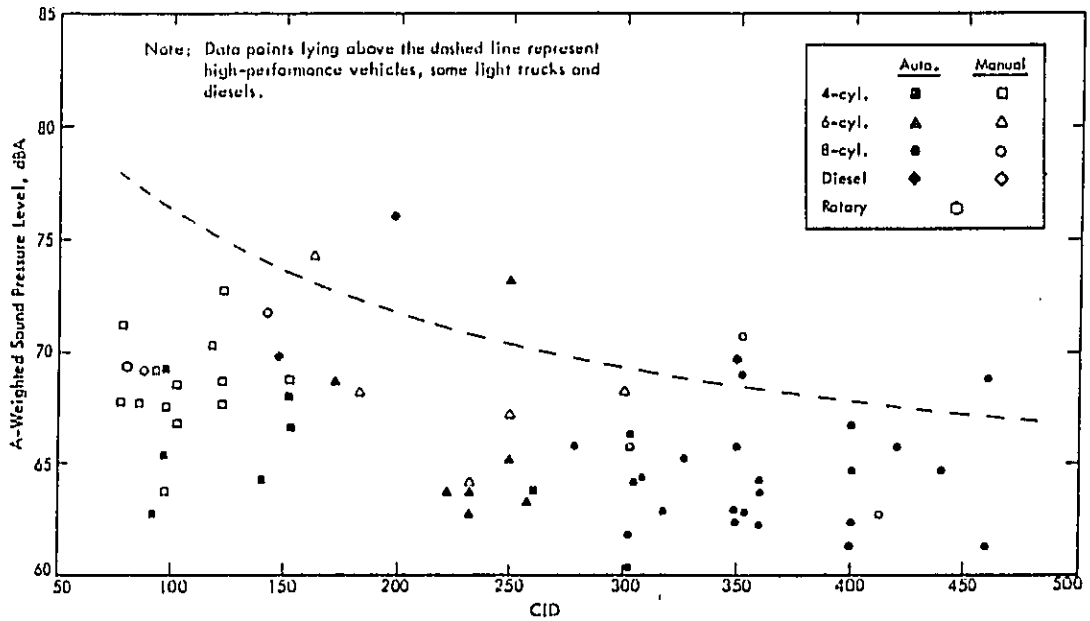

Figure 3.3. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of Engine Capacity.

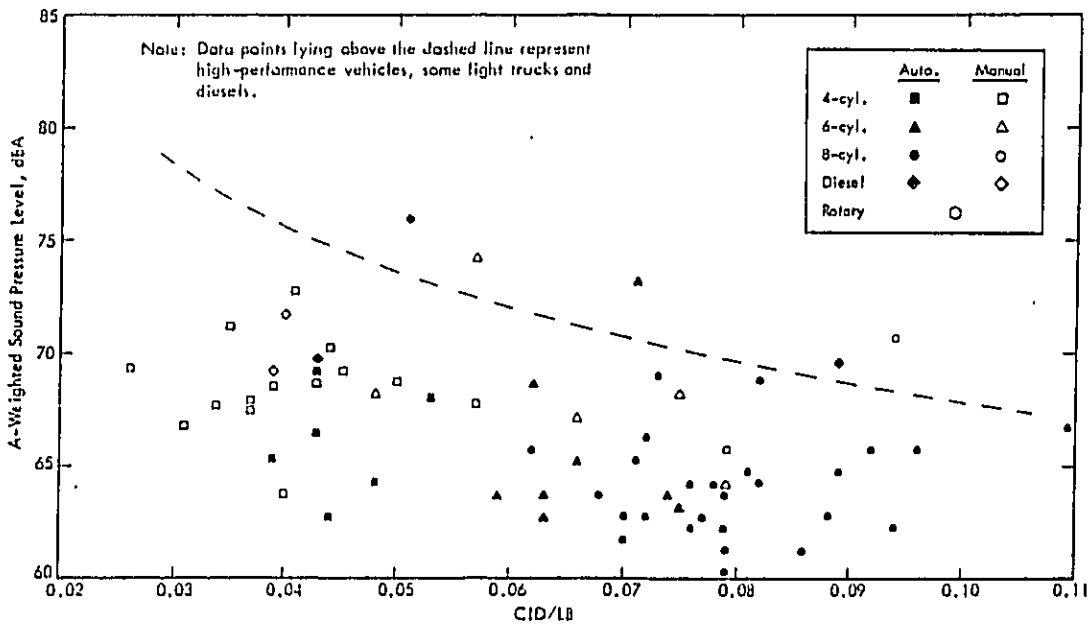

Figure 3.4. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of CID/LB.

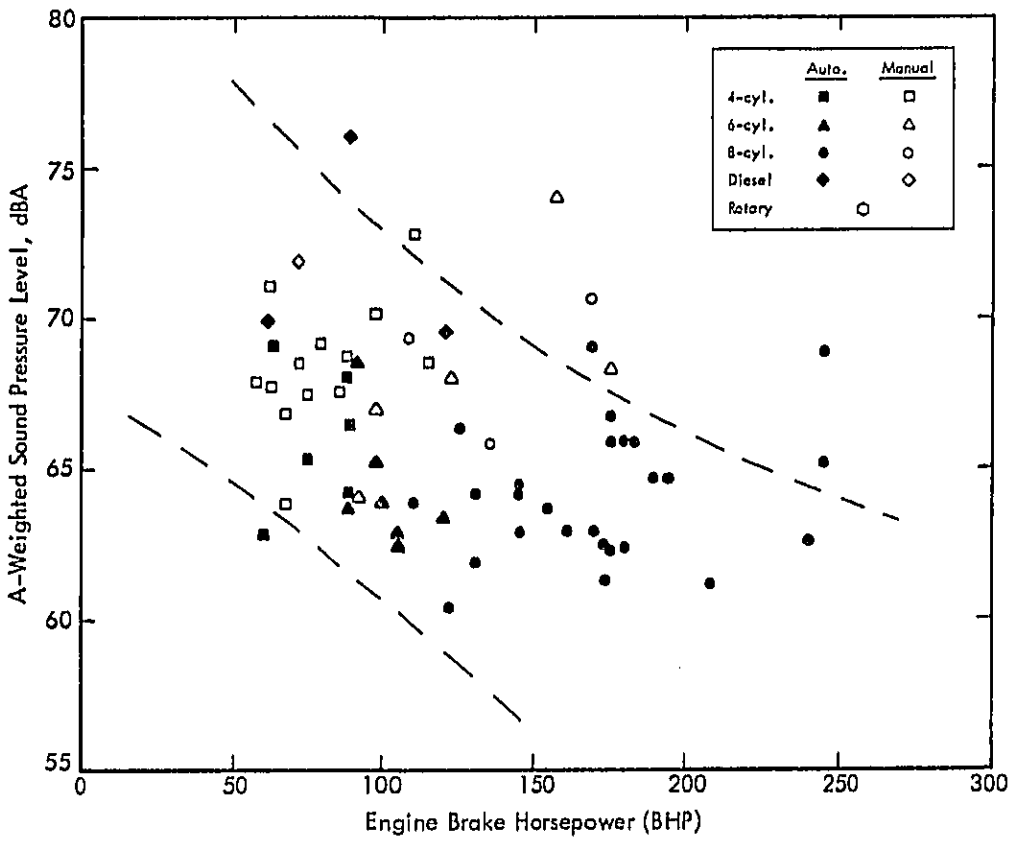

Figure 3.5. Vehicle Sound Levels Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of Engine Brake Horsepower.

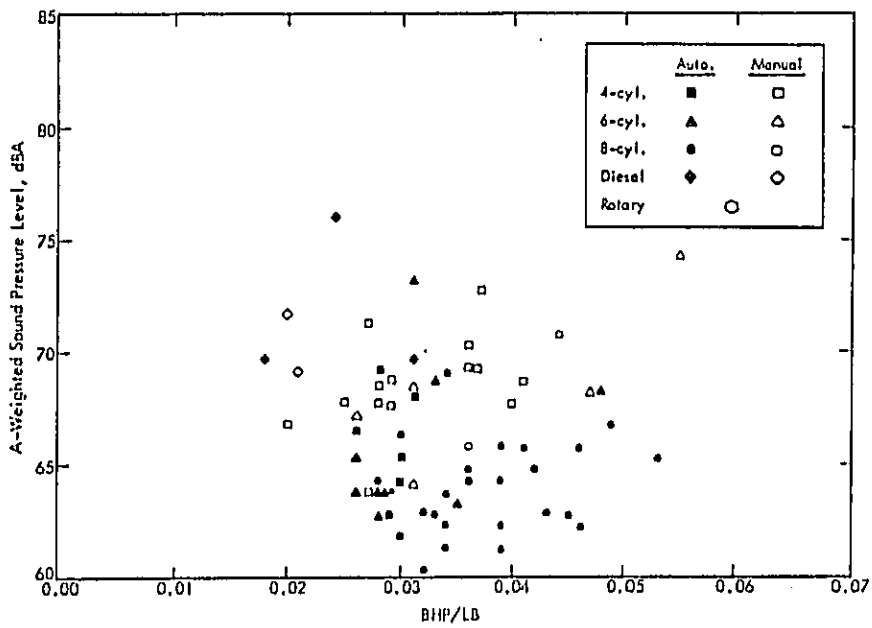

Figure 3.6. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of BHP/LB.

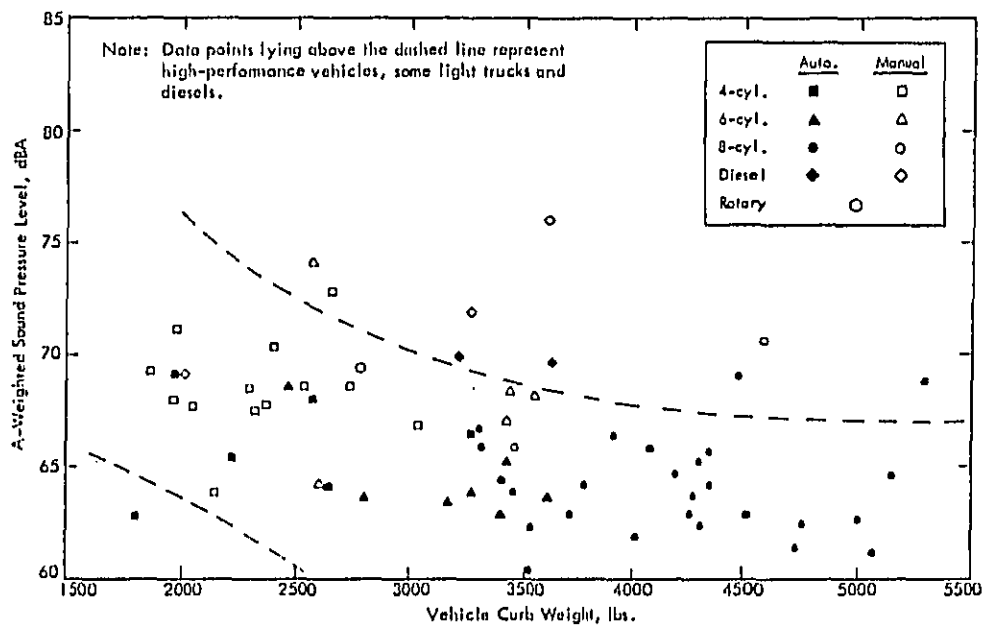

Figure 3.7. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of Vehicle Curb Weight.

high-performance vehicles, light trucks and diesels. There is a fairly strong correlation between fuel economy and vehicle weight, but Figure 3.7 shows no convenient method of classification. In common with the previous graphs, however, the data points for different engine and transmission types are grouped together fairly closely.

Reviewing the relationships between vehicle sound levels and the parameters CID, CID/LB, BHP, BHP/LB, and LB, indicates that there are no strong correlations. The difference in sound levels between vehicles is not so much due to the difference in engine design parameters as to the engine speed at which they are operated. In this respect there is a closer relationship between the sound levels generated by different vehicles operated at the same level of performance and the engine speed necessary to attain that level of performance. This is shown in Figure 3.8 for the vehicles tested in this program.

The EPA Urban Acceleration Noise Test Procedure requires that the vehicle sound level be measured prior to or at the 1-2 shift or 25 mph, whichever occurs first. However, for automatics, the engine speed at the 1-2 shift depends strongly on the design of the transmission and cannot be predicted from the engine parameters and vehicle weight. The range of engines and transmissions available in 1977 model year vehicles results in a wide range of maximum engine speeds, and hence maximum sound levels, produced by different vehicles in the EPA test. Hence a strong correlation between vehicle sound level and engine design parameters is not to be expected.

It will be noticed that in Figure 3.8, the data groups fairly closely according to the type of engine and transmission. The fuel economy also groups well with this classification scheme, as indicated in Figure 3.9. Thus, categories representing automobiles equipped with 4-, 6-, and 8-cylinder engines immediately suggest themselves. Classification by number of cylinders effectively overcomes the previously mentioned problems associated with the use of engine capacity as a parameter. A distinction between automatic and manual transmissions is possible for automobiles with 4-cylinder engines; a lack of data for 6- and 8-cylinder engines with manual transmissions does not allow this distinction to be made with certainty. Furthermore, vehicles equipped with 8-cylinder engines and manual transmissions are sufficiently rare that they may be included in the automatic transmission category. Diesel engine vehicles in general produce significantly higher sound levels than their gas counterparts regardless of engine size and transmission

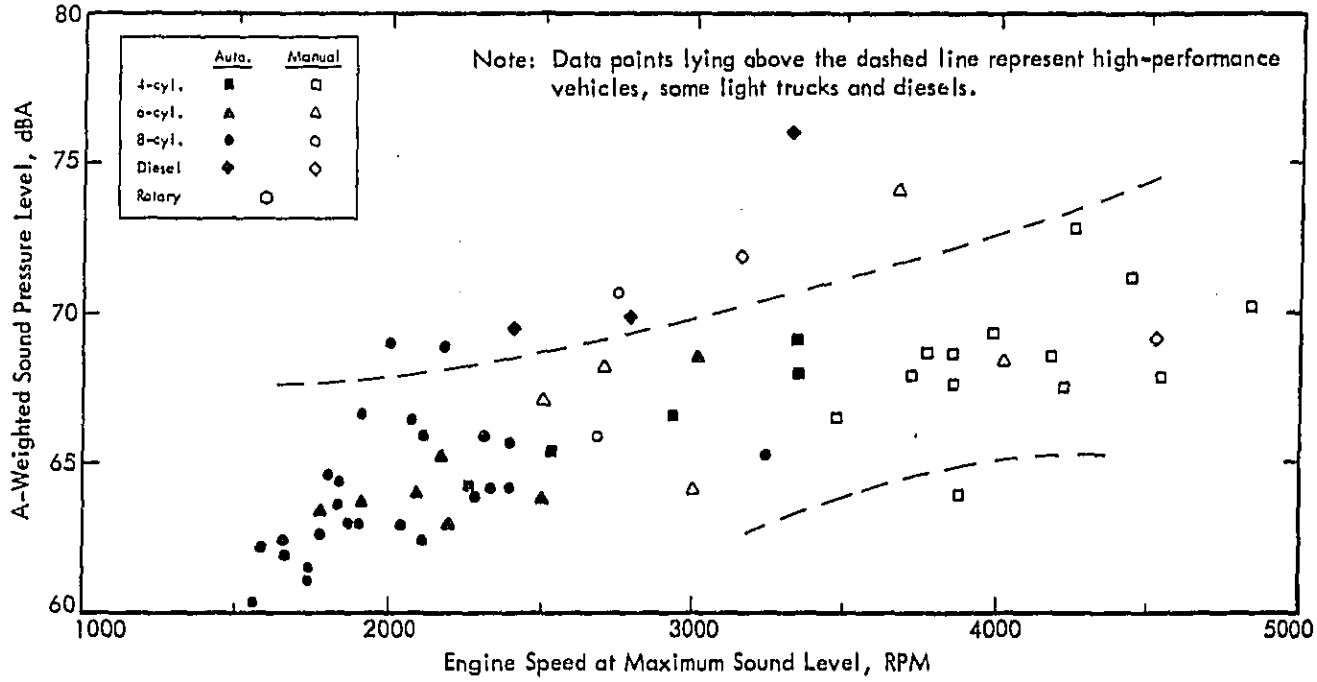

Figure 3.8. Vehicle Sound Level Measured at 50-Foot Distance According to the EPA Urban Acceleration Noise Test Procedure as a Function of Engine Speed.

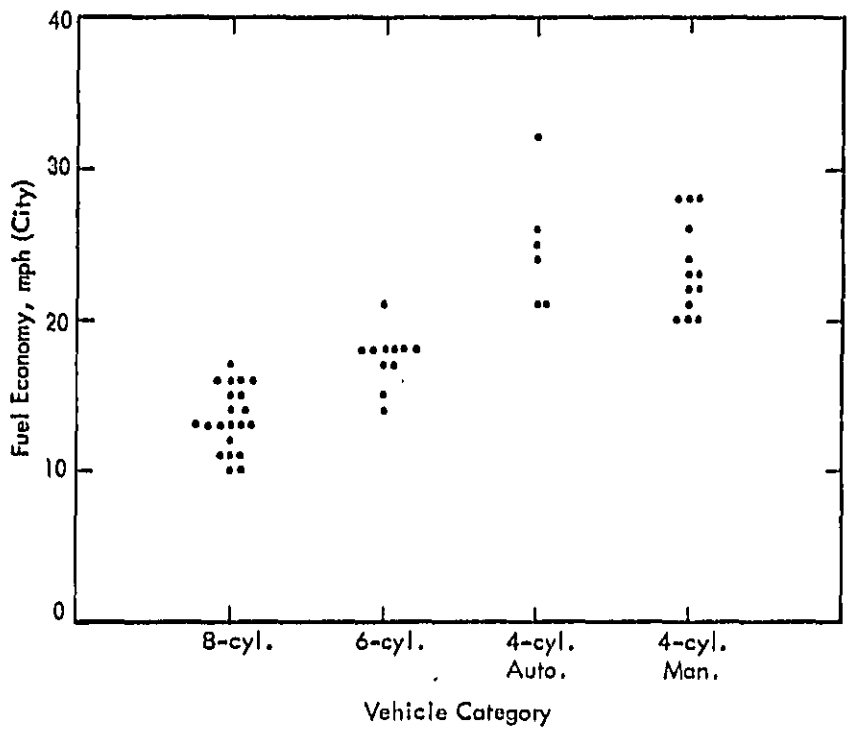

Figure 3.9. Fuel Economy as a Function of Vehicle Category.

type, and hence require a separate category. A final category is provided for light trucks with 6- and 8-cylinder engines which, taken as a whole, do not appear to belong in any of the above categories, even though some individual light trucks do exhibit sound levels typical of these categories. Light pickup trucks equipped with 4-cylinder engines are essentially the same as the corresponding automobile models and generate similar sound levels. Accordingly, they are included in the automobile categories.

A summary of the vehicle categories is given in Table 3.2. The distribution of sound levels for vehicles in each category is shown in Figure 3.10, together with the mean sound levels representative of each category. In calculating the mean levels, the data for some vehicles were excluded, as indicated in Figure 3.10, because the vehicles were not considered typical of their class. In one case, however, subsequent review of the operational data showed that one vehicle (#054) may have been operated under the wrong test condition. This case will be discussed more fully in Chapter 4.

In general, the data points separate well within the six categories, with the exception of 6- and 8-cylinder light trucks. Some of the light trucks would appear to fit quite well in Categories 1 and 2, but others clearly do not, and there is no straightforward explanation for this inconsistency other than the differences in basic design. The results indicate that under typical acceleration, the smaller 4-cylinder engine vehicles with high fuel economy generate sound levels that are 3 to 5 dB higher than the larger 8-cylinder engine vehicles, while those with 6-cylinder engines lie somewhere in between. In general, the automatic transmission vehicles equipped with 6-cylinder engines of capacity greater than 200 CID are little different from those with 8-cylinder engines. The one example of a 6-cylinder engine less than 200 CID (vehicle #047) shows a sound level of 68.6 dBA which is more in line with the general data applicable to 4-cylinder engines.

The most significant increase in sound levels is found with the diesel engine vehicles that have been recently introduced. With the exception of one vehicle, a light truck, the sound levels for diesel engine vehicles appear to be relatively insensitive to engine size or transmission type. The data base is limited, but includes the majority available in the U.S. in 1977.

The test results described above were obtained with vehicles operating within their normal temperature range. Several of the test vehicles were equipped with fan

Table 3.2

Summary of Vehicle Categories

Category No.	Vehicle Type	Engine	Transmission
1	Automobiles	8-cylinder gasoline	Automatic & Manual
2	Automobiles	6-cylinder gasoline	Automatic & Manual
3	Automobiles & Light Trucks	4-cylinder gasoline	Automatic
4	Automobiles & Light Trucks	4-cylinder gasoline	Manual
5	Light Trucks	6- & 8-cylinder gasoline	Automatic & Manual
6	Automobiles	4-, 6-, & 8-cylinder diesels	Automatic & Manual

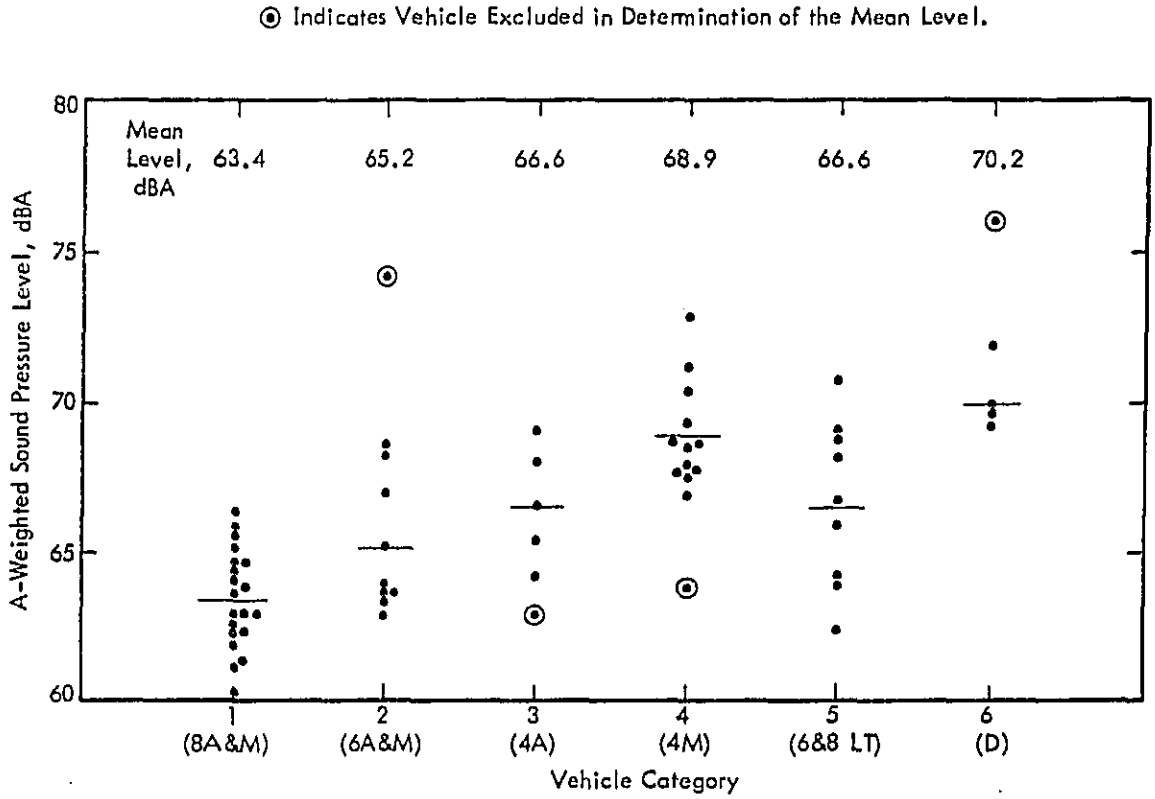

Figure 3.10. Vehicle Sound Level Measured at 50-Foot Distance According to the EPA Urban Acceleration Noise Test Procedure as a Function of Vehicle Category.

clutches that partially or fully disengage the cooling fan from the engine drive at normal operating temperatures and engage to an increasing degree as the engine temperature increases. The resulting increase in fan speed can cause an increase in vehicle sound level for some vehicles. Since a portion of the engine power is used to operate the fan, the power required to achieve the test operating condition will also increase, thus introducing a secondary mechanism that can cause vehicle sound levels to increase.

To determine the effect of fan engagement on vehicle sound levels, the fan clutches on 10 vehicles were adjusted to achieve the minimum slippage possible and the sound levels measured using the EPA Urban Noise Test Procedure. The results of these tests are shown in Table 3.3, together with the data obtained with the fans operating under normal conditions. Figure 3.11 shows the increase in sound level plotted as a function of the baseline level. As would be expected, the general trend is towards greater increases in sound level for vehicles exhibiting lower baseline levels. The two data points in Figure 3.11 that do not follow the general trend correspond to vehicles that exhibited transmission resonances at the increased engine speed needed to satisfy the end conditions with the fan engaged. It can be concluded that the increase in sound level with temperatures generally will be greatest for vehicles equipped with 8-cylinder engines, and least for those with 4-cylinder engines.

3.2 Tire Sound Levels

The sound level data presented in the previous section for vehicles operating according to the EPA Urban Noise Test Procedure include contributions from both the propulsion system, consisting of the engine, its accessories and the transmission, and the tires. In some cases, and particularly for vehicles with 8-cylinder engines which tend to be the quietest, the tires may contribute significantly to the overall vehicle sound level. To determine this contribution, and to assist in the subsequent identification of the effectiveness of noise abatement techniques applied to the propulsion system, measurements of tire sound levels were made on vehicles coasting at specified speeds past a microphone array, with their engines turned off and transmission in neutral.

The measured sound level data are presented in Figure 3.12 as a function of vehicle speed. The first point to notice is the very limited range of sound levels obtained for the

Table 3.3

The Effect of Fan Engagement on Vehicle Sound Levels

Veh. No.	Vehicle	Engine	Trans-mission	Sound Level, dBA		Sound Level Difference, dB
				Normal	Fan On	
003	Lincoln Continental	V8	3A	61.1	64.5	3.4
009	Mercedes Benz 240D	L4(D)	4A	69.9	69.7	-0.2
018	Buick Skylark	V6	3A	62.8	72.0	9.2
022	Fiat X 1/9	L4	4M	67.7	68.1	0.4
023	Fiat 128	L4	4M	71.2	70.7	-0.5
024	Peugot 504D	L4(D)	4M	71.9	72.8	0.9
030	Chrysler Cordoba	V8	3A	64.7	67.9	3.2
034	Renault 12 SW	L4	4M	68.5	69.2	0.7
035	Chevrolet Caprice	V8	3A	64.1	70.9	6.8
050	Subaru 4WD SW	H4	4M	63.8	64.5	0.7

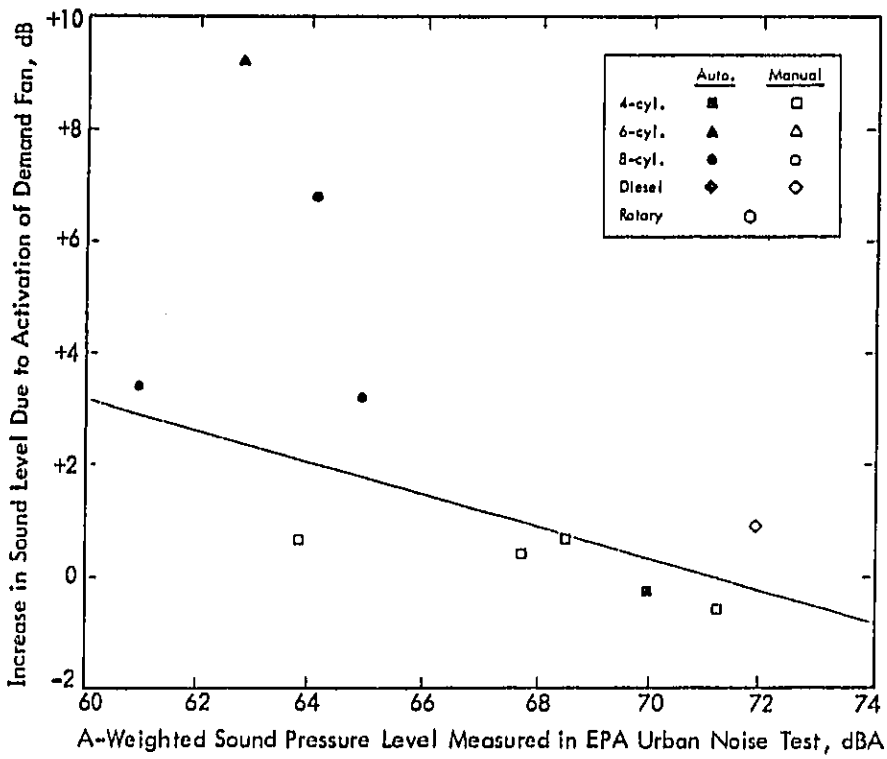

Figure 3.11. The Effect of Activating Demand Fans on Sound Levels Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure.

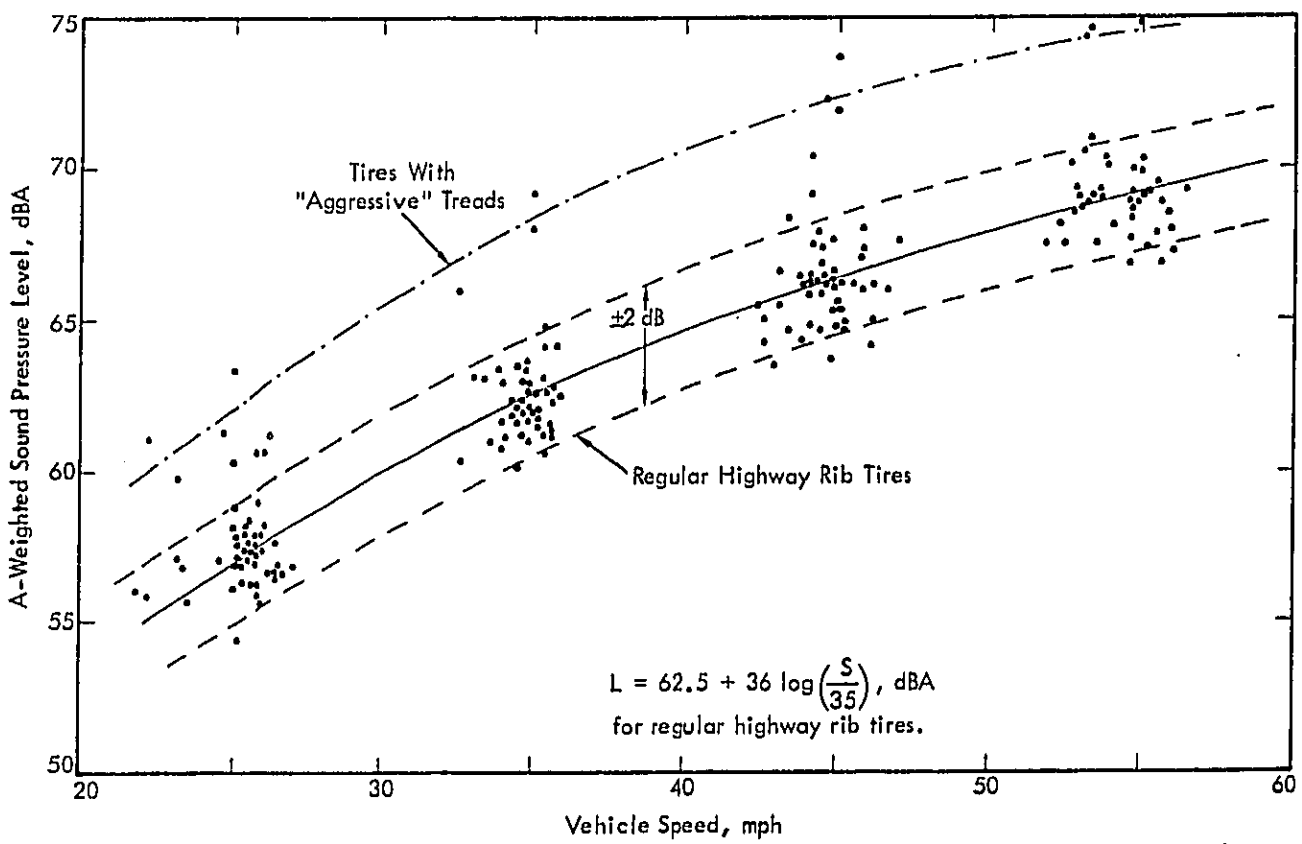

Figure 3.12. Measured Tire Sound Levels at 50-Foot Distance as a Function of Vehicle Speed.

majority of vehicles equipped with the regular highway tire. As shown in Figure 3.12, the majority of data points lie within ±2 dB of the mean value at all speeds for vehicles and tires of all sizes and makes. The mean relationship can be quantified as follows:

$$L = 62.5 + 36 \log \left(\frac{S}{35}\right), \text{ dBA}$$

where S is the vehicle speed in mph. The standard deviation is 1.3 dB.

The sound levels measured for vehicles equipped with tires having an "aggressive" tread, such as mud-and-show or town-and-country tires, are 5 to 6 dB greater than rib tires used for normal highway conditions. However, the levels increase at about the same rate with increasing speed.

As would be expected from these data, there is very little variation in tire sound levels between the various vehicle categories. Figure 3.13 shows a slight tendency for increasing levels with the smaller vehicles, and a major increase of 4 to 5 dB for light trucks with aggressive tread tires at a vehicle speed of 25 mph.

The effect of tire noise on the sound levels measured for the EPA Urban Noise Test Procedure can be determined by subtracting the tire contribution at the vehicle speed where the sound levels were measured. This has been done for each vehicle individually using the 36-log (speed) scaling factor and the resulting differences in sound level are indicated in Table 3.4, only for the 19 vehicles where the difference is greater than 0.5 dB. It should be noted that the EPA test level was, in general, less than 65 dBA for these 19 vehicles; notable exceptions were two light trucks (#014 and #070). Of the vehicles tested with 4- and 6-cylinder engines, only 11 percent exhibit a change in sound level greater than 0.5 dB when the tire noise contribution is subtracted. However, for over 50 percent of the vehicles tested with 8-cylinder engines, the change in sound level is significant, and is as much as 3 dB in some cases. The associated average reduction in sound levels for the various categories is less than 0.5 dB, except for Category 1 where it is 1.3 dB.

3.3 SAE J986a Test Procedure

The SAE J986a procedure involves a full-throttle operation of the vehicle such that maximum potential noise is generated. The procedure specifies only a single microphone position, however, so the measured sound level is not always the maximum produced

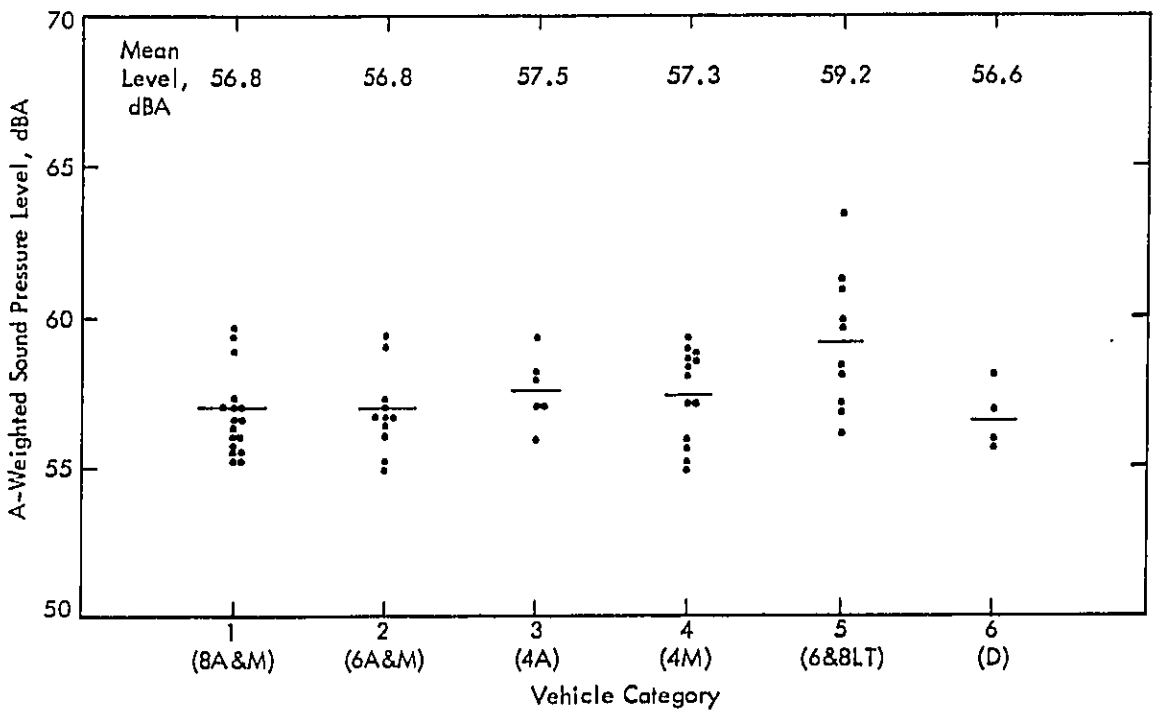

Figure 3.13. Tire Sound Levels at 25 mph* at 50-Foot Distance as a Function of Vehicle Category.

* Sound levels calculated at 25 mph using separate regression equations for each vehicle based upon data taken at nominal speeds of 25, 35, 45, and 55 mph.

Table 3.4

Effect of Tire Noise on Sound Levels Measured According to the EPA Urban Noise Test Procedure*

Vehicle No.	Engine Type	Trans.	EPA Test Level, dBA	Tire Sound Level at EPA Test Condition, dBA	Propulsion System Sound Level at EPA Test Condition, dBA	Difference in Level Due to Tire Noise Contribution, dB
001	V8	3A	62.9	59.1	60.6	-2.3
003	V8	3A	61.1	58.6	57.5	-3.6
004	L4	3A	65.4	58.0	64.5	-0.9
014	V8	3A	69.0	63.5	67.6	-1.4
018	V6	3A	62.8	55.8	61.8	-1.0
027	V8	3A	61.8	56.0	60.5	-1.3
032	V8	3A	62.9	53.8	62.3	-0.6
033	V8	3A	62.6	53.0	60.8	-1.8
035	V8	3A	64.1	56.3	63.3	-0.8
036	V8	3A	60.3	56.6	57.9	-2.4
038	L4	3A	64.2	57.9	63.0	-1.2
042	V8	3A	61.3	56.3	62.4	-1.0
046	V8	3A	62.4	56.9	61.0	-1.4
052	V8	3A	62.8	58.4	60.8	-2.0
057	V8	3A	63.8	55.3	63.1	-0.7
058	V8	3A	62.3	59.6	59.0	-3.3
065	V8	3A	62.3	55.5	61.3	-0.7
067	V6	3A	63.7	56.1	62.9	-0.8
070	V8	3A	68.9	60.7	68.2	-0.7

* Data shown only for vehicles where the difference in sound level due to tire noise contribution is greater than 0.5 dB.

during the test. The sound levels measured for this test procedure are shown in Figure 3.14. as a function of the rated engine horsepower. In contrast with the data for the EPA test shown in Figure 3.5, it is clear that there is no general trend in the data. Attempts to relate the sound levels to other engine or vehicle parameters result in similar displays.

An illustration of the distribution of sound levels measured for the test vehicles in the six categories defined in Section 3.1 is shown in Figure 3.15. The major point to be noted is the relative insensitivity of the sound levels to the type and size of engine and transmission in the case of gasoline-powered automobiles and light trucks. The mean value for Categories 1 through 5 is 73.4 dBA with a standard deviation of 2.6 dB. Comparing these data with those for 1973 vehicles[6] (where sould levels ranged from 75 to 85 dBA) it is clear that SAE J986a vehicle sound levels have been reduced considerably by a combination of modified exhaust systems and reduced rear-axle ratios. Higher sound levels are exhibited by vehicles equipped with diesel engines, the average value being 77.6 dBA. However, only five diesels were tested and only one of these (#059) had a level greater than that exhibited by the other classes of vehicles.

A plot of the sound levels measured according to the SAE test against the EPA test levels is shown in Figure 3.16. Examination of this figure indicates that the correlation between sound levels measured by the two test procedures is very low. Recalling that the EPA test procedure is designed to simulate typical acceleration conditions encountered in urban driving, and hence duplicate the noise exposure of the local community, it appears that the usefulness of the SAE J986a test procedure is strictly limited to the measurement of near-maximum sound levels that are unrelated to community noise exposure.

A comparison of the sound levels measured according to SAE J986a and the EPA Urban Test Procedure is given in Table 3.5 as a function of vehicle category. The difference in sound levels, ranging from 5 to 10 dB as shown in this table, is only partly due to the increased throttle setting required in the SAE procedure. The main reason for the increase in sound levels is that the engine speeds achieved in the SAE procedure are considerably higher than those in the EPA partial-throttle test, approaching rated engine speed in some cases at the time when the maximum level is measured. However, there appears to be no consistent relationship between the difference in sound levels measured in the two tests and parameters relating to vehicle performance. As a result, there appears

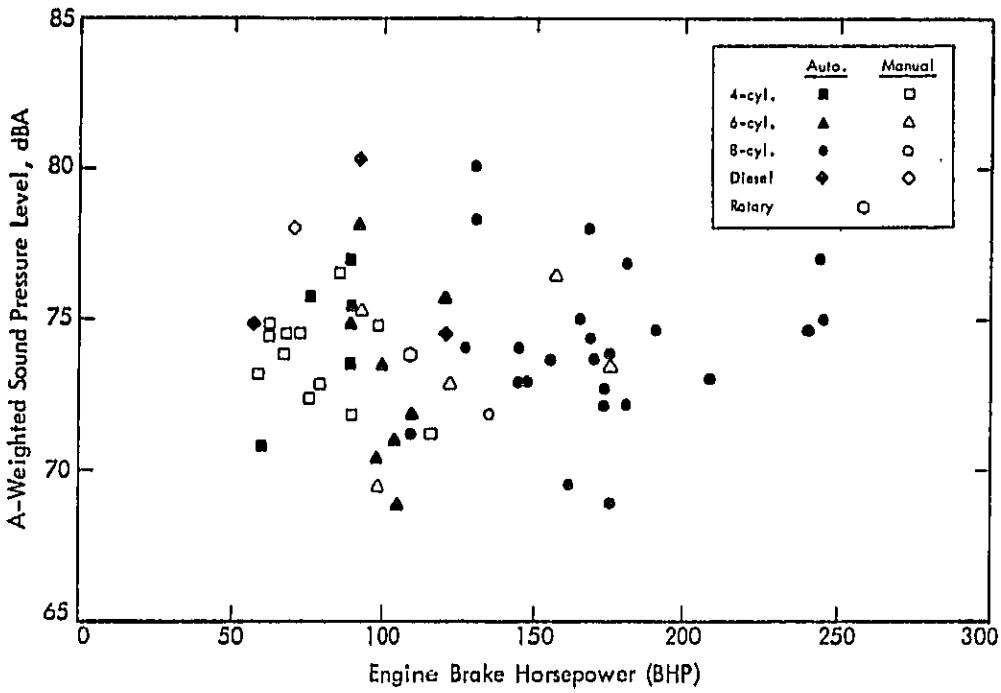

Figure 3.14. Vehicle Sound Levels Measured According to the SAE J986a Test Procedure as a Function of Engine Brake Horsepower.

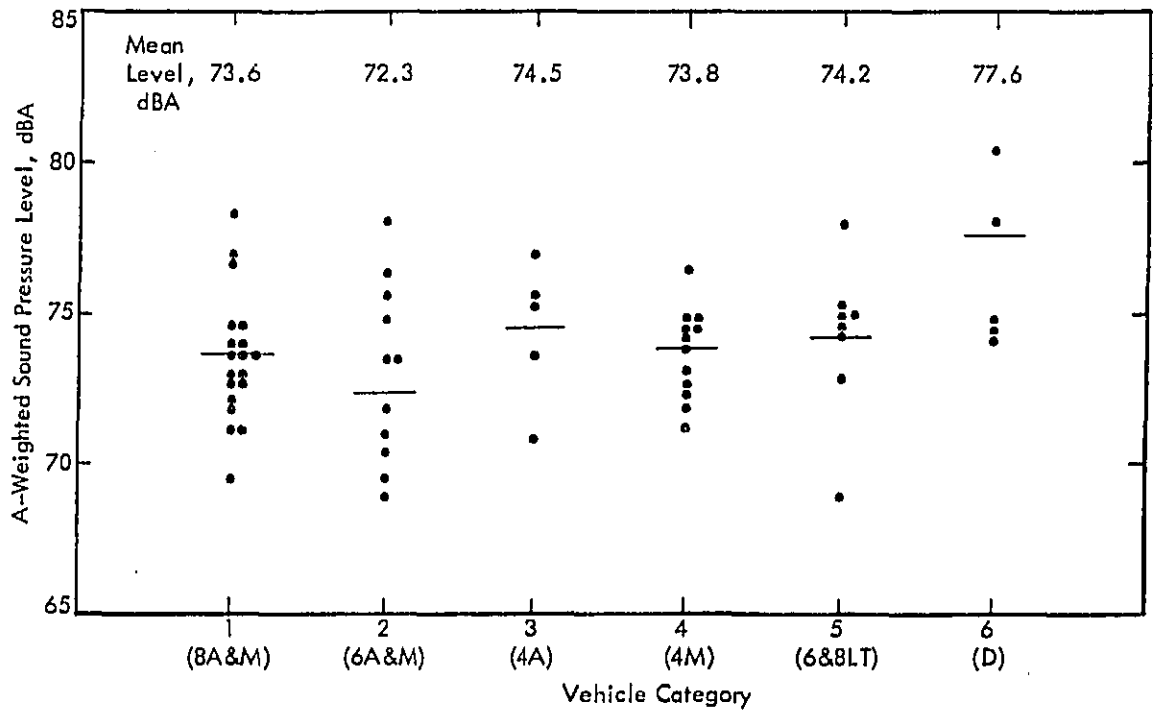

Figure 3.15. Vehicle Sound Levels Measured According to SAE J986a as a Function of Vehicle Category.

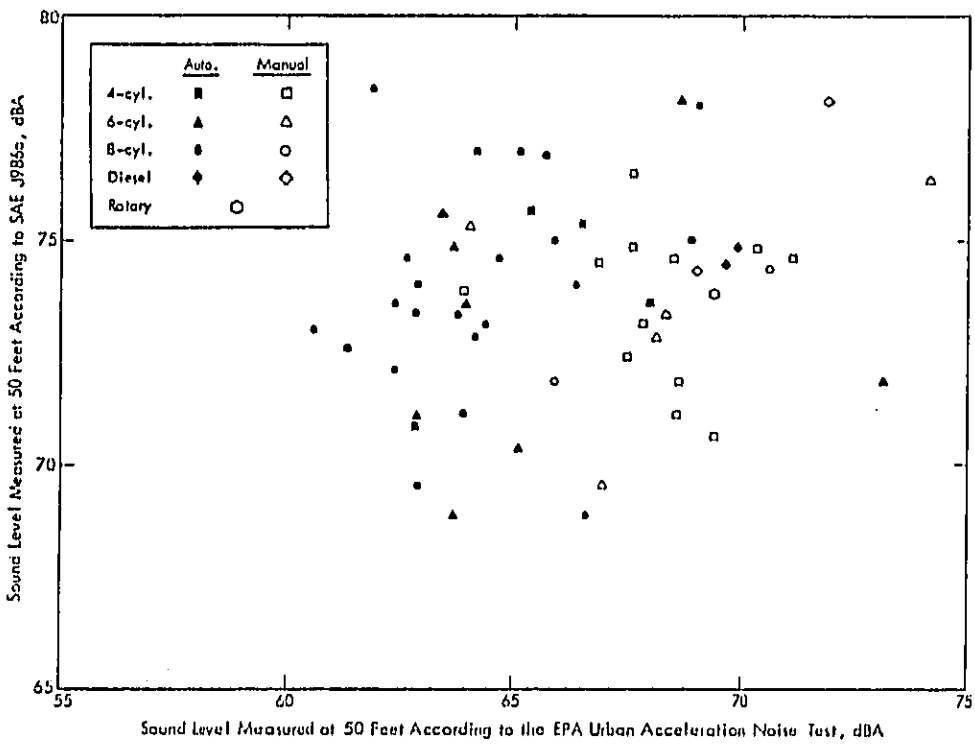

Figure 3.16. Comparison of Sound Levels Measured at 50 Feet According to the SAE J986a and EPA Urban Acceleration Noise Test Procedures.

Table 3.5

Comparison of Sound Levels Measured According to the SAE J986a and the EPA Urban Acceleration Test Procedures

Vehicle Category		Sound Levels (dBA) According To:		Difference in Sound Level, dB
No.	Vehicle Type	SAE J986a	EPA Urban Test Procedure	
1	8A	73.6	63.4	10.2
2	6A & M	72.3	65.2	7.1
3	4A	74.5	66.6	7.9
4	4M	73.8	68.9	4.9
5	Light Trucks	74.2	66.6	7.6
6	Diesels	77.6	70.2	7.4

to be no validity to the hypothesis that the sound levels measured by the SAE test could be "adjusted" by means of a correction factor to provide equivalent levels under partial-throttle operation. A procedure developed by the Committee of Common Market Automobile Manufacturers (CCMC) attempts to do just this by means of an interpolation technique that is applied to each vehicle. This method was reviewed in a previous report,[1] and additional data are presented in a later chapter.

3.4 Cruise Sound Levels

The sound levels generated under cruise conditions were measured in the test series to provide additional information on vehicle noise characteristics, and for input into noise prediction models that include all modes of operation. Measurements were conducted with the vehicles cruising at 35 and 55 mph using a throttle setting sufficient to achieve zero acceleration. The maximum sound levels measured during a pass-by at 35 mph are plotted against fuel economy in miles per gallon in Figure 3.17. It can be noticed that the majority of data points lie within a band with a range of about 4 dB, and there is a definite trend towards higher sound levels at high fuel economy. At least 70 percent of the data points lie within the range of tire sound levels, i.e., 62.5 ±2 dBA, measured in the test program. With few exceptions, the data points that lie outside this range correspond to vehicles with 4-cylinder or diesel engines, or to high-performance vehicles with manual transmissions. Two of these vehicles, identified in Figure 3.17, are light trucks equipped with tires having "aggressive" treads.

The cruise sound level data for speeds of 35 and 55 mph are presented for the six vehicle categories in Figure 3.18, together with the mean value for each category. For vehicles equipped with gasoline engines and regular-rib tires, there is a maximum variation of 2 dB between any of the categories at each vehicle speed. As expected, vehicles equipped with diesel engines produce higher sound levels due to the dominance of engine noise. The light truck category shows considerable scatter of the data at each vehicle speed, the sound level at cruise being highly dependent on the type of tires installed. In fact, the sound levels generated by vehicles equipped with tires having an "aggressive" tread, such as mud-and-snow or town-and-country tires, are 5 to 6 dB greater than vehicles with the regular highway-rib tire. Based on the data taken at the two speeds only, it appears that average cruise noise levels increase with vehicle speeds according to a relationship given by 32 log (S).

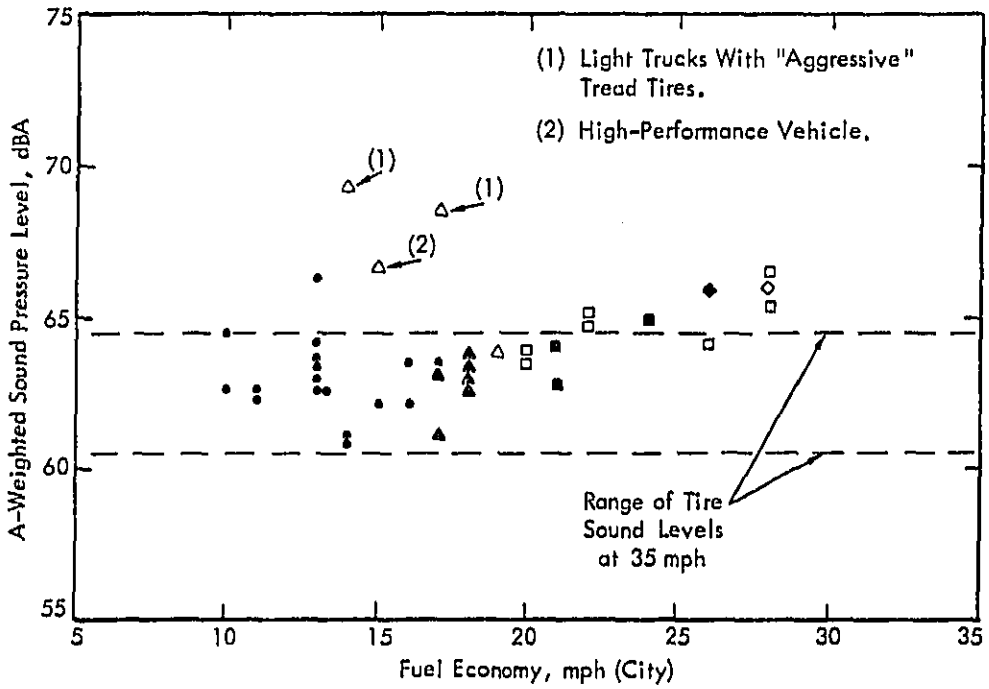

Figure 3.17. Vehicle Sound Level at 50 Feet for Cruise at 35 mph as a Function of City Fuel Economy.

1. High-Performance 6-Cylinder Manuals.
2. Vehicles With Regular Highway Rib Tires.
3. Vehicles With Aggressive Tread Tires.

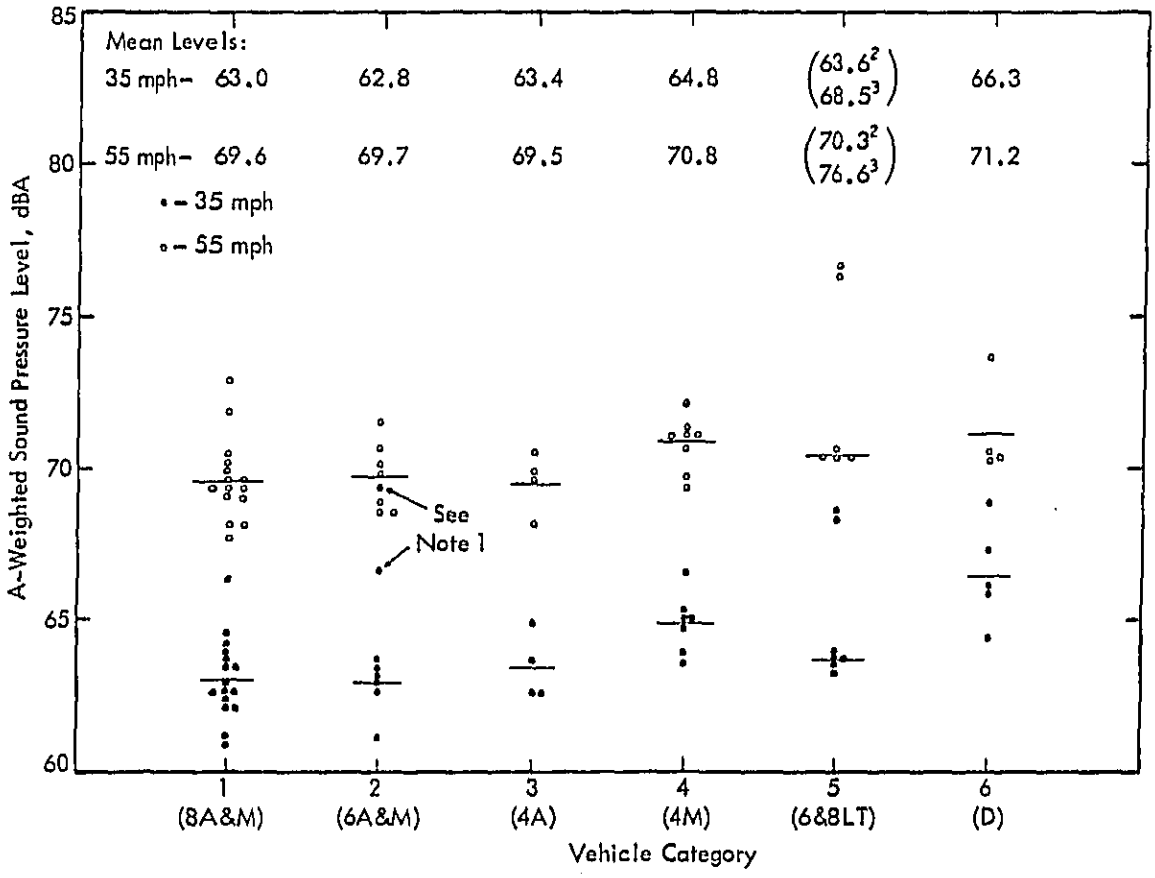

Figure 3.18. Vehicle Sound Level at 50 Feet Measured Under Cruise Conditions as a Function of Vehicle Category.

As expected, the sound levels are lower for cruise at 35 mph than for the EPA test operation, the difference in levels being most noticeable for vehicles equipped with 4- and 6-cylinder engines, but negligible for those with 8-cylinder engines. This result verifies the hypothesis used in the development of the EPA Urban Noise Test Procedure — namely, the introduction of more fuel-efficient vehicles with smaller engines will cause greater increases in sound levels produced under acceleration than under cruise conditions.

3.5 Interior Sound Levels

During each of the tests, the sound level inside the vehicle was monitored continuously by means of a microphone located approximately 6 inches from, and in the same horizontal and vertical planes as the driver's right ear. The microphone location was established using the method prescribed in the Society of Automotive Engineers Standard, SAE J336.[2] The maximum sound level up to and including the end condition for vehicle operation according to the EPA Urban Acceleration Noise Test Procedure was then recorded. In general, it would be expected that the sound levels inside the larger, heavier vehicles where the manufacturers attempt to provide a sense of luxury, would be lower than in the smaller, lighter vehicles where overall economy is the major factor. Since fuel economy is strongly dependent on vehicle weight, this would imply that the interior sound level increases as the fuel economy increases. This general trend can be observed in Figure 3.19. The difference in levels between vehicles equipped with the large 8-cylinder engines and those with 4-cylinder engines and manual transmission are on the order of 10 to 15 dB. This is the result of two factors. First, the difference in exterior sound levels generated is 3 to 5 dB; and second, considerably more attention is given to sound insulation of the engine firewall and door seals in the larger, heavier, and more expensive vehicles as noted above.

It is interesting to note that some vehicles do not follow this general trend — witness the small cluster of data points representing vehicles with a fuel economy in the range 16 to 21 miles per gallon and interior sound levels in the range 60 to 65 dBA. One of these vehicles (#007) is equipped with a rotary engine. Four of the others are equipped with 6-cylinder engines, but, judging from a comparison of the exterior and interior sound levels, their body structures more closely resemble those normally found in larger vehicles.

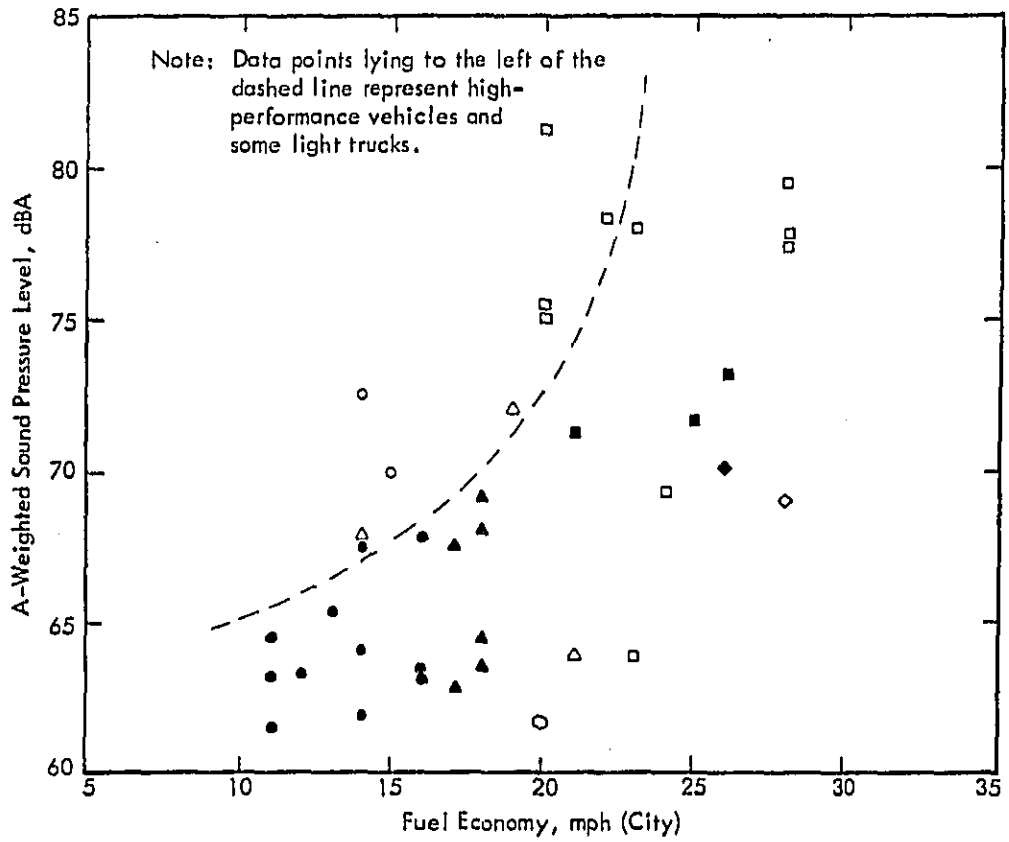

Figure 3.19. Interior Sound Levels Measured According to the EPA Urban Acceleration Noise Test Procedure as a Function of City Fuel Economy.

In fact, the curb weights of these four vehicles are about 400 pounds greater than for the other similar 6-cylinder vehicles included in Figure 3.19, hence the lower interior sound levels.

Figure 3.20 presents the interior sound level data for the six vehicle categories, and allows a further conclusion to be made regarding the vehicles equipped with 8-cylinder engines. The two data points at the top of Category 1 are for vehicles defined as compact or subcompact by virtue of their interior volume, whereas the remainder are mid-size and large-size vehicles. This reinforces the assumption that low interior sound levels for 1977 model vehicles are associated with high vehicle weight.

Some interesting conclusions can also be drawn from the data for Category 4 vehicles with 4-cylinder engines and manual transmissions. In this category, three vehicles exhibit exterior sound levels that are significantly lower than the others. A characteristic common to two of these vehicles (#020 and #023) is that they incorporate a front-wheel drive; the other is equipped with a rotary engine. In each case, the gearbox is located closer to the engine and further from the passenger compartment than in vehicles with front engines and rear-wheel drive, potentially resulting in lower interior sound levels.

3.6 Stationary Test Sound Levels

The stationary tests were conducted at six stabilized engine speeds, as described in Section 2.3, with the microphone locations shown in Figure 3.21. The purpose of the tests was to determine whether any relationship existed between the sound levels measured and those obtained from the EPA Acceleration Procedure. The measured data for each microphone location are presented in Tables 3.6, 3.7, and 3.8. Included in these tables are the sound levels measured at 50 feet according to the EPA Urban Acceleration Noise Test Procedure, and the levels measured with the vehicle stationary and the engine stabilized at a speed equal to that at which the maximum sound level in the EPA test was generated.* Figure 3.22 shows the stationary sound levels measured 25 feet from the vehicle plotted against the EPA Urban Acceleration Noise Test Procedure levels. The

* The 25-foot stationary test sound levels were measured on one side of the vehicle only — the side on which the exhaust outlet was located. Therefore, to obtain a realistic comparison, the Urban Acceleration Test sound levels are quoted in Tables 3.6, 3.7, and 3.8 for the same side of the vehicle.

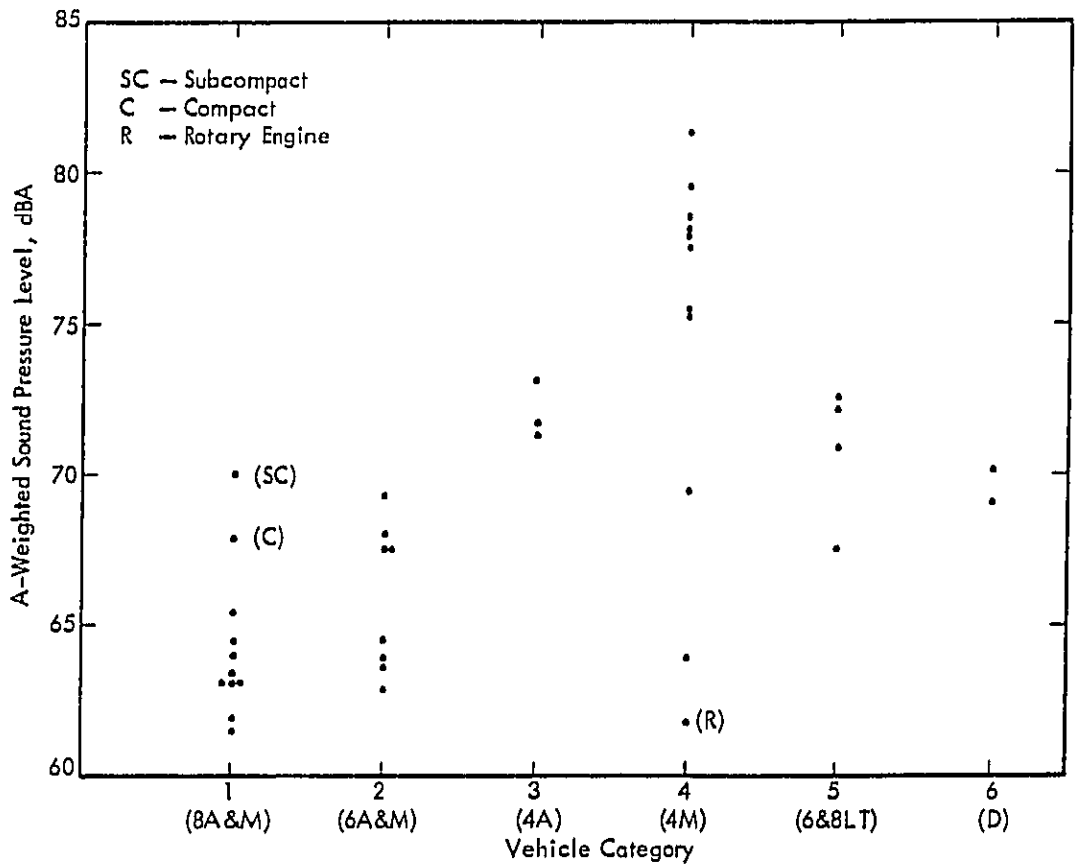

Figure 3.20. Interior Vehicle Sound Levels Measured According to the EPA Urban Noise Test Procedure as a Function of Vehicle Category.

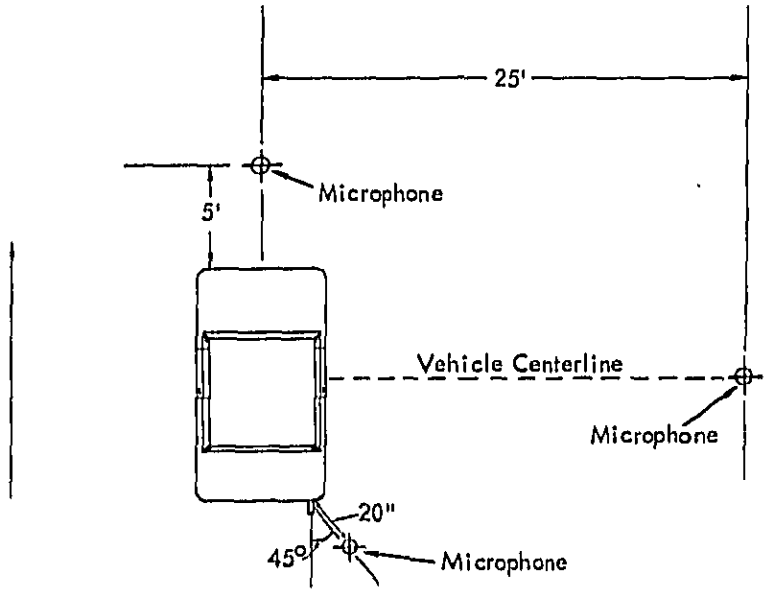

Figure 3.21. Microphone Locations for Stationary Test.

Table 3.6

Sound Level Data Measured at 25 Feet From Stationary Vehicles

Vehicle No.	Stationary Test Sound Levels, dBA, at 25 Feet								EPA Test Level, dBA[2]
	Percent Rated Engine Speed						3000 RPM	EPA Test RPM[1]	
	50	60	70	75	80	90			
003	64.1	66.6	68.6	69.8	71.9	74.0	69.8	62.0	60.6
005	62.1	66.6	71.2	71.9	73.7	76.7	63.1	71.0	67.5
009	64.2	67.0	70.0	70.0	73.2	74.8	70.0	71.5	69.9
011	62.8	65.5	69.2	71.0	71.6	74.1	65.2	70.5	67.9
014	63.0	65.3	67.5	68.7	70.7	73.0	70.3	64.5	67.5
015	66.5	67.5	72.0	72.7	75.2	78.0	75.5	73.0	70.7
019	59.7	64.1	66.7	67.6	70.4	73.8	64.8	67.0	66.2
022	65.0	66.5	69.5	70.5	71.7	75.0	65.0	69.0	67.7
023	66.5	68.4	69.5	70.9	71.8	73.5	66.5	69.5	71.2
024	70.7	73.7	76.0	78.0	79.3	80.5	75.0	75.5	71.0
025	65.0	68.0	71.7	73.2	74.1	75.0	66.5	69.0	67.5
026	65.0	68.2	70.8	72.4	73.0	76.2	67.2	68.0	64.4
028	68.3	70.4	72.4	73.7	75.3	76.4	71.5	68.2	65.8
030	62.0	63.3	65.3	66.3	68.5	72.0	69.5	63.0	64.7
031	61.0	63.0	66.7	69.0	70.0	73.7	72.7	61.8	63.7
032	65.2	68.1	71.3	73.7	73.8	75.0	72.7	63.5	62.0
033	62.2	64.5	67.4	68.5	69.5	71.9	68.5	60.4	62.6
034	66.0	70.0	74.0	74.5	77.3	80.5	67.3	72.0	67.4
035	59.5	62.5	65.6	66.4	67.3	70.1	67.2	63.5	64.1
037	60.7	62.5	65.5	67.8	70.3	72.1	64.4	66.2	65.5
038	68.5	67.3	72.7	74.5	75.5	77.5	70.4	67.0	64.2
039	64.0	67.3	70.9	72.9	73.6	76.5	74.6	63.5	63.4
040	69.3	72.0	76.1	78.5	80.2	83.6	69.6	75.5	72.8
041	63.7	66.9	71.2	72.5	74.1	73.5	65.6	70.5	68.3
042	62.4	66.0	69.2	70.4	71.7	74.7	71.5	60.9	61.3
045	65.5	67.3	70.0	71.4	72.5	75.5	71.4	67.0	65.4
046	64.0	67.0	70.0	71.0	72.0	73.5	72.0	61.5	62.4
048	60.5	63.0	65.9	67.5	69.9	71.0	71.0	65.0	64.0
050	58.7	61.0	64.2	66.7	67.3	69.7	60.2	63.5	63.8
053	69.5	72.0	72.8	73.0	74.0	76.0	74.5	72.0	69.4
054	60.1	62.6	64.3	65.3	67.3	68.8	62.6	62.0	62.5
055	68.5	65.5	68.2	70.5	71.0	72.6	71.0	66.5	64.1
056	66.7	65.5	66.4	68.7	74.5	75.0	63.5	66.7	66.6
057	60.0	63.0	65.0	68.0	70.0	77.0	75.0	64.5	61.9
058	65.5	68.3	70.0	72.0	72.9	74.7	72.0	61.4	62.3
059	70.3	74.6	77.0	78.8	80.7	82.3	79.0	81.0	75.0
060	65.5	67.0	69.9	71.0	72.5	77.9	70.4	70.5	69.2
061	62.5	66.5	68.1	69.3	70.0	71.9	75.0	68.0	64.0
062	66.4	66.5	71.7	73.7	74.8	75.7	74.7	67.5	66.4
064	66.7	68.9	71.0	72.5	74.4	74.0	67.7	71.5	70.3
065	64.0	68.5	70.6	72.3	74.2	77.1	69.9	65.0	62.3
066	63.0	64.5	67.0	68.5	69.0	71.0	70.2	64.0	64.1
067	57.5	58.5	61.3	63.2	64.4	67.9	67.0	61.0	63.2
068	65.0	68.0	72.0	72.5	73.0	75.0	72.5	70.5	66.9
069	61.3	65.7	68.0	69.0	69.8	73.2	74.0	68.5	68.2
070	64.0	67.5	71.5	72.5	73.0	75.5	71.9	66.0	68.7

[1] Engine speed for maximum sound level in the EPA Urban Acceleration Noise Test.

[2] EPA Urban Acceleration Noise Test sound level measured at 50 feet.

Table 3.7

Sound Level Data Measured 20 Inches From Exhaust Outlet of Stationary Vehicles

Vehicle No.	Stationary Test Sound Levels, dBA, at 25 Feet								EPA Test Level, dBA[2]
	Percent Rated Engine Speed						3000 RPM	EPA Test RPM[1]	
	50	60	70	75	80	90			
003	75.2	76.0	75.8	78.3	79.5	81.8	78.3	74.7	60.6
005	72.5	76.4	80.0	82.0	83.3	85.3	72.8	79.3	67.5
009	77.0	78.7	81.2	82.5	84.3	86.2	82.5	83.6	69.9
011	73.3	77.5	80.6	82.5	83.8	86.3	77.5	80.6	67.9
014	75.3	79.0	85.0	84.7	87.0	89.7	86.5	76.4	67.5
015	77.0	81.7	85.9	88.0	89.5	92.0	88.5	86.7	70.7
019	70.0	73.9	78.2	78.9	81.0	82.6	75.0	76.1	66.2
022	73.7	76.0	80.0	81.7	82.9	84.5	83.7	80.7	67.7
023	73.5	77.8	80.4	81.7	83.3	86.2	73.4	80.1	71.2
024	78.5	82.7	87.6	89.6	89.1	90.1	85.7	87.1	71.0
025	83.3	84.2	85.5	86.7	87.1	87.7	84.3	85.5	67.5
028	77.3	80.0	83.7	84.5	86.0	88.4	81.2	76.8	65.8
029	76.0	79.5	84.0	86.0	87.5	90.5	88.3	78.8	63.8
030	73.0	74.2	77.3	78.2	79.7	82.2	80.5	73.0	64.7
031	74.3	76.1	79.0	80.5	81.7	84.5	83.9	75.3	63.7
032	79.1	84.0	87.4	89.1	90.7	92.0	89.1	77.6	62.0
033	79.5	80.5	82.0	82.0	81.7	83.0	82.0	78.9	62.6
034	76.0	78.8	83.0	83.7	84.5	86.5	77.0	82.2	67.4
035	71.0	74.3	77.6	79.4	80.5	82.9	80.2	74.6	64.1
037	78.1	78.7	82.1	85.7	84.4	85.5	81.7	83.5	65.5
039	78.5	79.8	86.3	87.3	87.8	89.5	88.2	78.3	63.4
040	79.3	81.0	83.4	85.6	87.2	90.7	78.7	82.9	72.8
041	78.7	83.5	85.6	87.7	89.5	92.3	80.5	85.4	68.3
042	77.5	82.0	85.5	87.4	89.5	92.3	89.1	75.7	61.3
045	78.7	81.3	83.0	84.0	86.1	88.5	84.0	81.0	65.4
046	77.5	83.0	85.5	86.5	88.5	91.0	88.0	74.2	62.4
048	77.5	81.5	85.2	86.5	88.5	90.0	90.0	82.6	64.0
050	74.5	72.7	75.5	78.3	79.3	79.7	72.3	75.5	63.8
053	78.0	80.8	82.5	83.0	84.5	87.0	85.4	82.0	69.4
054	69.7	72.3	77.3	79.3	80.5	81.3	72.3	72.3	62.5
055	85.0	78.5	80.5	82.3	83.4	85.5	83.7	79.3	64.1
056	93.7	82.7	85.7	91.5	92.7	89.0	81.5	85.7	66.6
057	75.5	76.5	78.9	80.5	81.5	85.5	84.0	78.2	61.9
058	79.5	82.4	83.4	84.2	85.7	86.7	84.2	76.6	62.3
059	81.7	85.2	88.4	89.7	91.7	94.4	89.4	90.9	75.0
061	79.5	82.7	85.3	86.7	84.7	86.0	87.4	85.0	64.0
062	78.4	78.8	80.7	81.8	83.3	84.5	84.0	78.6	66.4
064	77.5	80.7	83.6	83.9	84.7	88.6	79.4	83.6	70.3
065	74.7	76.0	80.0	81.7	82.7	85.7	77.7	74.3	62.3
066	77.0	78.0	80.0	81.5	82.0	84.5	83.0	77.3	66.1
067	68.7	71.7	74.7	75.5	76.5	80.0	77.0	73.2	63.2
068	75.0	78.0	82.0	82.5	83.0	85.0	82.5	81.5	66.7

[1] Engine speed for maximum sound level in the EPA Urban Acceleration Noise Test.

[2] EPA Urban Acceleration Noise Test sound level measured at 50 feet.

Table 3.8

Sound Level Data Measured 5 Feet in Front of Stationary Vehicles

Vehicle No.	Stationary Test Sound Levels, dBA, at 25 Feet							EPA Test Level, dBA[1]
	Percent Rated Engine Speed						3000 RPM	
	50	60	70	75	80	90		
003	79.1	80.3	82.0	84.1	85.4	88.3	84.1	60.6
005	74.7	80.4	84.3	85.5	86.7	88.1	76.0	67.5
009	79.4	85.3	85.5	87.3	89.5	91.5	87.3	69.9
011	76.7	78.6	82.7	82.4	83.6	85.3	78.6	67.9
014	77.3	78.2	79.7	81.2	83.7	83.6	82.7	67.5
015	80.7	81.3	85.9	87.0	87.3	88.0	87.3	70.7
019	75.7	79.2	80.9	80.4	81.5	83.7	80.2	66.2
022	85.7	89.3	90.4	91.3	92.3	95.6	85.7	67.7
023	86.4	88.3	88.7	90.5	91.4	91.6	86.4	71.2
024	84.0	86.5	91.5	92.4	95.5	97.0	89.0	71.0
026	77.0	79.4	80.9	82.4	84.0	87.6	79.8	64.4
028	81.9	83.5	85.3	86.4	86.5	87.7	84.4	65.8
030	62.9	65.7	67.7	69.4	74.2	77.2	77.7	64.7
031	77.6	79.9	84.7	86.5	88.3	91.5	90.7	63.7
032	80.3	84.3	87.7	89.6	91.5	94.0	89.6	62.0
033	77.8	80.3	81.7	83.5	84.5	86.5	83.5	62.6
034	78.8	83.0	85.3	86.7	88.6	91.5	80.0	67.4
035	72.5	75.8	75.7	76.3	77.7	79.5	77.5	64.1
038	78.7	77.5	80.7	83.6	83.6	84.8	78.5	64.2
039	80.0	84.3	87.4	89.7	91.0	94.5	93.0	63.4
040	83.0	87.0	91.0	92.6	94.1	97.0	84.2	72.8
041	77.3	79.4	82.0	83.0	83.1	85.7	78.9	68.3
042	78.3	81.3	82.5	83.7	84.5	86.7	84.2	61.3
045	79.4	80.2	82.0	83.7	86.0	88.0	83.7	65.4
046	76.5	80.5	80.5	82.5	83.0	87.5	82.0	62.4
048	70.0	74.0	77.0	79.0	79.5	82.5	82.5	64.0
050	73.3	78.3	81.2	82.7	83.7	87.5	77.3	63.8
053	80.9	83.0	88.0	89.0	91.0	94.0	91.5	67.4
054	81.0	82.2	82.0	82.5	82.9	83.0	82.2	62.5
055	81.7	83.7	86.5	89.0	90.5	89.3	91.3	64.1
056	74.6	77.5	77.7	81.7	83.3	85.5	76.2	66.6
057	82.0	84.5	87.0	87.0	87.0	90.5	87.0	61.9
058	81.5	84.5	86.0	86.0	87.5	90.0	86.0	62.3
059	84.5	88.7	91.6	93.4	95.0	97.4	93.4	75.0
061	75.0	78.2	81.4	83.0	84.5	87.2	89.4	64.0
062	82.0	86.0	88.5	90.4	91.1	93.7	92.4	66.4
064	81.5	83.7	85.7	86.4	87.7	90.3	82.5	70.3
065	77.3	80.0	83.0	84.3	85.4	89.3	82.2	62.3
066	73.2	75.5	78.0	79.5	80.0	84.0	81.5	66.1
067	74.3	73.3	74.0	74.7	75.5	77.0	77.3	63.2
068	84.0	86.0	88.5	89.5	90.0	93.0	87.2	66.7

[1] EPA Urban Acceleration Noise Test sound level measured at 50 feet.

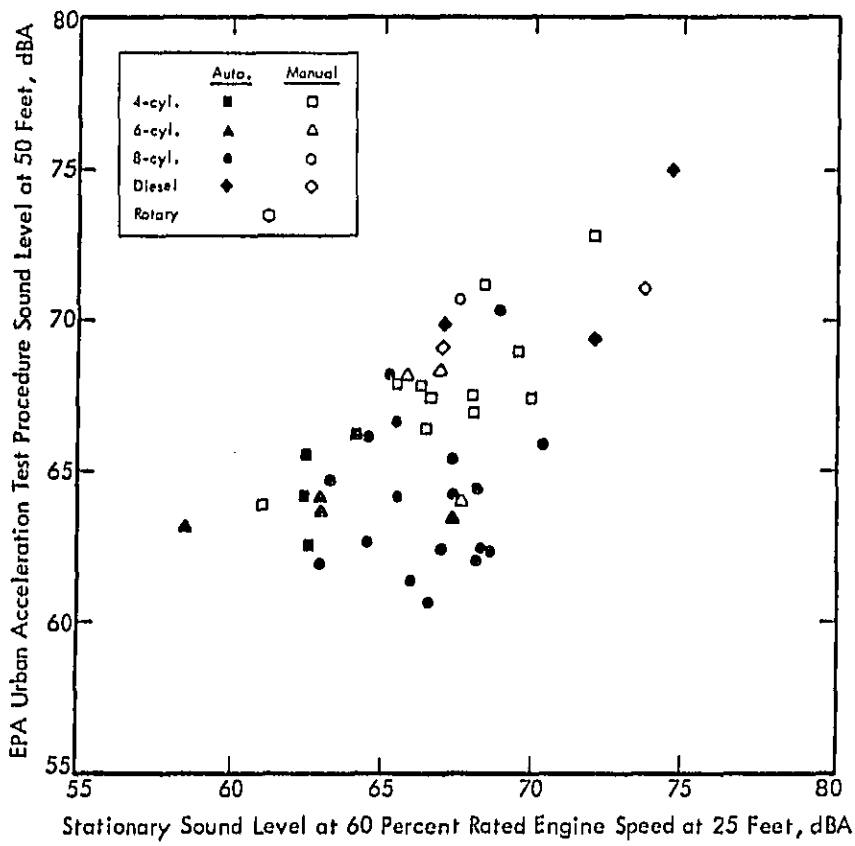

Figure 3.22. Correlation of Sound Levels Measured by the EPA Urban Acceleration Test With Stationary Sound Levels at 60 Percent Rated Engine Speed.

stationary levels in this figure correspond to a normalized engine speed of 60 percent for all vehicles — the engine speed at which the highest correlation ($r = 0.59$) was obtained. Lower values of the correlation coefficient are obtained for the other two microphone locations at all engine speeds.

Since the purpose of a stationary test procedure is to allow simple enforcement of noise regulations, it is not necessary for the sound levels measured by the two procedures to correlate exactly. It is only necessary for the simple test to identify the vehicles not complying with the regulation, without discriminating against those which do comply. To this end, contingency table analysis has been used in the past. Such an analysis attempts to find an independent variable (in this case the stationary test sound level) that can be used to discriminate between different groups of the dependent variable (the EPA test sound level), assuming that different groups do in fact exist. Reviewing the data in Figure 3.22, there is a tendency for grouping of Category 4 vehicles, but many anomalies exist for other categories. There is also a noticeable spread in the data (up to 10 dB) in both coordinate directions, which would lead to significant errors of omission (vehicles incorrectly passed by the stationary test) and commission (vehicles incorrectly failed by the test). Thus, the basic assumption necessary for contingency analysis is not valid, and so the method is unsuitable in this case.

The lack of agreement between the sound levels measured by the two test methods can be ascribed to the following reasons:

- The stationary test procedure was not performed at the same throttle setting used in the EPA Urban Acceleration Noise Test Procedure, due to the requirement for achieving a stabilized engine speed. Previous tests[1] have shown that the vehicle sound level is sensitive to throttle setting, although much less so than to engine speed.
- In Condition 1 of the EPA Urban Acceleration Noise Test Procedure, vehicles equipped with automatic transmissions tend to shift from first to second gear at a lower normalized engine speed (50 to 60 percent) than those with manual transmissions, where the shift point is defined as 70 percent rated engine speed. Thus, although this difference is considered typical of normal driving, a good correlation with a stationary test conducted at any one engine speed would not be expected.

- The maximum sound levels measured in the EPA Urban Acceleration Noise Test Procedure for vehicles equipped with automatic transmissions may be produced under Condition 1 or Condition 2, depending on the transmission characteristics. These characteristics also determine the end condition at which the sound level is measured under each of the test conditions, but they are not considered at all in the stationary test procedure.

Accordingly, it is concluded that a stationary test procedure involving sound level measurements at a fixed, stabilized engine speed, is not suitable as a simple test for the enforcement of noise regulations that might be based on sound levels measured by the EPA Urban Acceleration Noise Test Procedure.

As would be expected, a much stronger correlation exists between the sound levels measured by the EPA Urban Acceleration Noise Test Procedure and the levels measured at the same engine speed with the vehicle stationary. The relationship is shown in Figures 3.23 and 3.24 for stationary test levels measured at 25 feet to the side and at 20 inches from the exhaust outlet, respectively — see Figure 3.21. The correlation coefficient for the data taken at 25 feet is 0.89 and the standard error of estimate is 2.2 dB. If the three vehicles identified in Figure 3.23 (light trucks #014 and #070, and automobile #023) are excluded, the correlation coefficient increases to 0.93 and the standard error of estimate reduces to 1.7 dB, indicating a fairly strong relationship between the two measurements of vehicle sound level. The correlation coefficient for the data taken 20 inches from the exhaust outlet is lower (0.72) because the exhaust system is often not the major source of vehicle noise. If vehicles #023, #040, #059, and #061 are excluded, as indicated in Figure 3.24, the correlation coefficient increases only slightly to 0.73. The sound levels measured to the front of the stationary vehicle exhibit a very low correlation with those measured at 50 feet in the EPA Urban Acceleration Noise Test Procedure, leading to the conclusion that the sound energy radiated to the front is not representative of that measured at the vehicle sideline.

The results of this analysis show that the sound levels measured at 25 feet from the vehicle and at 20 inches from the exhaust outlet correlate reasonably well with those measured by the EPA Urban Acceleration Noise Test Procedure for most vehicles, provided that the measurements are conducted at the same engine speeds. The problem in specifying

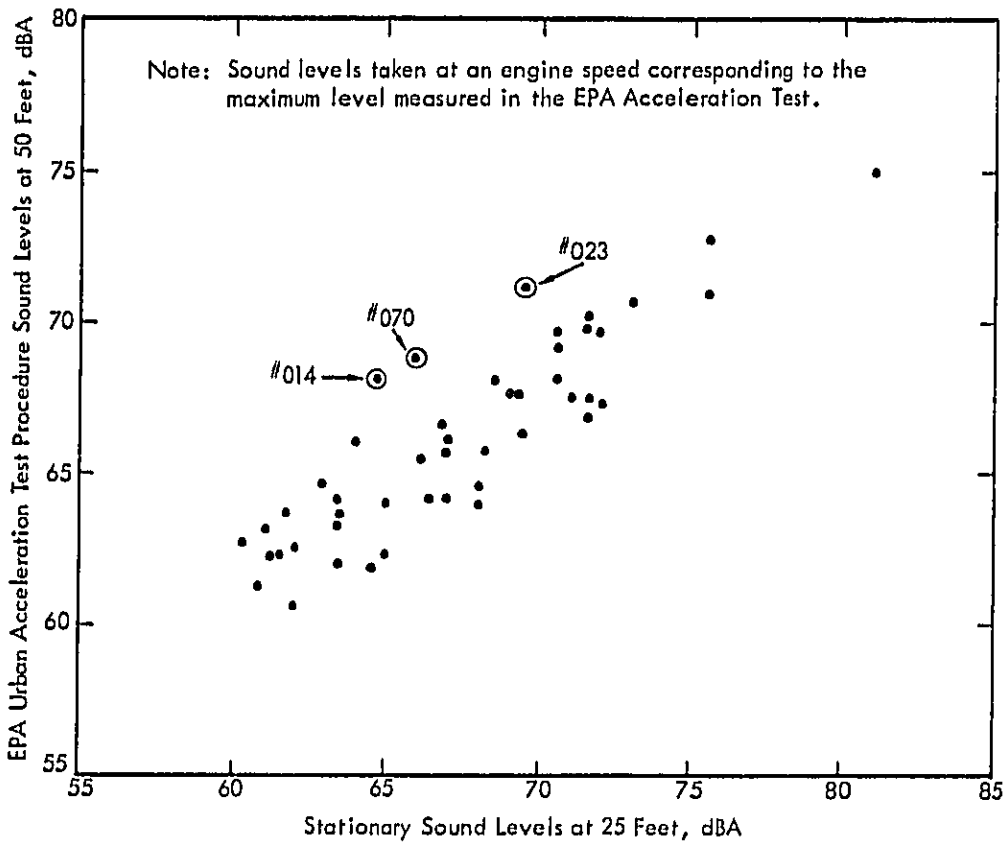

Figure 3.23. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of the Sound Level Measured at 25 Feet at the Same Engine Speed With the Vehicle Stationary.

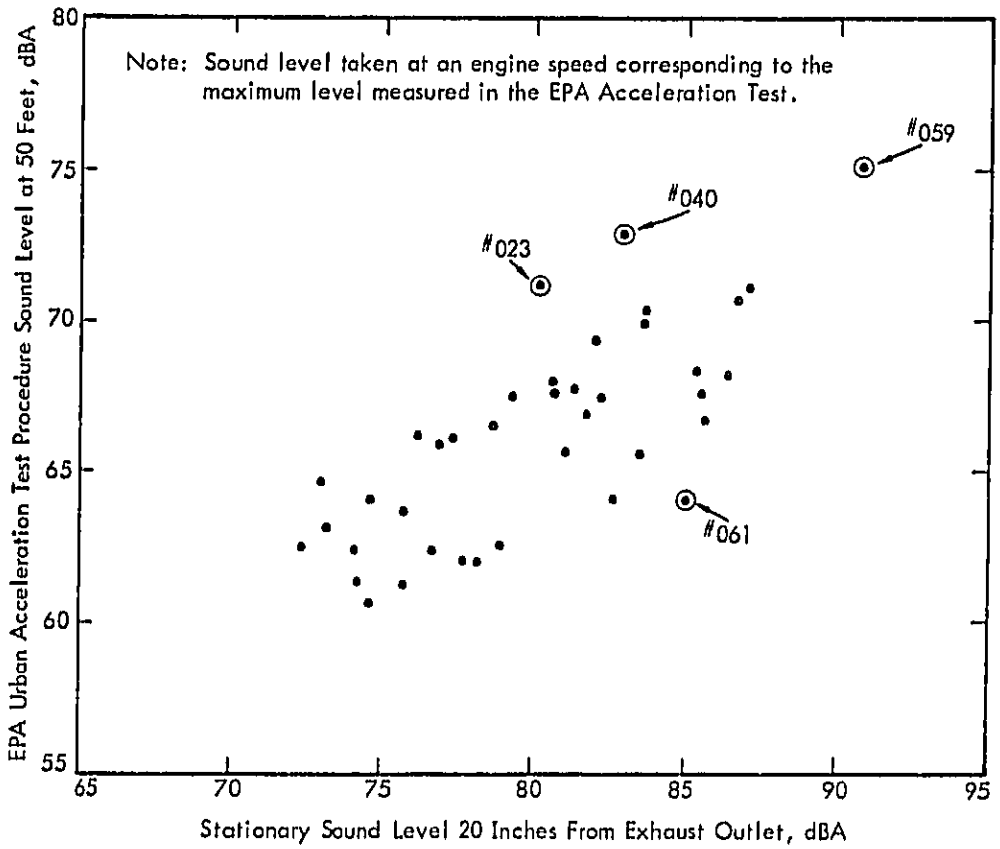

Figure 3.24. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of the Sound Level Measured 20 Inches From the Exhaust Outlet at the Same Engine Speed With the Vehicle Stationary.

a stationary test condition is that the engine speeds corresponding to the maximum sound level measured in the EPA Acceleration Test are not known unless this test is first conducted.

A review of the data in the Summary Tables (see Appendix C) shows that, for vehicles with manual transmissions, the mean engine speed at the maximum sound level generated in the EPA Urban Acceleration Noise Test is 69 percent of the rated speed with a standard deviation of 1.3 percent. Accordingly, it would be satisfactory to test all manuals at 70 percent rated engine speed in a stationary test procedure.

The engine speeds at maximum sound level for the automatics tested are presented in Table 3.9 for each vehicle category. It will be noted that the range of values is much greater than for manuals. However, it appears that suitable engine speeds for a stationary test are as follows:

- Automobiles and light trucks with 8-cylinder engines — 50 percent rated engine speed.
- Automobiles and light trucks with 4- and 6-cylinder engines — 60 percent rated engine speed.
- Diesels — 75 percent rated engine speed.

The sound levels produced at 25 feet in the stationary test conducted at the above settings can be extracted from Table 3.6 and are plotted as a function of the EPA Acceleration Test levels in Figure 3.25. The correlation coefficient between the two quantities is 0.77 and the standard error of estimate is 2.1 dB. If vehicles #014, #070 (heavy vans), and #023 are excluded, the coefficient is 0.83, and 93 percent of the data points lie within a ±2.5 dB band about the mean trend of the data.

In summary, the stationary test described above involving specified engine speeds for each vehicle category provides the best correlation with the levels measured by the EPA Urban Acceleration Test Procedure if the actual engine speeds achieved in this procedure are unknown. It should be noted that the relationships developed and the definition of test engine speeds strictly apply only to the vehicles tested in this program. It is not known whether similar relationships apply to vehicles manufactured prior to or after 1977.

Table 3.9

Engine Speeds for Automatics at Which Maximum Sound Levels Are Produced in the EPA Urban Acceleration Noise Test Procedure

8-Cylinder Automatics			6-Cylinder Automatics			4-Cylinder Automatics			8-Cylinder Light Trucks			Diesels		
Vehicle No.	N (RPM)	N/N_r (%)	Vehicle No.	N (RPM)	N/N_r (%)	Vehicle No.	N (RPM)	N/N_r (%)	Vehicle No.	N (RPM)	N/N_r (%)	Vehicle No.	N (RPM)	N/N_r (%)
001	1999	53	018	2083	65	004	2526	44	014	2002	53	009	3125	78
002	1803	50	029	2087	58	019	3101	65	016	2115	56	053	2409	67
003	1741	44	031	1885	55	037	3160	72	055	2358	64	059	3122	78
027	1667	49	039	1758	49	038	2260	47	058	1591	40	Mean	2885	74
028	2300	48	047	2820	67	072	2900	66	066	1722	48	σ	--	--
030	1814	50	048	2161	64	Mean	2789	59	070	2184	52			
032	1864	47	063	2308	61	σ	386	12	Mean	1975	52			
033	1775	44	067	2228	66				σ	290	8			
035	2312	61	Mean	2166	61									
036	1560	49	σ	319	6									
042	1736	46												
044	1787	47												
045	2379	59												
046	1656	44												
051	1792	50												
052	1856	52												
057	2231	66												
062	2059	57												
065	2053	47												
Mean	1915	51												
σ	243	6												

N = Engine Speed at Maximum Sound Level.

N/N_r = Percent Rated Engine Speed at Maximum Sound Level.

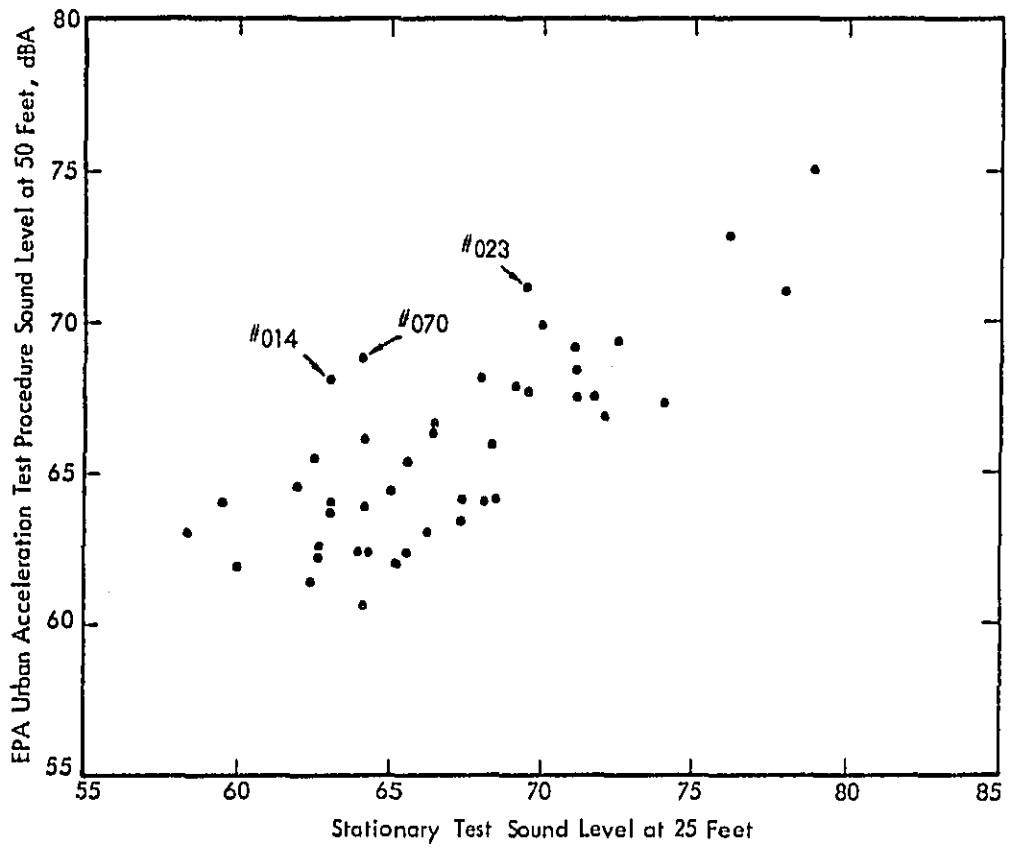

Figure 3.25. Vehicle Sound Level Measured at 50 Feet According to the EPA Urban Acceleration Noise Test Procedure as a Function of the Stationary Test Sound Level at Prescribed Engine Speeds for Each Vehicle Category.

3.7 Summary of Sound Level Data

A summary of the sound level data generated from tests conducted on 66 light vehicles and presented in this chapter is shown in Table 3.10 for each of the vehicle categories. It must be stated that the trends in these data, and the conclusions that will be drawn in this section, may only be applicable to 1977 model year vehicles since modifications to vehicles manufactured in subsequent years may affect the sound levels generated without changing the vehicle parameters. The conclusions are as follows:

- There is a general trend towards increasing sound levels with increasing fuel economy. For example, vehicles equipped with 4-cylinder engines and manual transmissions, with an average city fuel economy of 23.5 miles per gallon, produce sound levels that are, on average, 5.5 dB greater than those for vehicles with 8-cylinder engines and an average city fuel economy of 13.5 miles per gallon. Vehicles equipped with diesel engines produce sound levels that are almost 7 dB greater than those with 8-cylinder gasoline engines.
- The application of demand cooling fans with mechanical or electromechanical clutches can decrease vehicle sound levels by up to 4 dB for vehicles with 8-cylinder engines. The increase is in the order of 0 to 1 dB for vehicles with 4-cylinder engines.
- With the exception of vehicles in Category 1 and light trucks with aggressive-tread tires, the sound levels measured according to the EPA Urban Acceleration Noise Test Procedure are not significantly influenced by tire noise.
- The sound levels measured according to the SAE J986a test procedure appear to be relatively independent of vehicle type, size, and engine parameters. The levels for almost 70 percent of the vehicles tested lie within ±2.5 dB of the overall mean of 74 dBA.
- The difference in sound levels measured according to the EPA test and for cruise at 35 mph is greatest for vehicles in Categories 2, 3, and 4, but negligible for vehicles in Category 1. This shows that the introduction of more fuel-efficient vehicles with smaller engines will cause greater increases in sound levels produced under acceleration than under cruise conditions.

Table 3.10

Summary of Sound Level Data for Vehicle Categories

Cat. No.	Vehicle Category		Transmission	EPA Urban Test Sound Level dBA	SAE Test Level, dBA	Cruise Level, dBA		Coast Level, dBA		
	Vehicle Type	Engine				35 mph	55 mph	25 mph	35 mph	55 mph
1	Automobiles	8-cylinder gasoline	Automatic & Manual	63.4	73.6	63.0	69.6	56.8	61.8	68.6
2	Automobiles	6-cylinder gasoline	Automatic & Manual	65.2	72.3	62.8	69.4	56.8	61.7	68.4
3	Automobiles & Light Trucks	4-cylinder gasoline	Automatic	66.6	74.5	63.4	69.5	57.5	62.5	69.3
4	Automobiles & Light Trucks	4-cylinder gasoline	Manual	68.9	73.8	64.8	70.8	57.3	62.1	69.3
5	Light Trucks	6- & 8-cylinder gasoline	Automatic & Manual	66.6	74.2	65.0	72.4	59.2	64.4	71.5
6	Automobiles	4-, 6-, & 8-cylinder diesel	Automatic & Manual	70.2	77.6	66.3	71.2	56.6	61.2	67.6

- Interior sound levels appear to be related to vehicle weight and engine horsepower. There is a significant difference of 10 to 15 dB between the levels in small vehicles with 4-cylinder engines and those in large vehicles with 6- and 8-cylinder engines operating according to the EPA Urban Acceleration Noise Test Procedure.
- The stationary test procedure involving measurements at different engine speeds according to the vehicle category allows the EPA Urban Acceleration Noise Test Procedure sound level to be estimated within ±2.5 dB with a 93 percent confidence. However, a procedure involving a measurement of the vehicle sound level at a single, fixed, stabilized engine speed, does not appear to relate well with the EPA Urban Acceleration Noise Test Procedure, and hence should not be considered as a useful enforcement technique.

4.0 ANALYSIS OF THE EPA TEST PROCEDURE

The development of the EPA Urban Acceleration Noise Test Procedure is described in a previous report,[1] together with the results of a preliminary implementation designed to identify potential problems that might occur in practice. These preliminary tests were conducted on 10 light vehicles and the results were used to introduce slight modifications in the procedure. The data obtained from the subsequent tests presented in Chapter 3.0 of this report allow for an additional evaluation and refinement of the procedure based upon the results from 66 vehicles that represent a cross-section of those manufactured in 1977. This evaluation is given in the following sections. First, however, it may be helpful in following the evaluation to explain the details of the EPA Urban Acceleration Noise Test Procedure.

4.1 The EPA Urban Acceleration Noise Test Procedure

The basic EPA test procedure is performed with the transmission in first gear and involves a constant-throttle operation with the throttle set to achieve an acceleration of 0.15g at the "operating" condition — defined as 100 RPM prior to the maximum engine speed at the 1-2 shift point (70 percent rated engine speed for vehicles equipped with manual transmissions) or 22 mph, whichever occurs first. The sound level recorded is the maximum value occurring up to and including the "end" condition, defined as the 1-2 shift point (which will occur at a speed greater than 22 mph if the throttle is set to achieve 0.15g at 22 mph) or 25 mph, whichever occurs first. This basic test is known as Condition 1. Note that the operating condition, which establishes the vehicle operation, and the end condition, where the sound level is measured, are not the same.

For some vehicles equipped with automatic transmissions, the 1-2 shift may occur at such a low vehicle speed that a higher sound level may be generated under acceleration in second gear at speeds up to 25 mph — the maximum speed of interest in this acceleration test procedure. Previous tests[1] indicated that this was most likely to occur if the 1-2 shift in Condition 1 takes place at speeds less than 22 mph, whereupon a second test is required to ensure that the maximum sound level is measured. This second test is conducted with the transmission in second gear and the operating condition is 0.12g at 25 mph. The sound level recorded is the maximum value occurring up to and including the end condition, in this case, 25 mph. This test is known as Condition 2.

Some vehicles with automatic transmission shift from first to second gear in Condition 1 without any appreciable change in engine speed, making it difficult to define accurately the shift point. Since this small change in engine speed will result in a correspondingly small change in sound level, a higher sound level can be expected in second gear at speeds up to 25 mph. Hence, for vehicles that exhibit a change in engine speed of less than 150 RPM at the 1-2 shift, testing is only required under Condition 2.

In all tests, the vehicle is required to achieve the end condition within a given "end zone", defined as a distance of ±10 feet about the "end point" — see Figure 2.4. A run that satisfies this condition is called a "valid" run.

In performing the vehicle tests, it is expected that the acceleration at the operating condition will vary from run to run about the required value. A test sequence for a vehicle consists of at least 4 valid runs at the same throttle setting, where the average of the values of acceleration at the operating condition is within ±0.005g of the required value for vehicles equipped with automatic transmissions, or within ±0.01g for manuals. It is important to note that all valid runs must be included in this average, regardless of the actual acceleration at the operating condition for each run. If, after 4 valid runs, the average value of the acceleration is not within these limits, then one of two options is available. First, if the average is close to the allowable tolerance, additional runs may be conducted at the same throttle setting in the hope that the average value of all the runs may eventually lie within the tolerance. Second, the throttle setting may be changed, whereupon at least 4 valid runs are again required meeting all the above requirements.

The maximum sound levels obtained from each valid run of a test sequence are combined arithmetically to obtain a single average maximum level for each side of the vehicle. The reported sound level for a vehicle is then the average maximum level for the louder side of the vehicle. For vehicles equipped with automatic transmissions, the reported level is the highest of the average maximum levels measured under Conditions 1 and 2.

At first reading, it may seem that the test procedure is unnecessarily complex. However, as will become evident from the data presented in the following section, the procedure is rather straightforward in practice, and the many requirements to be satisfied are necessary to ensure its repeatability.

4.2 Test Repeatability

To assess the repeatability of the EPA test procedure, it is necessary to review the variation in vehicle parameters at the operating condition and the sound levels recorded. A summary of the variations in vehicle acceleration, engine speed, position, and sound level is given in Table 4.1 for the vehicles equipped with automatic transmissions that were included in the study. A similar presentation for the vehicles with manual transmissions is given in Table 4.2. Also included in the tables are the number of runs required to complete the test sequences, and the average acceleration at the operating condition. The column entitled "Condition No." refers to the Test Condition number (1 or 2) under which the maximum sound level was recorded.

The third column in Table 4.1 (second column in Table 4.2) provides data on the number of runs required to complete the test sequence. In this study, the procedure for establishing the required throttle setting was as follows. First, the driver set the throttle at a position that experience showed was approximately correct for many vehicles. Trial runs were then performed away from the test pad, and adjustments made to the setting after each run. It was found that no more than three, and often only two, trial runs were required to obtain an approximate setting. The next runs were conducted on the test pad to finalize the throttle setting and to ensure that the end condition occurred in the end zone. The first number in the third column refers to the number of initial runs performed on the test pad. The second number refers to the number of runs required to complete the test sequence. Thus, if 2 runs were required to establish the end condition in the end zone, followed by 4 to complete the sequence, the entry under the corresponding condition number would be 2/4, or 6 in total. If the first number is 0, then this indicates that the first run on the test pad was a valid run, and hence could be included as part of the test sequence. If the entry under the third column is 1/-, then the first run on the test pad showed that the change in engine speed at the shift point was less than 150 RPM, and hence, testing was required only under Condition 2. Three vehicles (nos. 003, 027, and 038) of the test sample were found to exhibit this characteristic.

Reviewing the data in Table 4.1 shows that for automatics the average total number of runs required for Conditions 1 and 2 were 6.5 and 5.5, respectively, and 12 when both conditions were required. Significant problems were encountered only twice, with

Table 4.1

Summary of Vehicle Parameter Ranges for Automatics

Vehicle No.	Condition No.	No. of Runs		Avg. Accel. (g's)	Range in Parameters at Operating Condition			Range in Max. Sound Level	
		Cond. 1	Cond. 2		Accel. (±g's)	RPM (±%)	Distance (±ft.)	50 feet (±dB)	25 feet (±dB)
001	1	3/4	-	0.147	0.006	0.4	2.5	0.4	-
002	1	7/4	2/5	0.152	0.002	1.0	2.5	0.5	-
003	2	1/-	1/4	0.120	0.002	0.8	7.0	0.1	0.5
004	2	1/4	2/4	0.125	0.003	0.6	7.4	0.3	-
009	1	0/4	-	0.133'	0.002	0.2	2.8	0.4	0.3
014	2	1/4	0/4	0.120	0.002	3.2	5.2	0.5	-
016	1	1/4	-	0.146	0.004	0.2	1.4	0.3	-
018	1	4/5	-	0.147	0.004	8.6	6.2	1.1	-
019	1	3/4	0/4	0.152	0.003	1.0	1.8	0.2	-
026	1	2/4	-	0.155	0.015	0.5	3.2	0.2	0.2
027	2	1/-	1/4	0.122	0.001	0.5	2.8	0.5	0.3
028	1	5/4	-	0.145	0.005	3.3	5.9	0.8	0.8
029	1	0/4	0/8	0.149	0.003	0.7	4.2	0.4	-
030	1	3/6	-	0.148	0.003	0.4	0.7	0.4	-
031	1	2/4	3/5	0.150	0.005	1.8	4.6	0.7	0.7
032	1	4/4	6/4	0.153	0.004	0.9	1.1	0.2	0.3
033	2	8/4	0/4	0.119	0.002	0.5	6.3	0.3	0.5
035	1	1/4	-	0.152	0.009	2.0	1.4	0.5	-
036	2	6/4	0/4	0.119	0.002	1.2	4.6	0.7	0.1
037	1	1/4	-	0.156	0.009	0.7	2.5	0.3	0.2
038	2	2/-	0/4	0.119	0.008	1.5	4.6	0.8	0.9
039	2	0/6	1/5	0.121	0.003	0.7	5.0	0.4	0.3
042	2	0/4	0/4	0.119	0.003	0.7	3.2	0.2	0.2
044	1	2/4	1/4	0.147	0.007	4.5	2.8	0.6	0.5
045	1	8/5	-	0.147	0.011	1.5	6.3	0.2	0.4
046	2	3/4	0/4	0.118	0.004	0.7	1.8	0.3	0.3
047	1	4/4	-	0.152	0.002	1.3	1.4	0.1	0.4
048	1	8/4	-	0.149	0.005	1.1	3.7	0.2	0.5
051	1	1/4	0/4	0.150	0.009	3.3	3.9	0.9	0.5
052	1	21/4	-	0.150	0.004	0.6	5.6	0.2	0.5
053	1	12/4	-	0.149	0.004	2.3	3.2	0.6	0.4
054	1	1/4	-	0.149	0.005	0.8	5.3	0.3	0.5
055	1	7/4	1/4	0.150	0.007	0.8	3.2	0.4	0.4
057	1	1/4	-	0.148	0.007	0.5	3.5	0.5	0.4
058	2	0/4	1/4	0.121	0.003	0.4	6.3	0.5	0.1
059	1	0/4	-	0.129	0.005	2.0	1.8	0.3	1.1
062	1	1/4	0/4	0.149	0.003	0.9	7.4	0.5	0.5
063	1	0/4	-	0.150	0.004	0.7	6.0	2.9	2.4
065	1	0/4	-	0.149	0.010	3.3	9.1	0.9	1.2
066	2	6/4	3/4	0.117	0.005	0.4	5.3	3.3	3.9
067	1	0/4	-	0.155	0.004	1.1	4.2	1.0	1.1
070	2	0/4	1/5	0.129	0.005	0.5	2.8	0.5	0.5
072	1	0/5	-	0.144	0.008	0.7	1.3	0.5	0.2
Mean Value					0.005	1.4	3.9	0.5	0.5

Table 4.2

Summary of Vehicle Parameter Ranges for Manuals

Vehicle No.	No. of Runs	Average Accel. (g's)	Range at Operating Condition		Range in RPM at Max. Sound Level (±%)	Range in Max. Sound Level (dB)	
			Accel. (±g's)	Distance (±ft.)		50 feet	25 feet
005	1/4	0.153	0.002	2.6	1.4	0.2	0.5
007	1/4	0.151	0.006	2.1	0.7	0.2	-
010	1/4	0.153	0.004	2.5	0.9	0.8	-
011	1/5	0.151	0.002	3.5	4.2	0.6	-
013	2/4	0.147	0.012	6.7	1.0	0.5	-
015	1/5	0.154	0.016	2.1	3.2	0.8	-
020	0/4	0.155	0.003	3.4	0.4	0.4	-
022	3/4	0.154	0.003	4.6	1.5	0.5	-
023	4/4	0.157	0.003	1.8	0.9	0.5	-
024	6/4	0.147	0.006	0.4	0.1	0.4	0.2
025	6/4	0.149	0.017	4.6	0.7	0.5	0.3
034	1/4	0.149	0.007	6.0	4.2	0.4	-
040	2/5	0.153	0.005	1.1	1.1	0.4	0.2
041	1/4	0.146	0.002	2.1	1.2	0.4	0.4
050	1/4	0.151	0.005	3.1	1.1	0.3	0.4
056	1/4	0.148	0.012	5.1	0.4	0.6	0.8
060	0/4	0.154	0.006	3.9	0.9	0.4	0.3
061	4/4	0.163	0.010	1.0	3.2	0.6	1.0
064	0/4	0.147	0.003	2.8	0.2	0.2	0.6
068	0/4	0.149	0.003	3.5	1.2	0.2	0.2
069	0/4	0.147	0.017	4.9	2.1	0.4	0.6
071	1/5	0.146	0.001	3.0	0.3	0.4	1.2
073	0/5	0.155	0.005	5.8	3.7	0.7	0.6
Mean Value			0.007	3.3	1.6	0.5	0.5

vehicles #052 and #053, where the operating condition was extremely sensitive to throttle setting. The vehicles were tested in approximately the order represented by their identification number, and it can be seen that the experience gained resulted in fewer tests being required in the later stages of the study. For manuals, the average total number of runs was less than 6, and there were no significant problems with any vehicle. It should be noted that only occasionally were more than 4 runs required to complete a test sequence once the throttle setting had been established, indicating that the end condition could be achieved within the end zone with a high degree of repeatability.

With one vehicle (#054) there was some uncertainty in the appropriate test condition. This vehicle was equipped with a 2-speed automatic gearbox requiring a manual shift to change gear. Testing under Condition 1 was not possible because of the absence of an automatic gear shift. Therefore, it was tested under Condition 2 (an operating condition of 0.12g at 25 mph). In retrospect, it would have been more appropriate to test the vehicle as though it were equipped with a manual transmission, by achieving an operating condition of 0.15g at 70 percent rated engine speed.

The following columns in Tables 4.1 and 4.2 present the measured range in parameters at the operating condition for the 4 or more valid test runs required in a test sequence. For convenience, the ranges are given as ± one-half of the difference between the maximum and minimum values measured for each parameter.

The results show that the mean range in vehicle acceleration at the operating condition was ±0.005g for automatics; ranges larger than this often, but not always, resulting in larger ranges in engine speed. Since the engine speed is largely dependent on the acceleration at the operating condition, and to a large extent determines the maximum sound level, this result justifies the requirement for including a fairly small allowable tolerance (±0.005g) in average acceleration over the runs in a test sequence. The mean range of ±0.007g for manuals was slightly greater than that for automatics, as was discovered in the development of the test procedure, and justifies the greater allowable tolerance (±0.01g) in the mean value. It should be noted that there is no apparent correlation between the larger ranges in acceleration and the number of runs required to complete a test sequence.

The mean ranges in engine speed at the operating condition were ±1.4 percent and ±1.6 percent for automatics and manuals, respectively, corresponding to a range of about ±0.3 dB in vehicle sound level (using a 45 log (engine speed) scaling law which is typical at the 1-2 shift point[1]). Of the 66 test vehicles, only 11 exhibited ranges exceeding ±3 percent, which corresponds to a range in sound level of ±0.6 dB. The ranges of engine speed occurring at the instant when the maximum sound level was measured were essentially the same.

The ranges in distance at which the vehicle end condition occurred are given as ± feet about the end point – see Figure 2.4. The mean values are ±3.9 feet and ±3.3 feet for automatics and manuals, respectively. Over 75 percent of the vehicles achieved the end condition within a range of ±5 feet. Furthermore, less than 5 percent of the total number of runs for all vehicles were invalid, i.e., with the end condition occurring outside the end zone. The range is much less than the ±10-foot end-zone tolerance allowed in the test procedure. However, since there is no correlation between the extent of the range in distance and the range in measured sound level, there is no reason to change this tolerance.

The final two columns in Tables 4.1 and 4.2 provide data on the range of sound levels measured at 50 feet and 25 feet. The figures in these columns refer to ranges as measured by the microphones in line with the end point at each distance – see Figures 2.3 and 2.4. The mean values of the ranges for automatics and manuals at both 50 feet and 25 feet were ±0.5 dB which is the same order of magnitude as the accuracy of the acoustic instrumentation system. It is interesting to note that the automatics which exhibited ranges in engine speed of less than, and greater than, ±3 percent at the operating condition, produced ranges in sound level of ±0.4 dB and ±0.9 dB, respectively. Again, this justifies the small allowable tolerance in average acceleration for these vehicles.

In general, the range in sound level was significantly less than ±1 dB. However, notable exceptions were vehicles #018, #063, and #066, each of which exhibited noticeable resonances of narrow frequency bandwidth. The larger than usual ranges in sound level for these vehicles were due to the variations in engine speed at the end condition that either coincided with these resonances or missed them entirely.

The time required to conduct the tests is shown in Table 4.3. The instrumentation installed in the vehicle included a fifth wheel, accelerometer, engine speed pickup,

interior microphone and sound level meter, signal conditioning equipment, visual readout devices for the driver, a chain and turnbuckle for constant-throttle operation, and telemetry equipment. The total time for installation was about 30 minutes on average. Calibration of the complete system, including the 10 exterior microphones, was achieved in 45 to 60 minutes. For a system with 1 or 2 microphones (as required in the finalized test procedure – see Appendix B) it is estimated that this time would be reduced to about 30 minutes.

The next step in the procedure, involving 2 or 3 runs off the pad to establish an approximate throttle setting, took about 5 minutes. The time taken to determine the exact throttle setting and the starting position for automatics so that the end condition occurred within the end zone depended on whether testing was required under Condition 1, Conditions 1 and 2, or Condition 2 only. The figures given in Table 4.3 are based on a weighted average of the number of runs required as given in Table 4.1 and the average total time for each test condition as obtained from the computer logs. The average time to complete a test sequence is obtained in a similar manner. Finally, a post-test calibration to check each system component took about 20 minutes. Thus the average total time for the complete test procedure was 115 to 130 minutes for automatics and 100 to 110 minutes for manuals.

Summarizing the data obtained from the tests conducted on 66 light vehicles, it can be stated that the ranges in vehicle parameters and sound level are small, and that the tolerances are necessary, achievable, and adequate to provide repeatable results. The number of runs required to determine the vehicle sound level is considered reasonable for the accuracy that is obtained. It must be remembered that the test program included a large number of vehicles of different types, most of which were unfamiliar to the test driver. It is probable that the time taken to conduct the procedure would be shortened if the driver was familiar with the vehicles.

4.3 Criteria for Measuring Under Condition 2

In the brief explanation of the EPA test procedure in Section 4.1, the two tests required for some vehicles equipped with automatic transmissions were discussed. It will be remembered that testing under Condition 2 is required only if the 1-2 shift in Condition 1 occurs at such a low speed that a higher sound level may be generated in second gear at speeds up to 25 mph. This is most unlikely if the 1-2 shift in Condition 1 occurs

Table 4.3

Average Times to Complete Vehicle Tests

Task	Time Required in Minutes	
	Automatics	Manuals
Vehicle Instrumentation	30	
System Calibration	30[1]	
Approximate Throttle Setting (Off Pad)	5	
Determination of Exact Throttle Setting and Starting Point	10-15[2]	5-10
Test Sequence	20-30[2]	10-15
Post Calibration	20	
Total[1]	115-130	100-110

[1] Assuming 1 or 2 microphones.

[2] Calculated using weighted average of the number of runs required for each test condition obtained from Table 4.1.

at or above 22 mph, and this tentative speed criteria was used in the tests described earlier in this report. One of the objectives of the tests was to establish a firm criteria that would eliminate unnecessary testing under Condition 2.

The application of the tentative speed criteria in the vehicle tests resulted in the requirement to test 18 vehicles under Conditions 1 and 2. The speeds at which the 1-2 shift occurred in Condition 1 are given in Table 4.4, together with the maximum sound levels measured under both conditions. The difference in maximum sound level measured is plotted against the speed at which the 1-2 shift occurred in Condition 1 in Figure 4.1. In cases where the difference in sound levels is negative, i.e., a higher sound level measured for Condition 1 than for Condition 2, then it is unnecessary to test under Condition 2. It is clear from Figure 4.1 that the 22 mph criteria is overly conservative, in that it requires more tests under Condition 2 than are actually required to establish the maximum sound level. If the criteria were set instead at 21 mph, then 2 of the 18 vehicles would need to be tested under Condition 1 only, with a corresponding saving in test time. As the criteria speed is lowered, however, there comes a point between 19 and 20 mph where a positive value of the sound level difference is shown for one vehicle, and hence an error will be made if Condition 2 is not implemented. The effect of reducing the criteria from 22 mph in incremental steps of 1 mph is shown in Table 4.5. On the basis of these data, it is recommended that the criteria speed be reduced from 22 mph to 19 mph, resulting in a 50-percent reduction in the number of tests required under Condition 2 while affecting (lowering) the measured sound levels for approximately 6 percent of vehicles (one out of the 18 vehicles tested).

4.4 Microphone Locations

The series of noise tests described in Chapter 3 was conducted initially using a total of 6 exterior microphones, 3 each on either side of the end zone, situated 50 feet from the centerline of vehicle travel as indicated in Figure 4.2(a). With this configuration, 19 vehicles were tested. The remaining 47 vehicles were tested using a total of 10 microphones, 2 at 50 feet and 3 at 25 feet on both sides of the centerline as indicated in Figure 4.2(b). One of the objectives of the test series was to identify a single microphone position that would adequately represent the sound levels measured by these arrays.

Table 4.4

Vehicle Sound Levels as Measured Under Conditions 1 and 2

Vehicle No.	1-2 Shift Speed (mph)	Maximum Sound Level (dBA)		Difference in Sound Levels (dB)
		1-2 Shift	25 mph	
002	19.9	63.6	61.8	-1.8
004	13.0	59.2	65.4	+6.0
019	18.9	69.1	68.2	-0.9
029	19.9	63.8	63.6	-0.2
031	19.7	63.7	62.6	-1.1
032	20.9	62.9	62.5	-0.4
033	18.0	61.3	62.6	+1.3
036	13.9	56.2	60.3	+4.1
039	13.5	59.2	63.4	+4.2
042	18.3	60.0	61.3	+1.3
044	20.2	64.4	62.9	-1.5
046	19.3	60.6	62.4	+1.8
051	20.7	64.6	63.8	-0.8
055	21.4	64.1	62.6	-1.5
058	16.0	59.7	62.3	+2.6
062	21.7	66.4	65.0	-1.4
066	16.2	65.1	66.7	+1.6
070	10.9	62.8	68.9	+6.1

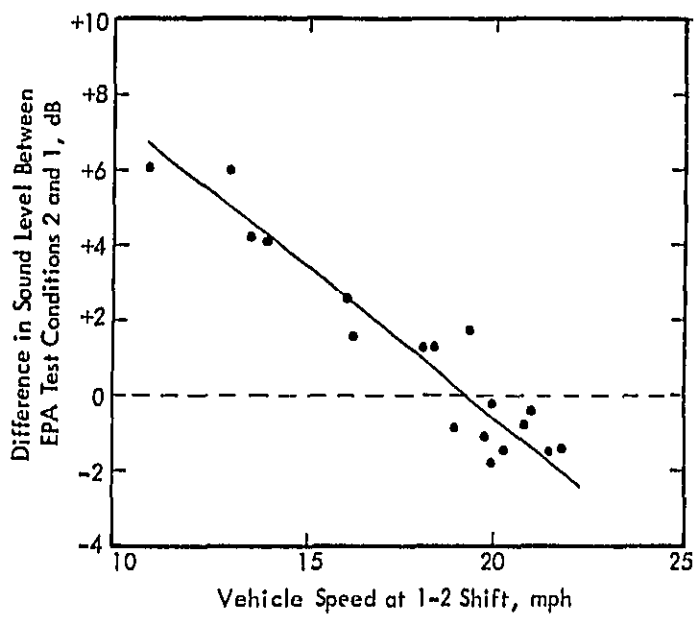

Figure 4.1. Development of Criteria for Measurement Under EPA Test Condition 2.

Table 4.5

Effect of Reducing the Speed Criteria for Testing Under Condition 1

Speed Criteria (mph)	No. of Vehicles Requiring Testing Under Condition 2	Percentage of Reduction in No. of Tests	Percentage of Vehicles for Which SL is Affected
22	18	0	0
21	16	11	0
20	13	28	0
19	9	50	6
18	6	67	17

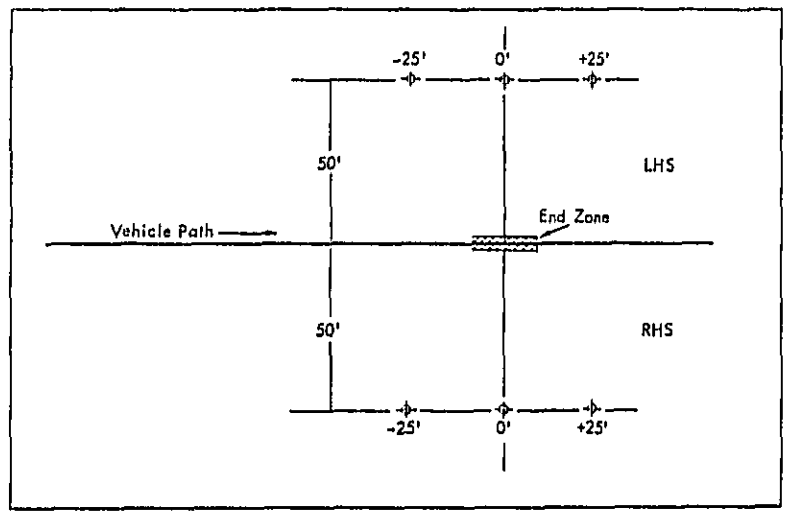

Figure 4.2(a). Initial Microphone Locations.

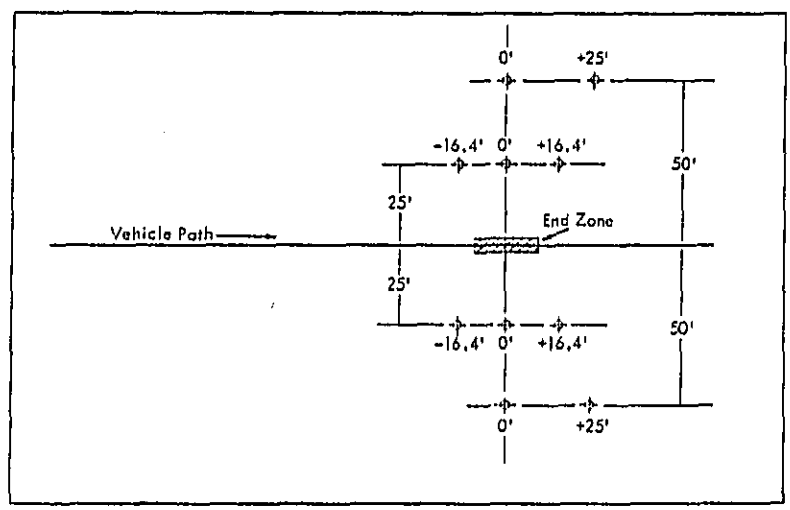

Figure 4.2(b). Subsequent Microphone Locations.

The sound level data measured by the two microphone arrays discussed above are presented in Tables 4.6 and 4.7 for microphones located 50 feet and 25 feet, respectively, from the centerline of vehicle travel. The data are given in terms of the difference between the maximum level as measured by any of the microphones at the same distance and on the same side of the vehicle, and the maximum level as measured by each individual microphone. At the bottom of each table, the mean values of the differences are given for all vehicle tests, as well as for tests where sound levels were measured at all 6 microphones at the same distance on both sides of the vehicle. It should be noted that the latter mean values are taken from different vehicle samples.

In general, it will be noticed that the mean differences are small, except for microphones positioned at +25 feet (for the 50-foot microphone distance), and +16.4 feet (for the 25-foot microphone distance) – see Figures 4.2(a) and (b). These two locations are clearly unsuitable for measuring the maximum sound level during the test, and can be discarded in the following discussion. For microphones at both 50 feet and 25 feet from the vehicle, there is little to choose between the remaining locations — in fact, different conclusions can be made as to the optimum location for the left- and right-hand sides of the vehicles. Since all of the mean differences are less than 1 dB, and most less than 0.5 dB, it does not seem realistic to make a strong point for any location. Therefore, for the sake of convenience, microphones located along a line perpendicular to the vehicle path and passing through the center of the end zone are selected to provide a representative measurement of the maximum level produced by a vehicle in the EPA Urban Acceleration Noise Test.

To determine whether the optimum microphone distance is 50 feet or 25 feet from the vehicle centerline, the following points can be made on the basis of the data obtained in the test series:

- The mean variation in sound level taken over a vehicle test sequence is ±0.5 dB at 50 feet and 25 feet.
- The mean difference between the maximum sound level and that measured by the selected microphone locations is essentially the same at both 50 feet and 25 feet. The same is true for the standard deviation of the differences. However, the mean difference in levels for the loudest side of the vehicle only is 0.5 dB at 50 feet and 0.3 dB at 25 feet.

Table 4.6

Microphone Data at 50-Foot Distance

Veh. No.	Test Cond.	RIGHT-HAND SIDE				LEFT-HAND SIDE			
		Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)	Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)
		-25'	0'	+25'		-25'	0'	+25'	
001	1	0.2	0	1.3	62.5	1.0	0	1.2	62.9
002	1	0.7	0.3	3.1	63.6	0.9	0	1.1	62.2
	2	0.7	0	1.3	61.7	1.4	0	0.5	61.8
003	2	-	0	0.7	60.6	-	0.2	0.1	61.1
	2(F)	0.7	0	1.2	64.5	0.7	0.8	0	63.9
004	1	0	1.5	2.8	59.2	0.8	0	1.6	59.2
	2	0.4	0	1.5	63.6	2.0	0	0.7	65.4
005	1	-	0	0.2	67.0	-	0	-	67.5
006	1	0.3	0.2	0.6	67.9	1.4	1.2	0	69.3
007	1	-	-	-	-	0.7	0.2	0.1	69.4
009	1	-	0.2	0.1	69.5	-	0.4	0	69.9
	1(F)	-	0.2	0	69.6	-	0.3	0.1	69.7
010	1	0.8	0	1.8	67.0	0.3	0.9	0	66.3
011	1	0.7	0.5	0	67.9	0.9	0	0.4	66.8
013	1	-	-	-	-	0.3	0.2	0.8	65.8
014	2	0.1	0.7	0.5	68.2	0.6	0.7	0.8	69.0
015	1	0.2	0.4	0.4	70.7	1.5	0.7	0.1	70.0
016	1	-	-	-	-	0	0.4	0.8	65.8
018	1	0.4	0.2	1.8	62.0	0.2	0.5	1.6	62.8
	1(F)	0.9	0.1	1.9	72.0	0.6	0.7	0.2	71.4
019	1	0	0.1	0.8	69.1	0.7	0	1.3	66.2
	2	0	0.3	1.5	68.2	0.1	0.1	0.4	64.3
022	1	0	0.7	2.6	67.6	0	2.0	2.2	66.6
	1(F)	0	0.9	3.0	68.1	0	2.3	2.1	67.1
023	1	0	1.5	2.3	71.2	0	3.1	1.7	70.2
	1(F)	0	0.9	1.8	70.7	0.1	3.0	1.7	70.0
025	1	0.3	0	0.7	73.8	-	0	3.1	74.3
026	1	-	0	0.3	64.4	-	0.2	0	65.2
027	2	-	0.2	0.1	61.7	-	1.0	0	61.8
028	1	-	0	1.3	65.6	-	0.4	0	66.0
029	1	0.8	0	1.0	63.8	0.2	0.5	0.2	63.2
	2	0.4	0	1.3	63.6	0	0.5	0.7	62.6
030	1	0.1	0.2	0.8	64.7	0.6	1.4	0	64.1
	1(F)	0.8	0	1.2	67.9	0.8	1.1	0	66.9
031	1	-	0.4	0.1	62.7	-	0.8	0	63.7
	2	-	0.3	0.1	61.6	-	0	0.2	62.6
032	1	-	0	0.9	62.0	-	0.2	0.2	62.9
	2	-	0	1.1	61.7	-	0	0.4	62.5
033	1	-	0	0.3	60.8	-	-	0	61.3
	2	-	0.1	0.7	61.7	-	0.3	0.1	62.6

F signifies activation of clutch fan.

Table 4.6 (Continued)

Veh. No.	Test Cond.	RIGHT-HAND SIDE				LEFT-HAND SIDE			
		Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)	Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)
		-25'	0'	+25'		-25'	0'	+25'	
034	1	0.1	0.2	1.2	68.5	0.3	1.9	0.3	67.4
	1(F)	0.1	0.3	1.8	69.2	0.2	1.9	0.1	67.9
035	1	0	0.1	1.8	64.1	0.2	1.0	0.2	63.2
	1(F)	0.6	0	0.8	70.9	0.9	0.8	0	69.9
036	1	-	0	1.5	56.2	-	0.1	0.3	55.3
	2	-	0	1.5	60.3	-	0.1	0.3	59.4
037	1	-	0	-	65.5	-	0	1.8	68.0
039	1	-	0.1	0.5	58.2	-	0.2	0.2	59.2
	2	-	0	0.2	62.2	-	0.7	0	63.4
040	1	-	0	0.2	72.8	-	0.2	0.1	72.3
041	1	-	0	0.5	67.8	-	0	0.9	68.3
042	1	-	0.1	0.1	60.0	-	0.1	0.5	59.7
	2	-	0.2	0.1	61.3	-	0	0.7	61.2
044	1	-	0.3	0.5	63.2	-	0.3	0.5	64.3
	2	-	0	0.4	61.7	-	0	0.5	62.9
045	1	-	0	0.4	65.4	-	0	0.8	65.7
046	1	-	0.4	0.3	60.6	-	0.2	0	59.6
	2	-	0.4	0.1	62.4	-	0.3	0	61.1
047	1	-	0	0.5	67.5	-	0	0.6	68.6
048	1	-	0.2	0.1	64.0	-	0.9	0	65.2
050	1	-	0.2	0.2	63.6	-	0.6	0	63.8
051	1	-	0	0.8	64.1	-	0.5	0.1	64.6
	2	-	0	0.9	63.2	-	0.6	0	63.8
052	1	-	0	0.9	62.8	-	0.2	0.6	62.4
	2	-	0.2	0.1	61.3	-	0	0.7	61.2
053	1	-	0	0.9	69.4	-	0	0.7	69.7
054	1	-	0	1.0	62.5	-	0.1	0.5	62.8
055	1	-	0.4	0	64.1	-	0	0.7	63.7
	2	-	0.1	0.8	62.6	-	0.1	0.7	61.5
056	1	-	0.1	1.1	66.6	-	0	0.8	68.6
057	1	-	0	0.3	61.9	-	1.0	0.6	63.8
058	1	-	1.1	0	59.7	-	0.2	0	59.7
	2	-	0.8	0	61.6	-	0.8	0	62.3
059	1	-	1.0	0	75.0	-	1.0	0	76.0
060	1	-	0	0.6	66.8	-	0.7	0	69.2
061	1	-	0.4	0.2	65.1	-	0	0.4	65.9
062	1	-	1.0	0	65.8	-	0.5	0	66.4
	2	-	0.7	0	64.0	-	0.2	0.1	65.0
063	1	-	0	3.8	72.0	-	0.1	3.1	73.2
064	1	-	0.5	0	66.9	-	0	0.8	70.3
065	1	-	0	0.7	61.2	-	0	0.8	62.3

Table 4.6 (Continued)

Veh. No.	Test Cond.	RIGHT-HAND SIDE				LEFT-HAND SIDE			
		Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)	Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)
		-25'	0'	+25'		-25'	0'	+25'	
066	1	-	0	0.7	64.8	-	0.1	0.2	65.1
	2	-	0.2	0.6	66.1	-	0.2	0.3	66.7
067	1	-	0	2.4	63.2	-	0	2.2	63.7
068	1	-	0	0.8	66.9	-	0	2.0	66.8
069	1	-	0	0.6	68.2	-	0	0.1	68.9
070	1	-	0	0.7	62.8	-	1.4	0.1	61.0
	2	-	0	1.4	68.9	-	0.1	0.5	66.2
Mean for all Vehicle Tests		0.4	0.2	1.0		0.6	0.6	0.6	
Mean for 16 Vehicles*		0.3	0.3	1.3		0.7	0.9	0.7	
Standard Deviation		0.3	0.4	0.9		0.6	0.9	0.7	

* For which data are available at all microphone positions.

Table 4.7

Microphone Data at 25-Foot Distance

Veh. No.	Test Cond.	RIGHT-HAND SIDE				LEFT-HAND SIDE			
		Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)	Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)
		-16.4'	0'	+16.4'		-16.4'	0'	+16.4'	
003	1	0.1	0.3	1.7	66.7	0.2	0.1	2.5	66.8
005	1	-	0	0.8	72.1	0.5	0.1	1.9	73.7
009	1	-	0	0.9	75.1	0.7	0	1.4	75.6
	1(F)	-	0	0.9	75.2	0.8	0	1.6	75.6
024	1(F)	2.3	2.1	1.1	78.9	0.2	0.3	2.2	77.3
	1	2.2	1.8	0	78.5	0	0.8	2.0	77.3
025	1	0.3	0	0.7	73.8	-	0	3.1	74.3
026	1	0	1.1	2.3	71.6	0.4	0.1	2.7	71.4
027	2	0.1	0.2	1.3	67.8	0.5	0	1.2	67.1
028	1	0.2	0	2.0	71.9	0	0.2	2.2	71.2
031	1	0.7	0	0.4	68.4	1.2	0	1.8	68.9
	2	0.8	0	0.3	67.1	0.4	0	1.9	68.0
032	1	0	0.2	2.1	68.3	0	0.6	3.1	69.2
	2	0.5	0	2.0	67.9	0.2	0.1	3.1	68.2
033	1	-	0.1	0.4	65.6	0.4	0	2.0	66.5
	2	-	0.1	0.6	67.5	0.5	0	1.4	67.8
036	1	0	0	2.6	62.4	0.5	0.2	2.5	61.2
	2	0	0.2	1.5	65.6	0.2	0	2.1	65.3
037	1	0.1	0.4	1.9	72.0	0	0.5	3.6	74.5
039	1	0	0.3	2.2	64.7	0.2	0.4	3.0	65.1
	2	0	0.5	2.5	69.0	0.1	0	2.3	68.7
040	1	1.0	0.3	0.1	78.9	2.3	0.9	0	78.4
041	1	0.4	0.2	0.5	74.8	0.7	0	0.9	73.5
042	1	0	0.5	1.8	66.7	-	0	1.6	65.1
	2	0.1	0.2	2.3	68.4	-	0	1.5	66.8
044	1	0.1	0.6	1.5	69.8	1.3	0	1.6	70.7
	2	0	0.5	1.8	68.4	1.3	0	1.5	69.4
045	1	0	0.2	0.9	71.4	0.4	0.1	3.4	71.9
046	1	-	1.1	2.6	67.0	0.4	0	2.0	65.3
	2	0	0.7	2.4	68.7	0.5	0	2.3	66.8
047	1	0.1	0	1.6	73.7	-	0	1.8	73.2
048	1	0.6	0	0.7	70.6	0.8	0	1.9	70.9
050	1	1.1	0	1.3	69.7	0.9	0	0.9	69.4
	1(F)	0.9	1.0	1.1	69.8	1.2	0	1.3	69.6
051	1	0	1.5	1.2	71.1	0.2	0	0.8	70.0
	2	0	1.6	2.6	70.6	0.6	0	2.3	69.7
052	1	0	0.4	2.4	69.2	0.1	0.2	2.6	68.4
	2	0.1	0.2	2.3	68.4	-	0	2.5	69.3
053	1	0	0.2	2.7	75.6	0.2	0	2.7	75.1

F signifies activation of clutch fan.

Table 4.7 (Continued)

Veh. No.	Test Cond.	RIGHT-HAND SIDE				LEFT-HAND SIDE			
		Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)	Difference in dB Between Max. SL and SL Measured by Microphone at:			Max. Sound Level (dBA)
		-16.4'	0'	+16.4'		-16.4'	0'	+16.4'	
054	1	0.3	0.1	0.8	67.9	0	2.1	1.4	68.2
055	1	0	2.9	5.3	74.1	-	0	2.8	68.9
	2	0	3.5	6.0	72.5	-	0	2.5	67.0
056	1	0.5	0.1	2.8	73.0	-	0	2.8	73.6
057	1	0	2.0	2.5	69.7	0.7	0	1.3	70.1
058	1	1.1	0.4	0	64.8	0.8	0.3	0.2	64.8
	2	0.7	0	0.7	67.0	0.7	0	0.7	67.0
060	1	0.5	0.2	2.6	73.5	0.7	0.1	0.9	74.9
061	1	0.1	1.1	0.9	71.9	0.9	0.1	0.7	71.9
062	1	0.4	0.4	0.4	71.5	-	0.6	0	71.6
	2	0	0.6	0.6	70.1	-	0.6	0.2	70.3
063	1	0	1.8	4.2	77.3	0.6	1.4	1.8	77.3
064	1	0	0.9	1.2	72.7	0.1	0	2.8	75.4
065	1	0	0.8	1.8	67.8	0.9	0	2.2	68.7
066	1	0	0.9	1.1	72.3	0	2.1	2.1	73.9
	2	0	1.8	2.0	73.3	0.1	1.2	1.2	73.8
067	1	0	2.0	4.5	70.6	0	1.6	4.5	70.3
068	1	0	1.0	2.7	73.1	0	0.9	3.4	73.5
069	1	0.1	0.6	1.9	74.7	1.3	0	0.8	73.7
070	1	0	0.5	1.9	68.2	0.7	0.5	0	66.1
	2	0	1.1	3.6	75.5	0	0.7	1.9	72.7
Mean for all Vehicle Tests		0.2	0.6	1.7		0.5	0.3	1.8	
Mean for 32 Vehicles*		0.2	0.6	1.8		0.5	0.4	2.0	
Standard Deviation		0.3	0.6	1.1		0.5	0.6	1.0	

* For which data are available at all microphone positions.

- In 11 cases out of the 66 vehicles tested, the side of the vehicle registering the highest sound level is different for measurements at 50 feet and 25 feet. The difference in sound level in these cases is up to 1.8 dB. This result is interesting but does not indicate which microphone distance is optimum.
- There is a strong correlation ($r = 0.97$) between the maximum sound levels measured at 50 feet and 25 feet. The mean difference in levels is 6.1 dB with a standard deviation of 0.9 dB.
- The maximum sound levels for all vehicles were measured under the same test condition at both microphone distances.

These results do not lead to a strong justification for selecting one microphone distance over another. Initially, there was a concern that the 25-foot microphone would tend to measure the sound levels from the front and rear of the vehicle separately, resulting in a lower maximum level. The data do not indicate that this concern was valid, even for the longer vehicles with greater separation between the engine and the exhaust outlet. Another concern was that the sound level measured at 50 feet could be extrapolated to greater distances using a typical decay law, whereas that measured closer to the vehicle would not obey the same law between 25 feet and 50 feet. Typically, for a point source, the sound level decays at a rate of about 6 dB per doubling of distance over a hard surface. At distances close to a vehicle, it is not valid to assume a point source, and the sound level decays at a rate less than 6 dB per doubling of distance. The mean decrease in sound level between 25 feet and 50 feet as measured in the test series was 6.1 dB, indicating that measurements can be conducted as close as 25 feet from the vehicle without being in the near field of the sound source. The advantage of measuring the sound level at 25 feet is that higher values of the ambient sound level (in the absence of the vehicle noise) can be tolerated. Furthermore, reflecting obstacles can be closer to the microphones and the vehicle than if the measurements were conducted at 50 feet. Accordingly, to provide additional flexibility in test site selection, a microphone distance of 25 feet is recommended.

5.0 THE CCME NOISE TEST PROCEDURE

5.1 Introduction

An alternative test procedure to determine vehicle noise emissions under partial-throttle operation has been proposed by the Comité des Constructeurs D'Automobile du Marché Commun (Committee of Common Market Automobile Constructors — CCMC).[7] The method takes advantage of the relative simplicity and repeatability of the full-throttle test procedure, and involves the interpolation of sound levels measured during full-throttle and cruise operations according to a formula developed from urban driving studies. As proposed, the method applies only to vehicles equipped with manual transmissions - further development of an equivalent test method suitable for automatics is currently under study.

In a previous report[1] devoted to the development of the EPA Urban Acceleration Noise Test Procedure, a preliminary evaluation of the CCMC approach was presented. The tests conducted in that evaluation did not correspond exactly to those specified in the CCMC procedure, because at the time it was necessary to compare the results with others obtained under varying operating conditions. However, the results did indicate a range of error that was considered to be excessive, leading to the conclusion that a direct partial-throttle test procedure was more suitable than the indirect, interpolation method for defining sound levels produced under urban acceleration. Nevertheless, it was considered desirable to perform the exact CCMC procedure to assess its potential benefits and problem areas.

5.2 Outline of Procedure

The proposed procedure involves three tests conducted under different operating conditions, as described in Table 5.1. For test Conditions 1 and 2, the vehicle is operated at the stated entry conditions until the front bumper reaches a point A, which is 10m (33 feet) from an imaginary line drawn across the test track connecting the locations of two microphones placed 7.5m (25 feet) from the centerline of the test track — see Figure 5.1. At this point, the throttle is fully opened as rapidly as possible until the rear bumper of the vehicle reaches a point B, 10m (33 feet) past the microphones, when it is closed as rapidly as possible. For all three conditions, the maximum sound level measured by the two microphones and the corresponding engine speed are recorded.

Table 5.1

Vehicle Operating Conditions for the Proposed CCMC Test Procedure

Test No.	Transmission	Vehicle Entry Condition	Vehicle Operation
1	2nd gear	40 km/hr (25 mph) but not greater than 70 percent rated engine speed	Full-throttle acceleration
2	3rd gear	1/3 rated engine speed	Full-throttle acceleration
3	2nd gear	40 km/hr (25 mph) but not greater than 70 percent rated engine speed	Constant speed (Cruise)

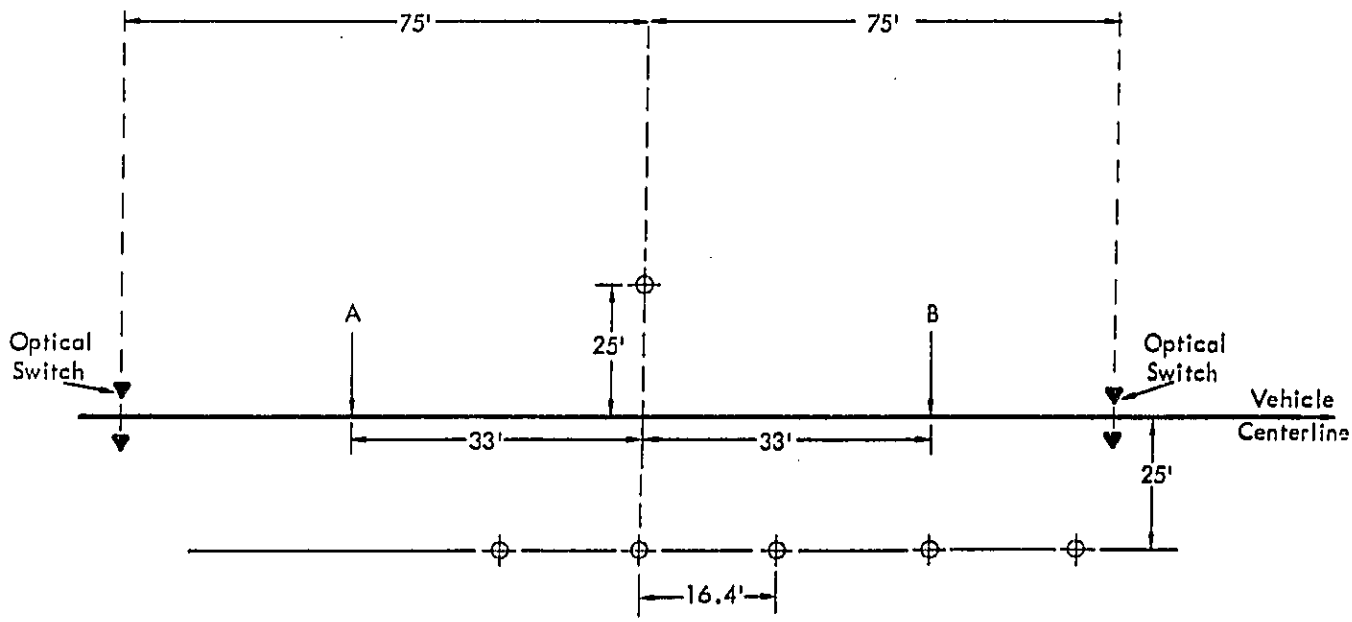

Figure 5.1. Test Track and Microphone Layout Used for CCMC Test Procedure Evaluation.

To eliminate the need to monitor the vehicle engine speed continuously, the CCMC has proposed a method involving correction factors applied to the entry engine speed. It has been found in previous tests[7] that the maximum sound level in Conditions 1 and 2 occurs on average when the vehicle is 17m (56 feet) past the two microphones, and that the average engine speed corresponding to this maximum level is higher than the entry engine speed by factors of 14 percent and 6 percent, respectively, for the two conditions. These factors are then used to retain the simplicity of operation of the procedure.

In order to evaluate fully the CCMC procedure and the sensitivity of microphone placement, additional microphones were located at the positions shown in Figure 5.1. Also, the vehicle parameters were continuously monitored throughout the tests, even though this is not required in the proposed procedure. The tests were conducted on two vehicles, a Toyota Corolla, 5-speed, and a Chevrolet Chevette, 4-speed, denoted by vehicle numbers 005 and 011, respectively, in Table 2.1. The Chevette was the same vehicle tested and described in Chapter 3.0; the Corolla was a different vehicle of the same type having the same parameters as described in Table 2.1.

The procedure for determining the interpolated sound level from the test results involves the use of standardized vehicle performance curves—see Figure 5.2—described in terms of normalized engine power and normalized engine speed, the normalization being with respect to the rated values of both quantities. The upper and lower curves shown are for full-throttle acceleration and cruise, and it is upon these curves that points are placed representing the maximum sound levels at the corresponding normalized engine speeds for each of the three tests. An interpolation procedure is then applied between the sound levels at the three points under the assumption that the sound level varies linearly with normalized engine power. The central curve is the interpolation curve that relates the typical performance characteristics of light vehicles operating in urban areas to the horsepower-to-weight ratio. The first step in the procedure is to construct lines of constant sound level, or "isophonic" lines as they are called. Then the partial-throttle vehicle sound level is determined by noting the isophonic line that intersects the central interpolation curve at the point corresponding to the horsepower-to-weight ratio for the vehicle.

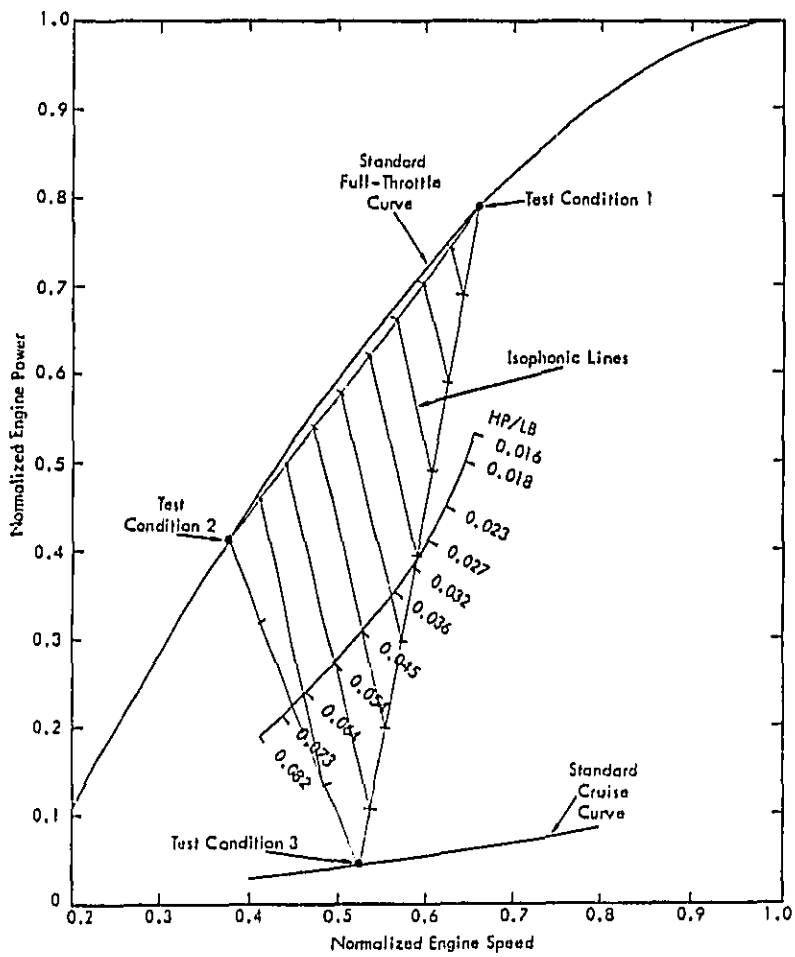

Figure 5.2. Standardized Vehicle Performance Curves Used in the CCMC Interpolation Procedure. Isophonic Lines are lines of constant sound level.

5.3 Review of Data

The data obtained from the CCMC tests are summarized in Table 5.2. It should be noted that whereas the corrected normalized engine speed agrees well with the actual normalized engine speed at the point of maximum sound level for the Chevette, there is a disparity of 7 percent in Condition 1 for the Corolla, corresponding to a sound level difference of about 1 dB. This is caused by the relatively slow rate of acceleration for the Corolla under full-throttle operation in second gear compared to that of the Chevette. The result is that the actual engine speed for the Corolla in the region near the microphone is correspondingly lower than the corrected entry engine speed. Thus, the universal correction factors proposed for the engine speed may not be applicable to all types of vehicles.

A review of the sound levels measured by the other microphones in Figure 5.1 shows that they all register lower sound levels at the instant when the maximum value is obtained at the CCMC microphone location. This is to be expected if the vehicle directivity does not change significantly with increasing engine speed. For the interpolation procedure, the location of the measurement microphone may not in fact be too critical provided that three points can be obtained forming a triangle about the value of horsepower-to-weight ratio on the interpolation curve. The interpolated sound levels for the two vehicles were calculated using the procedure described above, using the proposed method of applying correction factors to determine the engine speed at maximum sound level, as well as using the actual engine speeds as measured directly. The results are shown in Table 5.3, where it is seen that use of the engine speed correction factor results in an interpolated sound level for the Corolla that is 1.1 dB too high.

Also shown in Table 5.3 are the interpolated and measured sound levels for an acceleration of 0.15g at 70 percent rated engine speed — the end condition for manuals in the EPA Urban Acceleration test procedure. The interpolated values were determined assuming a linear relationship between sound level and acceleration. For both vehicles, it was necessary to construct the isophonic lines outside the area bounded by the three points on the standard performance curves, thus reducing the certainty of the results. Also, the interpolated and measured values of sound level for the Corolla were obtained with different vehicles. Even so, the discrepancies between the two values are rather large.

Table 5.2

Vehicle Parameters and Sound Levels
Measured in CCMC Test Procedure

Vehicle	Test Cond.	Entry Speed (mph)	Normalized Entry RPM* (%)	Corrected Normalized Entry RPM** (%)	Normalized RPM at Max Sound Level (%)	Max. Sound Level (dBA)	Vehicle Position (Ft.)***
Toyota Corolla	1	25.0	51	65	58	74.2	38.2
	2	24.2	34	40	37	67.2	47.4
	3	25.2	51	--	--	67.8	--
Chevrolet Chevette	1	24.9	65	79	78	78.2	46.0
	2	20.0	33	39	41	68.6	42.9
	3	25.4	67	--	--	72.4	--

* Normalized to rated engine speed.

** Using the correction factors applied to the entry engine speed, as discussed in Section 5.2.

*** Distance measured from point where acceleration is initiated to point where maximum sound level occurs.

Table 5.3

Interpolated and Measured Sound Levels
For Condition 1 in EPA Urban Noise Test

Vehicle	Interpolated Sound Level (dBA)		Difference (dB)	Sound Level for 0.15g at 70% Rated Engine Speed		Difference (dB)
	Using Engine Speed Correction Factor	Using Actual Engine Speed		Interpolated	Measured*	
Toyota Corolla	72.4	71.3	+1.1	71.6	67.5	+4.1
Chevrolet Chevette	72.5	72.6	-0.1	69.8	67.9	+1.9

* Measured at 50 feet according to EPA Urban Acceleration Test Procedure.

In summary, it can be said that the CCMC procedure does offer some advantages for measuring the noise emission of light vehicles. As proposed, it is repeatable in operation and does not require the vehicle to be instrumented. Furthermore, errors in individual measurements are diluted to a certain extent in the determination of the partial-throttle sound level due to the triangular interpolation procedure.

However, these advantages are achieved at the expense of inaccuracies in determining engine speed at maximum sound level, and uncertainties in the assumption of a linear relationship between sound level and normalized power. The engine speed can be measured accurately on the vehicle by means of a tachometer, but to correlate this with exterior sound level would require a more sophisticated instrumentation system than that required to conduct the EPA test. In the latter, the engine speed is merely required to establish an end condition and is not required in the measurement of the vehicle sound level. With only two vehicles tested, it is difficult to arrive at a definite conclusion; however, it appears that uncertainties in engine speed can lead to an error of at least 1 dB in the interpolated vehicle sound level.

The assumption of linearity in the interpolation process potentially presents a more serious error, and one that is additive to the error is determining engine speed. Previous data[1] indicates an average difference of 1.5 dB between interpolated and directly measured sound levels for partial-throttle operation, with a maximum difference of 3.4 dB. Examples of plots of the isophonic lines obtained from European manufacturers indicate that the assumption of linearity is valid within ±2 dB, mainly due to the effect of drivetrain resonances. Furthermore, it is commonly recognized that the effectiveness of some noise abatement methods as measured under full-throttle conditions is not always realized under partial-throttle operation. Because the CCMC procedure relies heavily on full-throttle measurements, even the interpolation procedure may result in an overestimation of noise reduction in some cases.

Finally, it is believed that further refinement and the development of an equivalent procedure for automatics are required before it can be considered as a standard for light vehicle noise emission measurements.

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2. "Sound Level for Truck Cab Interior:, SAE Recommended Practice J336, Society of Automotive Engineers, New York, 1973.

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APPENDIX A

Specifications for the Test Pad Materials at the EPA Noise Enforcement Facility, Sandusky

The following is a description of the asphaltic concrete specification used by the EPA Noise Enforcement Facility in the construction of their test pad at Sandusky, Ohio:

A. Composition

Aggregate Size	Total Percent Passing
1/2	100
3/8	90-100
#4	45-75
#16	15-45
#50	3-22
#200	0-8

B. Bituminus Content

AR 4000 4.5 - 9.5 percent.

C. Sealing

Federal Specification R-P-355-D
Example "Jennite"

Two coats of sealant were applied using no thinner. A squeegee was used for the application and a penetration of 70 to 80 percent was achieved.

APPENDIX B

Finalized Noise Test Procedure

This section contains the finalized version of the urban acceleration noise test procedure for light vehicles incorporating modifications as determined necessary from the preliminary implementation and data base development.

Urban Acceleration Noise Test Procedure For Light Vehicles

1.0 INTRODUCTION

The test procedure described in the following sections is designed to provide a measurement of the noise emissions of light vehicles operating under acceleration conditions typical of those in urban areas. Sound level measurements are made for a vehicle operation in which a given acceleration rate is achieved at a particular engine RPM or vehicle speed. A constant partial-throttle setting is used for the test. Appropriate test conditions are provided for vehicles equipped with either manual or automatic transmissions. The sound level is measured by a microphone located 25 feet (7.5m) from the centerline of the vehicle path. Criteria for the selection of the sitem the instrumentation and the test condition appropriate for a particular vehicle are specified in the procedure.

2.0 DEFINITIONS

Automatic Transmission: Any transmission which does not require action on the part of the driver to change gears.

Manual Transmission: Any transmission which requires direct action on the part of the driver to change gears.

Numerical Gear Ratio: The ratio between input and output shaft speeds in a transmission, excluding the torque converter. A ratio greater than 1:1 is a reduction. Note that the ratio of gears commonly called "low" have higher numerical ratio (e.g., 3:1) than gears commonly called "high". In this test procedure, the term numerical gear ratio is used to avoid ambiguity.

Test Run: The complete operation of a vehicle in a prescribed manner from initiation to termination of vehicle motion in the prescribed direction.

End Zone: The section of the vehicle path, 20 feet in length, within which the end condition must be achieved for a run to be valid.

End Condition: A particular value of vehicle speed or engine speed which must be achieved during testing for a run to be valid.

Excessive Speed: A 1.6-mph greater vehicle speed, or a 4-percent greater engine speed, than that specified by the end condition.

Operating Condition: A combination of vehicle acceleration and vehicle or engine speed which is simultaneously achieved when the vehicle is operated according to this test procedure.

Rated Engine Speed: An engine speed specified by the manufacturer which is either the speed at which maximum power occurs or the maximum allowable speed.

Synchronized Instrumentation System: An arrangement where all vehicle and acoustic data are simultaneously recorded with a common time reference. This usually requires some degree of telemetry between the vehicle and a fixed position.

Unsynchronized Instrumentation System: An arrangement where acoustic data are not measured on a common time reference with vehicle data.

Test Condition: A complete specification of gear, throttle stop, starting point, and vehicle operation.

Test Sequence: A series of runs employing a single throttle-stop setting, of which a minimum of four runs are valid runs.

Throttle Stop: An adjustable device which limits the opening of the vehicle's throttle but does not interfere with closing the throttle.

3.0 TEST SITE

3.1 The test site shall consist of a test pad over which the vehicle travels and sound level measurements are made, plus approach and departure paths. The site shall be located in an area free of reflecting structures and sources of acoustic interference. The dimensions of the site are shown in Figure B-1.

3.2 The following points shall be established on the test pad:

3.2.1 An end zone consisting of a 20-foot section of the vehicle's path of travel.

3.2.2 A microphone position located 25 feet from the center of the end zone on a line parallel to and 25 feet from the centerline of the vehicle path.

3.3 If space and equipment permit, a double-sided test pad with microphones located on both sides of the vehicle path may be employed to permit simultaneous measurement of the sound level or both sides of the test vehicle. Both sides of the site must meet the requirements specified in this section.

3.4 The surface material of the test pad shall be homogeneous over the entire area, and shall consist of sealed asphaltic concrete. The surface shall be smooth and flat within ±2 inches (0.05m) over the entire area, and shall be free of loose gravel and other particles, snow, ice, etc. The path over which the test vehicle travels shall be dry and free of snow and ice.

3.5 The approach and departure paths shall have their centerlines aligned with the vehicle path on the test pad, and shall be long enough to provide for accelerating the vehicle to test speed and safe stopping after the test. They shall be dry and free of snow, ice, and any loose material which might be carried onto the test pad by the test vehicles.

3.6 There shall be no reflecting obstacles located within 50 feet (15m) of the vehicle path on the pad or any microphone positions—see Figure B-1. The ambient sound level at the site, produced by sources other than the vehicle being tested, shall be at least 10 dB lower than the sound level measured from the test vehicles as it is operated according to the procedure described in Section 6.

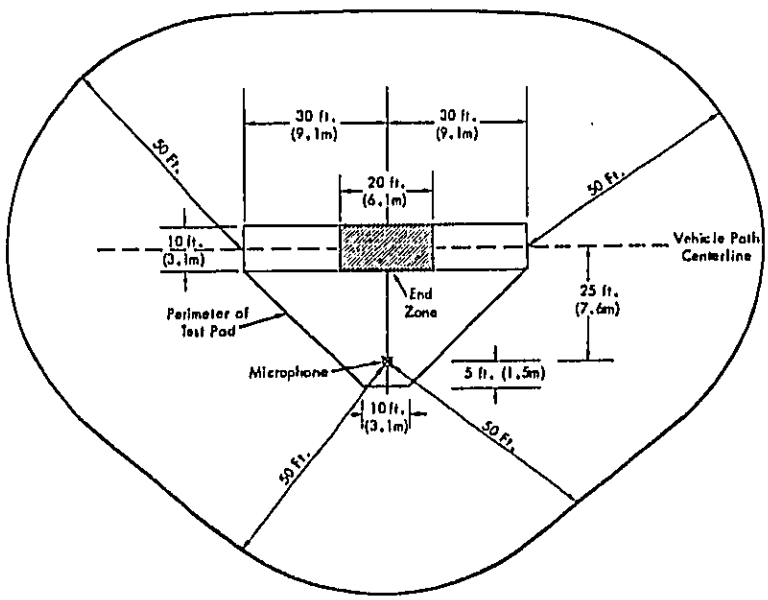

Figure B-1. Layout of Test Site for the Urban Acceleration Noise Test Procedure.

4.0 INSTRUMENTATION

4.1 Instrumentation System

Instrumentation is required to measure both acoustic data and vehicle parameters, including vehicle speed, acceleration, and engine speed. The instruments for measuring vehicle parameters are usually mounted in the vehicle, while instruments for measuring sound level are stationary. Obtaining a record in which all data are synchronized with respect to a common time reference usually requires some degree of telemetry between the vehicle and the fixed acoustic instrumentation. Such a synchronized system is not necessary to conduct the test, although it may be desired for research or other purposes. Therefore, this test provides alternative procedures for two instrumentation systems.

4.1.1 An unsynchronized instrumentation system requires that vehicle parameters be recorded with a common time reference, but synchronization with sound level data is not required.

4.1.2 A synchronized instrumentation system requires that a common time reference be used in recording vehicle parameters and sound level data. The synchronization method must be accurate to within ±50 msec.

4.1.3 Field calibration of the complete vehicle and acoustic instrumentation systems shall be performed immediately before and after each series of test sequences on a vehicle on the same day.

4.2 Acoustic Instrumentation

4.2.1 Acoustic measurements shall be made using instruments meeting the specifications of ANSI S1.4 (1971), "Specification for Sound Level Meters", for a Type 1 sound level meter. The meter shall be set to A-weighting and "fast" response. The field calibration device used shall have an accuracy of at least ±0.5 dB.

4.2.2 The microphones shall be oriented so as to provide the most uniform directivity in the plane of the vehicle travel and positioned at a height of 4 feet (1.2m) above the test pad surface. Windscreens shall be placed on all microphones in accordance with microphone and manufacturer's recommendations.

4.2.3 If a synchronized instrumentation system is used, sound levels must be recorded during each run such that the time history of the sound level is available. If an unsynchronized system is used, maximum levels may be read directly from the sound level meter, using one trained person for each channel in a double-sided test pad arrangement.

4.2.4 If a recording system is utilized, it must meet the requirements of ANSI S6.1 (1973), and "Qualifying a Sound Data Acquisition System" (SAE J184).

4.3 Vehicle Instrumentation

4.3.1 The vehicle shall be instrumented to record continuously vehicle speed, acceleration, and engine speed during each run. In addition, the times at which the vehicle enters and exits the end zone must be marked or otherwise recorded for each run. The measurements must be made to within the following accuracy:

Vehicle Acceleration	—	±0.002g
Engine Speed	—	±50 RPM
Vehicle Speed	—	±0.2 mph (0.3 km/h)
Time*	—	±50 msec

* Times at which the vehicle enters and exits the end zone.

4.3.2 The recording system must be such that vehicle parameters may be checked after each run to ensure that the operation specified in Section 6 has been satisfied.

4.3.3 To provide smoothing of vehicle parameter signals, a time constant of 100 to 150 msec is to be used. To assure proper time alignment, the same time constant must be used in all non-acoustic channels. No filtering shall be applied to acoustic data other than that associated with "fast" response.

4.3.4 For an unsynchronized instrumentation system, displays of vehicle speed and engine speed, as appropriate for the specified end condition, must be clearly visible to the driver during the test. These provide information needed by the driver to avoid excessive speed (see Section 6.3).

5.0 TEST VEHICLE PREPARATION

5.1 The test vehicle shall be tuned according to the manufacturer's specifications.

5.2 Prior to the test, the engine of the test vehicle shall be at its normal operating temperature.

5.3 The test vehicle shall contain only the driver and the instrumentation necessary for conducting the test.

5.4 An adjustable stop mechanism must be installed in the throttle linkage. This throttle stop must provide a positive, repeatable, stopping point at partial throttle, and not interfere with normal closing of the throttle. A continuously adjustable stop mechanism, such as provided by a screw thread, is recommended.

5.5 All auxiliary equipment on the test vehicle which can be turned off from the passenger compartment shall be in the off position during the test.

6.0 VEHICLE OPERATION

The purpose of this test is to measure the maximum sound level produced by light vehicles under partial-throttle acceleration at speeds up to 25 mph. The vehicle is operated at a constant-throttle setting in first gear to achieve a specified acceleration immediately prior to, or at, the shift to second gear. For vehicles with manual transmissions, shifting is defined to occur at 70 percent rated engine speed. For vehicles with automatic transmissions, the shift occurs at an engine speed controlled by the transmission. The maximum sound level up to and including the shift is then measured, unless the shift occurs at a speed above 25 mph, in which case the measurement is made at 25 mph.

For some vehicles with automatic transmissions, the sound level produced under acceleration in second gear at 25 mph is higher than that measured at the shift from first to second gear. A second test condition is therefore given for such vehicles, corresponding to 25 mph in second gear.

The following subsections describe, for each test condition, the vehicle operation, the appropriate adjustment of the throttle-stop setting, the starting point on the vehicle

path, as well as the requirements for a valid test sequence. Preliminary runs will be needed to establish the throttle-stop setting for the test sequence. A correct starting point cannot be established until completion of these preliminary runs.

6.1 Operation of Manual Transmission Vehicles (Test Condition 1M)

Step 1. Gear Selection: Place the transmission gear selector in first gear unless operation in a lower numerical ratio gear will produce 70 percent rated engine speed at or below 25 mph (40 km/h), in which case use the lowest numerical ratio gear which will produce 70 percent rated engine speed at or below 25 mph (40 km/h).

Step 2. Throttle-Stop Adjustment/Operating Mode: Adjust the throttle stop such that an operating condition of 0.15g acceleration at 70 percent rated engine speed or at 22 mph (35.4 km/h), whichever occurs first, is achieved during the operation of the vehicle as specified in Step 4. Allowable tolerances in the acceleration are specified in Section 6.4. Completion of this step will normally require preliminary runs.

Step 3. Starting Point/End Condition: Adjust the starting point such that the specified operation of the vehicle in Step 4 will result in the end condition occurring when the front-most edge of the front bumper is within the end zone. The end condition is 70 percent rated engine speed or 25 mph (40.2 km/h), whichever occurs first. The starting point can be established by performing a preliminary run in the reverse direction, initiating the vehicle operation in the end zone and noting the point where the end condition is achieved.

Step 4. Vehicle Operation: With the appropriate gear selected, approach the starting point at 25 percent rated engine speed, maintaining constant engine speed. At the starting point, rapidly open the throttle to the adjusted throttle-stop position. Maintain the throttle at the adjusted throttle-stop position until the end condition is achieved.

6.2 Operation of Automatic Transmission Vehicles

There are two test conditions for vehicles equipped with automatic transmissions. Test Condition 1 applies to all such vehicles; Test Condition 2 applies to vehicles exhibiting certain characteristics when operated according to Test Condition 1.

6.2.1 Test Condition 1A

Step 1. Gear Selection: Place the automatic transmission gear selector in the Drive position.

Step 2. Throttle-Stop Adjustment/Operating Mode: Adjust the throttle stop such that an operating condition of 0.15g acceleration at 100 RPM prior to the maximum RPM at the first transmission upshift, or 0.15g at 22 mph (35.4 km/h), whichever occurs first, is achieved during the operation of the vehicle as specified in Step 4. Allowable tolerances in the acceleration are specified in Section 6.4. Completion of this step will normally require preliminary runs. If an acceleration of 0.15g cannot be achieved, the throttle stop shall be adjusted to achieve the maximum acceleration possible. If the vehicle operating condition can be achieved at two different vehicle speeds, the transmission upshift at the lower speed shall be selected.

Exception: If in achieving the operating condition, the engine speed decreases 150 RPM or less from the maximum engine speed noted at the first transmission upshift, the vehicle shall be tested only under Test Condition 2.

Step 3. Starting Point/End Condition: The starting point shall be such that the specified operation in Step 4 of the vehicle will result in the end condition occurring when the front-most edge of the front bumper is within the end zone. The end condition is the maximum RPM at the first transmission upshift or 25 mph (40.2 km/h), whichever occurs first. The starting point can be established by performing a preliminary run in the reverse direction, initiating the vehicle operation in the end zone and noting the point where the end condition is achieved.

Step 4. Vehicle Operation: With the appropriate gear selected, position the vehicle at the starting point with the engine idling and the brake set. Simultaneously

release the brake and rapidly open the throttle to the adjusted throttle-stop position. Maintain the throttle at the adjusted throttle-stop position until the end condition is achieved.

6.2.2 Test Condition 2

Criteria for testing under Condition 2:

1. Vehicles for which the first transmission upshift occurs at a vehicle speed less than 19 mph* (30.6 km/h) when operated according to Test Condition 1 shall also be tested under Test Condition 2.

2. Vehicles that exhibit the characteristics specified in the Exception for Test Condition 1 shall be tested under Test Condition 2.

Step 1. Gear Selection: Place the automatic transmission selector in that position which corresponds to the gear attained after the first transmission upshift under Condition 1.

Step 2. Throttle-Stop Adjustment/Operating Mode: Adjust the throttle stop such that an operating condition of 0.12g acceleration at 25 mph (40.2 km/h) is achieved during the operation of the vehicle as specified in Step 4. Allowable tolerances in the acceleration are specified in Section 6.4. Completion of this step will normally require preliminary runs. If an acceleration of 0.12g at 25 mph cannot be achieved, the throttle stop shall be adjusted to achieve the maximum acceleration possible at 25 mph without producing a downshift from the selected gear.

Step 3. Starting Point/End Condition: Adjust the starting point such that the specified operation of the vehicle in Step 4 will result in the end condition occurring when the front-most edge of the front bumper is within the end zone. The end condition is 25 mph (40.2 km/h). The starting point can be established by performing a preliminary run in the reverse direction, initiating the vehicle operation in the end zone and noting the point where the end condition is achieved.

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* As determined from a review of the data obtained from 66 light vehicles.

Step 4. Vehicle Operation: With the appropriate gear selected, approach the starting point at 15 mph (24.1 km/h), maintaining constant vehicle speed. At the starting point, rapidly open the throttle to the adjusted throttle-stop position. Maintain the throttle at the adjusted throttle-stop position until the end condition is achieved.

6.3 Throttle Closing After End Condition

If an unsynchronized instrumentation system is used, the throttle shall be closed after the end condition is achieved to avoid excessive vehicle or engine speed. Excessive vehicle speed is 1.6 mph (2.6 km/h) greater than the specified end condition speed. Excessive engine speed is 4 percent rated engine speed greater than the engine speed specified for the end condition. It is permissible, but not required, to release the throttle after achieving the end condition when a synchronized instrumentation system is used.

6.4 Obtaining a Valid Test Sequence

6.4.1 If a synchronized instrumentation system is used, a run shall be considered valid when the end condition is achieved within the end zone.

6.4.2 If an unsynchronized instrumentation system is used, a run shall be considered valid when the end condition is achieved within the end zone and excessive vehicle or engine speed, as specified in Section 6.3, is avoided.

6.4.3 In order to characterize satisfactorily the sound level on each side of a vehicle for a specified test condition, a series of runs employing a single throttle-stop setting shall be obtained. For a site having a single microphone, a minimum of four valid runs in each direction (a total of eight runs) are required. For a site having a microphone on both sides of the vehicle path, a minimum of four valid runs are required. Thereby, a minimum of four valid sound level measurements for each side of the vehicle are obtained. Such a series of runs conducted at the same partial-throttle setting shall be termed a test sequence.

6.4.4 A test sequence shall be considered valid when the average of the measured acceleration values of all valid runs, at the engine or vehicle speed specified for the operating condition, are within the following tolerances:

6.4.4.1 For manual transmission vehicles, the average of the acceleration values of all valid runs of a test sequence shall be within ±0.010g of the stated acceleration for the specified operating mode.

6.4.4.2 For automatic transmission vehicles, the average of the acceleration values of all valid runs of a test sequence shall be within ±0.005g of the stated acceleration for the specified operating mode.

6.4.5 If the tolerances specified in 6.4.4 are not satisfied, the throttle stop shall be readjusted and another test sequence shall be obtained. Runs at the first throttle setting shall not be included in the reported data.

6.4.6 As an alternative to 6.4.5, it is permissible to conduct any number of additional runs at the same throttle setting until the average of all valid runs in the sequence is within the tolerance.

6.4.7 Runs with known instrumentation malfunctions or personnel errors shall not be considered valid runs. Such malfunctions and errors shall be documented.

7.0 ACOUSTIC MEASUREMENTS

7.1 The sound level shall be measured at the microphone position defined in Section 3.1 during each run of a test sequence.

7.2 The maximum measured sound level at each microphone shall be recorded for each valid run of a test sequence.

7.3 If a synchronized instrumentation arrangement is used, the maximum sound level for a valid run is the maximum level measured up to and including the instant when the end condition is achieved.

7.4 If an unsynchronized instrumentation arrangement is used, the maximum sound level for a valid run is the maximum level measured for the complete run.

7.5 The maximum sound levels obtained for all valid runs of a valid test sequence shall be combined to obtain a single arithmetic average maximum for each side of the vehicle (see Section 6.4.3). The reported sound level shall be the higher average

maximum value measured for the two sides of the vehicle. For automatic transmission vehicles, the reported level shall be the higher of the average maximum levels produced by Test Conditions 1 and 2.

8.0 ENVIRONMENTAL CONDITIONS

8.1 Noise measurements shall be conducted only when the wind speed — including gusts — is less than 10 mph (16 km/h) measured on the test pad at the microphone height.

8.2 Noise measurements shall not be conducted when the ambient temperature is less than -4°F, nor under temperature or humidity conditions outside of the specified range allowable for the instrumentation being used.

8.3 Noise measurements shall not be conducted in rain, snow, sleet, or hail.

APPENDIX C

Data Summary Tables for EPA Urban Noise Test Procedure

C.1 Description of Charts

The summary tables contained in this Appendix present the sound level and vehicle operation data for the tests performed on 66 light vehicles using the EPA Urban Noise Test Procedure. Each table contains a brief description of the vehicle, the appropriate test condition, and the distance at which the sound levels were recorded. Test Condition 1 is performed for automatics and manuals, the designations being 1A and 1M, respectively. Test Condition 2 is performed in some cases only for automatics, so this distinction is not required. Tests performed with a demand fan activated are indicated by the letter "F" in parenthesis following the test condition number, e.g., 1A(F).

The tables are divided into two parts. The upper part presents the vehicle operation data and the maximum sound levels measured at any of the microphones on each side of the vehicle. The lower part presents the maximum sound levels measured at each microphone on each side of the vehicle. Averages and maximum ranges for each column are given at the bottom of each table. Taking the table for vehicle #001 on page B4 as an example, the entries show that 4 runs were required to complete the test sequence, the average value of acceleration at the operating condition (22 mph in this case) being 0.147g. The end condition for this vehicle was the 1-2 shift, since this occured at a vehicle speed of less than 25 mph. In the first run (1.207), the 1-2 shift occurred at an engine speed of 2023 RPM, corresponding to a vehicle speed of 24.4 mph, at a position 3.0 feet before reaching the center of the end zone — the end point. The maximum sound level measured on the right side of the vehicle (as viewed by the driver) was 62.4 dBA at 1992 RPM, when the vehicle was at a position 7.9 feet before the end point. In other words, the maximum sound level occurred before the operating condition was reached. This maximum level was measured by the microphone at 0 feet, i.e., in line with the end point — see Figure 2.4. Similar data are shown for the left side of the vehicle.

In the lower table, the maximum sound levels are given for each microphone position, no account being taken for the instant at which they were measured.

C.2 Index of Vehicles

*Diesel

C.3 Data Summary Charts

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
1.207	.154	2023	24.4	-3.0	62.4	1992	-7.9	0	62.6	2006	-5.1	0
1.208	.144	2036	24.4	-8.6	62.1	2036	-8.6	0	62.8	2000	-1.0	0
1.209	.142	2054	24.6	-5.1	62.8	2047	-5.8	-25	63.3	2054	-5.1	0
1.210	.149	2059	24.9	-3.0	62.6	2047	-7.2	-25	63.0	1937	4.0	0
Average	.147	2043	24.6	-4.9	62.5	2031	-7.4	--	62.9	1999	-4.7	--
+/-	.007 / .005	16 / 20	0.3 / 0.2	1.3 / 3.7	0.3 / 0.4	16 / 39	1.6 / 1.2	-- / --	0.4 / 0.3	55 / 62	8.7 / 8.1	-- / --

TEST VEHICLE: #001

Oldsmobile Cutlass
3-Speed Automatic
V8-350 CID
170 bhp @ 3800 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 5/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
1.207	61.8	62.4	61.0		61.8	62.6	61.5	
1.208	62.1	62.1	60.9		61.7	62.8	61.2	
1.209	62.8	62.8	61.3		62.2	63.3	62.2	
1.210	62.6	62.6	61.5		61.9	63.0	61.8	
Average	62.3	62.5	61.2		61.9	62.9	61.7	
+/-	0.5 / 0.5	0.3 / 0.4	0.3 / 0.3	/	0.3 / 0.2	0.4 / 0.3	0.5 / 0.5	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
2.209	.154	1857	20.3	-2.3	64.3	1815	-10.4	0	62.2	1857	- 2.3	0
2.210	.151	1824	19.7	-4.4	63.4	1801	-10.0	0	62.0	1768	-12.8	0
2.211	.151	1820	19.7	-3.7	63.4	1792	- 9.3	0	62.2	1758	-12.8	0
2.212	.151	1827	19.8	0.5	63.3	1802	- 6.5	-25	62.2	1816	- 3.7	0
Average	.152	1832	19.9	-2.5	63.6	1803	- 9.3	--	62.2	1800	- 7.9	--
+/-	.002 / .001	25 / 12	0.4 / 0.2	3.0 / 1.9	0.6 / 0.3	12 / 11	2.8 / 2.1	-- / --	0 / 0.2	57 / 42	5.6 / 4.9	-- / --

TEST VEHICLE: #002

Dodge Royal Monaco
3-Speed Automatic
V8-360 CID
155 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 5/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
2.209	63.1	64.3	60.4		61.8	62.2	61.0	
2.210	63.1	63.4	60.2		61.8	62.0	61.8	
2.211	61.9	63.4	60.6		60.7	62.2	60.7	
2.212	63.3	62.1	60.9		60.7	62.2	60.7	
Average	62.9	63.3	60.5		61.3	62.2	61.1	
+/-	0.4 / 1.0	1.0 / 1.2	0.4 / 0.5	/	0.5 / 0.4	0.0 / 0.2	0.7 / 0.4	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
2.215	.123	1630	26.1	-1.6	62.1	25.2	1.2	0	61.6	25.7	8.9	0
2.216	.118	1631	25.6	6.1	61.6	24.8	3.3	0	61.8	24.8	3.3	0
2.217	.124	1658	25.9	-0.2	61.5	25.3	4.0	0	61.7	25.1	2.6	0
2.219	.119	1635	25.9	7.5	61.4	24.6	1.2	0	62.1	25.1	9.6	0
Average	.121	1639	25.9	3.0	61.7	25.0	2.4	--	61.8	25.2	6.1	--
+/-	.003 / .003	19 / 9	0.2 / 0.3	4.5 / 4.6	0.4 / 0.3	0.2 / 0.4	1.6 / 1.2	-- / --	0.3 / 0.2	0.5 / 0.4	3.5 / 3.5	-- / --

TEST VEHICLE: #002

Dodge Royal Monaco
3-Speed Automatic
V8-360 CID
155 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 5/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
2.215	61.1	62.1	60.7		60.3	61.6	61.5	
2.216	60.6	61.6	59.8		60.2	61.8	61.3	
2.217	61.4	61.5	60.2		60.8	61.7	61.3	
2.219	60.9	61.4	60.7		60.4	62.1	61.2	
Average	61.0	61.7	60.4		60.4	61.8	61.3	
+/-	0.4 / 0.4	0.4 / 0.3	0.3 / 0.6		0.4 / 0.2	0.3 / 0.2	0.2 / 0.1	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
3.342	.122	1754	28.5	-8.1	66.4	24.6	-13.0	-16.4	66.7	24.8	-10.2	0
3.343	.122	1753	26.9	+5.9	66.8	24.0	- 8.8	-16.4	66.7	24.2	- 5.3	-16.4
3.344	.118	1730	26.4	+3.8	66.4	24.8	+ 3.1	0	66.4	24.9	+ 3.8	-16.4
3.345	.119	1726	26.5	+1.7	67.0	24.6	- 3.9	0	67.4	24.0	-12.3	-16.4
Average	.120	1741	27.1	0.8	66.7	24.5	- 3.7	-	66.8	24.5	- 6.0	-
-/+	.002 / .002	15 / 13	0.7 / 1.4	8.9 / 5.1	0.3 / 0.3	0.5 / 0.3	9.3 / 6.8	- / -	0.4 / 0.6	0.5 / 0.4	6.3 / 9.8	- / -

TEST VEHICLE: #003

Lincoln Continental
3-Speed Automatic
V8 - 460 CID
208 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 7/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet		Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet	
3.342	66.4	65.4	63.4		65.9	66.7	63.4	
3.343	66.8	66.6	65.7		66.7	66.7	64.2	
3.344	66.2	66.4	65.4		66.4	66.3	64.8	
3.345	66.8	67.0	65.5		67.4	66.9	64.7	
Average	66.6	66.4	65.0		66.6	66.7	64.3	
+/-	0.4 / 0.2	1.0 / 0.6	1.6 / 0.7		0.7 / 0.8	0.4 / 0.2	0.9 / 0.5	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
3.342	.122	1754	28.5	-8.1	60.6	25.0	-8.1	0	61.0	24.9	-9.5	+25
3.343	.122	1753	26.9	+5.9	60.5	24.4	-3.2	0	61.0	25.0	-5.9	+25
3.344	.118	1730	26.4	+3.8	60.5	24.9	+3.8	0	61.1	24.6	-1.1	+25
3.345	.119	1726	26.5	+1.7	60.9	25.0	+1.7	0	61.1	24.7	-3.2	0
Average	.120	1741	27.1	0.8	60.6	24.8	-1.5	-	61.1	24.8	-2.0	-
-/+	.002 / .002	15 / 13	0.7 / 1.4	8.9 / 5.1	0.1 / 0.3	0.4 / 0.2	6.6 / 5.3	- / -	0.1 / 0.0	0.2 / 0.2	7.5 / 7.7	- / -

TEST VEHICLE: #003

Lincoln Continental
3-Speed Automatic
V8 - 460 CID
208 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 7/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max Sl at Mic at -25 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +25 feet		Max Sl at Mic at -25 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +25 feet	
3-342		60.6	59.6			60.4	61.0	
3-343		60.5	59.9			60.8	61.0	
3-344		60.5	59.9			61.1	61.1	
3-345		60.9	60.1			61.1	61.0	
Average		60.6	59.9			60.9	61.0	
-/+		0.1 / 0.3	0.3 / 0.2			0.5 / 0.2	0.0 / 0.1	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
3.311	.126	1730	26.8	1.7	64.9	24.9	1.0	0	64.3	24.9	1.0	+25
3.312	.117	1725	25.9	10.1	64.4	24.0	- 3.9	0	63.6	22.6	3.8	+25
3.313	.120	1722	26.3	- 0.4	64.2	24.3	-13.0	0	63.5	24.9	-2.5	+25
3.314	.120	1724	26.3	8.7	64.6	23.4	-13.0	0	64.3	24.7	4.5	+25
Average	.121	1725	26.3	5.0	64.5	24.2	- 7.2	--	63.9	24.3	1.7	--
+/-	.005 / .004	5 / 3	0.5 / 0.4	5.1 / 5.4	0.4 / 0.3	0.7 / 0.8	8.2 / 5.8	-- / --	0.4 / 0.4	0.6 / 1.7	2.8 / 4.2	-- / --

TEST VEHICLE: #003

Lincoln Continental
3-Speed Automatic
V8-460 CID
208 bhp @ 4000 RPM

TEST CONDITION: 2 (F)

Mic Distance - 50 ft.

TEST DATE: 7/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
3.311	64.1	64.9	63.2		63.4	63.2	64.3	
3.312	63.3	64.4	63.9		63.1	62.8	63.6	
3.313	64.1	64.2	62.7		63.3	63.4	63.5	
3.314	63.5	64.6	63.5		63.0	63.1	64.3	
Average	63.8	64.5	63.3		63.2	63.1	63.9	
+/-	0.3 / 0.5	0.4 / 0.3	0.6 / 0.6	/	0.2 / 0.2	0.3 / 0.3	0.4 / 0.4	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos.	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos.
4.204	.145	2205	13.0	-2.3	59.3	2205	-2.3	-25	59.7	2205	-2.3	0
4.205	.149	2230	13.4	-2.3	60.6	2230	-2.3	-25	60.7	2217	-4.4	0
4.206	.152	2198	12.9	-3.0	59.1	2193	-1.6	-25	59.8	2193	-1.6	0
4.207	.146	2197	12.9	-0.2	59.8	2179	-0.2	-25	59.6	2176	1.2	0
4.208	.151	2170	12.8	-1.6	59.2	2170	-1.6	-25	58.6	2157	-0.9	0
4.209	.156	2193	12.9	-0.2	58.8	2158	-0.9	-25	58.9	2158	-0.9	0
4.210	.148	2179	12.9	-0.9	59.0	2179	-0.9	-25	58.4	2179	-0.9	0
4.211	.147	2145	12.8	1.2	57.9	2131	-0.9	-25	57.9	2109	1.9	0
Average	.149	2190	13.0	-1.2	59.2	2181	-1.3	--	59.2	2174	-1.0	--
+/-	.007 / .004	40 / 45	0.4 / 0.2	2.4 / 1.8	1.4 / 1.3	49 / 50	1.1 / 1.0	-- / --	1.5 / 1.3	43 / 65	2.9 / 3.4	-- / --

TEST VEHICLE: #004

Toyota Corolla
3-Speed Automatic
L4-97 CID
75 bhp @ 5800 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 5/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
4.204	59.3	57.8	56.0		58.9	59.7	58.0	
4.205	60.6	59.0	56.9		58.7	60.7	58.0	
4.206	59.1	57.8	56.9		58.5	59.8	58.2	
4.207	59.8	57.7	56.8		58.3	59.6	57.7	
4.208	59.2	57.4	56.5		58.5	58.6	57.2	
4.209	58.8	57.9	56.4		58.3	58.9	57.7	
4.210	59.0	57.2	55.9		58.1	58.4	57.6	
4.211	57.9	57.0	55.7		57.8	57.9	56.6	
Average	59.2	57.7	56.4		58.4	59.2	57.6	
+/-	1.4 / 1.3	1.3 / 0.7	0.5 / 0.7		0.5 / 0.6	1.5 / 1.3	0.6 / 1.0	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
4.215	.123	2519	26.1	-6.5	63.8	25.6	4.0	0	65.8	25.5	1.9	0
4.216	.124	2546	26.1	8.2	63.3	24.9	6.8	0	65.2	24.5	0.5	0
4.217	.124	2522	25.9	4.7	63.6	25.2	8.2	0	65.2	25.3	8.9	0
4.218	.128	2516	26.1	3.0	63.8	25.1	4.7	0	65.2	25.6	13.1	0
Average	.125	2526	26.1	2.4	63.6	25.2	5.9	--	65.4	25.2	6.1	--
+/-	.003 / .002	20 / 10	0 / 0.2	5.8 / 8.9	0.2 / 0.3	0.4 / 0.3	2.3 / 1.9	-- / --	0.4 / 0.2	0.4 / 0.7	7.0 / 5.6	-- / --

TEST VEHICLE: #004

Toyota Corolla
3-Speed Automatic
L4-97 CID
75 bhp @ 5800 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 5/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
4.215	63.3	63.8	62.7		63.7	65.8	64.5	
4.216	63.3	63.3	62.4		63.1	65.2	65.0	
4.217	63.1	63.6	62.3		63.2	65.2	64.3	
4.218	63.2	63.8	62.4		63.6	65.2	64.8	
Average	63.2	63.6	62.5		63.4	65.4	64.7	
+/-	0.1 / 0.1	0.2 / 0.3	0.2 / 0.2	/	0.3 / 0.3	0.4 / 0.2	0.3 / 0.4	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
5.304	.152	19.6	4332	3.1	71.5	3989	0.3	0	73.2	3994	1.0	0
5.305	.154	19.6	4082	-3.2	72.7	4013	-4.6	0	74.2	4066	- 3.2	0
5.306	.155	19.5	4249	-0.4	72.3	3934	-3.9	0	73.4	3743	-12.3	-16.4
5.307	.152	19.6	4189	2.4	71.7	3903	-3.9	0	74.1	4055	2.4	0
Average	.153	19.6	4213	0.5	72.1	3960	-3.0	--	73.7	3965	- 3.0	--
+/-	.002 / .001	0 / 0.1	131 / 119	2.6 / 2.7	0.6 / 0.6	53 / 57	3.3 / 1.6	-- / --	0.5 / 0.5	101 / 222	5.4 / 9.3	-- / --

TEST VEHICLE: #005

Toyota Corolla SW
5-Speed Manual
L4-97 CID
75 bhp @ 5800 RPM

TEST CONDITION: 1M

Mic Distance - 25 ft.

TEST DATE: 7/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
5.304		71.5	71.3		73.2	73.2	71.9	
5.305		72.7	71.7		73.0	74.2	71.2	
5.306		72.3	71.7		73.4	72.8	72.1	
5.307		71.7	70.6		73.1	74.1	71.8	
Average		72.1	71.3		73.2	73.6	71.8	
+/-		0.6 / 0.6	0.4 / 0.7		0.2 / 0.2	0.6 / 0.8	0.3 / 0.6	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
5.304	.152	19.6	4332	3.1	67.0	3736	-10.2	0	67.5	3948	- 1.1	0
5.305	.154	19.6	4082	-3.2	66.9	4013	- 4.6	0	67.5	4110	- 3.2	0
5.306	.155	19.5	4249	-0.4	66.8	3753	-10.9	0	67.2	3753	-10.9	0
5.307	.152	19.6	4189	2.4	67.1	4055	2.4	0	67.6	3847	- 6.0	0
Average	.153	19.6	4213	0.5	67.0	3889	- 5.8	--	67.5	3915	- 5.3	--
+/-	.002 / .001	0 / 0.1	119 / 131	2.6 / 2.7	0.1 / 0.2	166 / 153	8.2 / 5.1	-- / --	0.1 / 0.3	196 / 162	2.1 / 5.6	-- / --

TEST VEHICLE: #005

Toyota Corolla SW
5-Speed Manual
L4-97 CID
75 bhp @ 5800 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 7/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
5.304		67.0	67.0			67.5		
5.305		66.9	66.6			67.5		
5.306		66.8	66.7			67.2		
5.307		67.1	66.9			67.6		
Average		67.0	66.8			67.5		
+/-		0.1 / 0.2	0.2 / 0.2			0.1 / 0.3		

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
7.52	.158	21.6	-	9.1					69.5	4087	4.9	+25
7.53	.150	21.5	-	13.3					69.2	4090	8.4	0
7.55	.147	21.4	-	10.5					69.3	4147	7.7	+25
7.56	.148	21.5	-	11.9					69.4	4096	7.7	+25
Average	.151	21.5		11.2					69.4	4105	7.2	-
+/-	.007 / .004	0.1 / 0.1	/	2.1 / 2.1	/	/	/	/	0.1 / 0.2	42 / 18	1.2 / 2.3	- /

TEST VEHICLE: #007

Mazda RX-4
5-Speed Manual
Rotary - 80 CID
110 bhp @ 6000 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 4/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	Max SI at Mic at +50 feet
7.52					68.9	69.3	69.5	67.3
7.53					68.6	69.2	69.0	66.5
7.55					68.6	69.0	69.3	66.9
7.56					68.6	69.3	69.4	66.7
Average					68.7	69.2	69.3	66.9
+/-	/	/	/	/	0.2 / 0.1	0.1 / 0.2	0.2 / 0.3	0.4 / 0.4

NOTE: Vehicle tested in Phase Prior to End Zone Specification

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
9.323	.131	2791	3242	3.1	75.5	3141	3.1	0	75.9	3141	3.1	0
9.324	.134	2797	3275	-1.8	74.7	3134	-1.8	0	75.4	3134	-1.8	0
9.325	.134	2797	3318	-1.1	75.0	3131	-1.8	0	75.7	3107	-4.6	0
9.326	.135	2788	3224	-2.5	75.4	3085	-8.1	0	75.6	3134	-3.2	0
Average	.133*	2793	3265	-0.6	75.1	3123	-2.1	--	75.6	3129	-1.6	--
+/-	.002 / .002	4 / 5	53 / 41	3.7 / 1.9	0.4 / 0.4	18 / 38	5.2 / 6.0	-- / --	0.3 / 0.2	12 / 22	4.7 / 3.0	-- / --

TEST VEHICLE: #009

Mercedes Benz 240D
4-Speed Automatic
L4-147 CID (Diesel)
62 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 25 ft.

TEST DATE: 7/14/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
9.323		75.5	74.3		74.8	75.9	74.9	
9.324		74.7	74.4		74.7	75.4	74.2	
9.325		75.0	74.2		75.4	75.7	73.8	
9.326		75.4	73.9		74.7	75.6	74.1	
Average		75.1	74.2		74.9	75.6	74.2	
+/-	/	0.4 / 0.4	0.2 / 0.3	/	0.5 / 0.2	0.3 / 0.2	0.7 / 0.4	/

*NOTE - C... 11 not attain 15g at 22 MPH

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
9.323	.131	2791	3242	3.1	69.8	3154	3.8	+25	69.7	3141	3.1	+25
9.324	.134	2797	3275	-1.8	69.3	3134	-1.8	+25	69.6	3096	-6.0	+25
9.325	.134	2797	3318	-1.1	69.5	3134	-1.1	0	69.8	3131	-1.8	+25
9.326	.135	2788	3224	-2.5	69.4	3129	-3.9	+25	70.4	3134	-3.2	+25
Average	.133*	2793	3265	-0.6	69.5	3138	-0.7	--	69.9	3125	-2.0	--
+/-	.002 / .002	4 / 5	53 / 41	3.7 / 1.9	0.3 / 0.2	16 / 9	4.5 / 3.2	-- / --	0.5 / 0.3	16 / 29	5.1 / 4.0	-- / --

TEST VEHICLE: #009

Mercedes Benz 240D
4-Speed Automatic
L4-147 CID (Diesel)
62 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 7/14/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
9.323		69.5	69.8			69.4	69.7	
9.324		69.0	69.3			69.3	69.6	
9.325		69.5	69.1			69.4	69.8	
9.326		69.1	69.4			69.8	70.4	
Average		69.3	69.4			69.5	69.9	
+/-	/	0.2 / 0.3	0.2 / 0.3	/	/	0.3 / 0.2	0.5 / 0.3	/

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
9.327	.129	2793	3203	5.2	75.5	3134	4.5	0	75.8	3137	5.2	0
9.328	.129	2789	3264	-1.1	75.0	3096	-6.7	0	75.6	3124	-3.2	0
9.329	.131	2802	3188	0.3	75.0	3094	-5.3	0	75.2	3143	0.3	0
9.330	.131	2802	3228	3.1	75.4	3140	2.4	0	75.8	3140	2.4	0
Average	.130*	2796	3221	1.9	75.2	3116	-1.3	--	75.6	3136	1.2	--
+/-	.001 / .001	6 / 3	43 / 33	3.3 / 3.0	0.5 / 0.2	24 / 22	5.8 / 5.4	-- / --	0.2 / 0.4	7 / 12	4.0 / 4.4	-- / --

TEST VEHICLE: #009

Mercedes Benz 240 D
4-Speed Automatic
L4-147 CID (Diesel)
62 bhp @ 4000 RPM

TEST CONDITION: 1A (F)

Mic Distance - 25 ft.

TEST DATE: 7/14/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
9.327		75.5	74.6		74.6	75.9	74.7	
9.328		75.0	74.5		74.7	75.6	73.6	
9.329		75.0	73.7		75.2	75.2	73.4	
9.330		75.4	74.3		74.9	75.8	74.2	
Average		75.2	74.3		74.8	75.6	74.0	
+/-	/	0.3 / 0.2	0.3 / 0.6	/	0.4 / 0.2	0.2 / 0.4	0.7 / 0.6	/

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
9.327	.129	2793	3203	5.2	69.9	3125	3.1	+25	69.8	3113	1.7	+25
9.328	.129	2789	3264	-1.1	69.4	3147	-1.1	+25	69.9	3147	- 1.1	+25
9.329	.131	2802	3188	0.3	69.4	3143	0.3	0	69.3	3135	- 0.4	0
9.330	.131	2802	3228	3.1	69.7	3131	1.7	+25	69.9	2977	-15.8	0
Average	.130*	2796	3221	1.9	69.6	3136	1.0	--	69.7	3093	- 3.9	--
+/-	.001 / .001	6 / 3	43 / 33	3.3 / 3.0	0.3 / 0.2	11 / 11	2.1 / 2.1	-- / --	0.2 / 0.4	54 / 116	5.6 / 11.9	-- / --

TEST VEHICLE: #009

Mercedes Benz 240D
4-Speed Automatic
L4-147 CID (Diesel)
62 bhp @ 4000 RPM

TEST CONDITION: 1A (F)

Mic Distance-50 ft.

TEST DATE: 7/14/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
9.327		69.5	69.9			68.7	69.8	
9.328		69.2	69.4			69.6	69.9	
9.329		69.4	69.4			69.3	69.2	
9.330		69.6	69.7			69.9	69.7	
Average		69.4	69.6			69.4	69.6	
+/-		0.2 / 0.2	0.3 / 0.2			0.5 / 0.7	0.3 / 0.4	

*NOTE: Could not attain 15g at 22 MPH.

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
10.204	.155	17.4	2530	-0.9	68.0	2366	-2.3	0	66.6	2389	-0.9	-25
10.205	.148	17.3	2499	4.0	67.0	2344	-0.9	0	65.9	2373	0.5	+25
10.206	.156	17.4	2518	4.0	66.5	2326	1.2	0	66.1	2326	0.5	0
10.207	.153	17.3	2451	2.6	66.4	2336	0.5	0	66.4	2396	4.0	0
Average	.153	17.4	2500	2.4	67.0	2343	-0.4	--	66.3	2371	1.0	--
+/-	.003 / .005	0.0 / 0.1	30 / 49	1.6 / 3.3	1.0 / 0.6	23 / 17	1.6 / 1.9	-- / --	0.3 / 0.4	45 / 24	3.0 / 1.9	-- / --

TEST VEHICLE: #010

Ford Granada
4-Speed Manual
L6-250 CID
98 bhp @ 3400 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 5/23/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
10.204	66.8	68.0	65.5		66.6	66.6	65.4	
10.205	66.4	67.0	65.5		65.7	65.9	65.9	
10.206	65.8	66.5	64.9		66.1	66.1	65.9	
10.207	65.9	66.4	65.0		65.7	66.4	65.4	
Average	66.2	67.0	65.2		66.0	66.3	65.6	
+/-	0.6 / 0.4	1.0 / 0.6	0.3 / 0.3	/	0.6 / 0.3	0.3 / 0.4	0.3 / 0.2	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
11.203*	.152	16.8	4020	2.6	67.4	3514	-1.6	+25	67.1	3514	-1.6	0
11.204*	.151	16.9	3990	-3.0	68.1	3632	-3.0	+25	66.4	3577	-5.8	0
11.205	.152	16.9	3685	0.5	67.7	3678	1.9	+25	66.3	3685	1.2	+25
11.206	.149	16.8	3685	1.2	68.6	3818	9.6	+25	68.1	3777	7.5	0
11.207	.150	16.8	3635	0.5	67.5	3599	1.2	+25	66.3	3449	3.7	0
Average	.151	16.8	3718	0.7	67.9	3648	1.6	--	66.8	3600	1.0	--
+/-	.001 / .002	0.1 / 0.0	117 / 83	3.3 / 3.7	0.7 / 0.5	170 / 134	10.2 / 4.6	-- / --	1.3 / 0.5	177 / 151	6.5 / 6.8	-- / --

TEST VEHICLE: #011

Chevrolet Chevette
4-Speed Manual
L4-85 CID
57 bhp @ 5200 RPM

TEST CONDITION: 1M

Mic Distance ~ 50 ft.

TEST DATE: 6/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
11.203	67.1	66.8	67.4		66.1	67.1	66.2	
11.204	67.2	67.9	68.1		65.5	66.4	65.8	
11.205	67.1	66.8	67.7		66.0	66.2	66.3	
11.206	67.7	68.4	68.6		66.7	68.1	67.7	
11.207	67.0	67.1	67.5		65.0	66.3	65.8	
Average	67.2	67.4	67.9		65.9	66.8	66.4	
+/-	0.5 / 0.2	1.0 / 0.6	0.7 / 0.5		0.8 / 0.9	1.3 / 0.6	1.3 / 0.6	

RUN #	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Vehicle Position at Max Sound Level	Mic. Pos. in feet
13.36	.144	2686	-	-5.4					66.3	2819	-5.4	-25
13.38	.143	2684	-	7.9					65.7	2769	4.4	+25
13.39	.162	2676	-	-0.5					65.8	2787	-4.0	0
13.41	.138	2684	-	3.7					65.3	2762	3.0	0
Average	.147	2683	-	1.4					65.8	2784	-0.5	-
+/-	.015 / .009	3 / 7		6.8 / 6.5					0.5 / 0.5	35 / 22	4.9 / 4.9	- / -

TEST VEHICLE: #013

Pontiac Firebird
4-Speed Manual
V8 - 301 CID
135 bhp @ 4000 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 4/27/77

RUN #	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
13.36					66.3	65.6	64.5	
13.38					65.2	65.5	65.7	
13.39					65.5	65.8	65.0	
13.41					64.9	65.3	64.8	
Average					65.5	65.6	65.0	
+/-					0.8 / 0.6	0.2 / 0.3	0.7 / 0.5	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
14.208	.121	2070	27.3	-3.7	67.4	24.7	- 7.2	0	68.0	24.7	-7.2	0
14.209	.118	1940	25.4	-1.6	67.7	24.5	- 7.9	0	69.0	24.9	-2.3	0
14.210	.118	2007	26.4	-2.3	67.6	25.0	-2.3	-25	67.9	25.0	-2.3	-25
14.211	.121	1991	26.1	-0.2	67.1	25.0	+2.6	-25	68.4	24.0	-7.9	0
Average	.120	2002	26.3	-2.0	67.5	24.8	-3.7	--	68.4	24.7	-4.9	--
+/-	.001 / .002	68 / 62	1.0 / 0.9	1.7 / 1.8	0.2 / 0.4	0.2 / 0.3	6.3 / 4.0	-- / --	0.6 / 0.5	0.3 / 0.7	2.6 / 2.3	-- / --

TEST VEHICLE: #014

Ford Van E-350
3-Speed Automatic
V8-351 CID
168 bhp @ 3800 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 5/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
14.208	67.3	67.4	66.7		67.2	68.0	67.5	
14.209	67.4	67.7	66.2		67.6	69.0	67.6	
14.210	67.6	67.4	66.3		67.9	67.8	67.2	
14.211	67.1	67.1	66.1		67.3	68.4	67.5	
Average	67.4	67.4	66.3		67.5	68.3	67.5	
+/-	0.2 / 0.3	0.3 / 0.3	0.3 / 0.2	/	0.4 / 0.3	0.7 / 0.5	0.1 / 0.2	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
15.206	.137	16.2	2700	-3.0	69.9	2618	-5.1	-25	69.4	2700	- 0.2	+25
15.207	.156	16.2	2725	-7.2	70.9	2716	-3.7	-25	70.1	2679	1.2	+25
15.208	.169	16.2	2793	-7.2	71.5	2792	0.5	+25	70.3	2772	- 1.6	+25
15.209	.153	16.1	2789	-3.0	70.8	2793	6.8	+25	70.0	2593	15.9	+25
15.210	.155	16.2	2794	-3.0	70.6	2776	3.3	-25	70.0	2654	15.9	+25
Average	.154	16.2	2760	-4.7	70.7	2739	0.4	--	70.0	2680	6.2	--
+/-	.015 / .017	0.0 / 0.1	34 / 60	1.7 / 2.5	0.8 / 0.8	54 / 121	6.4 / 5.5	-- / --	0.3 / 0.6	92 / 87	9.7 / 7.8	-- / --

TEST VEHICLE: #015

Ford Pickup F-150
4-Speed Manual (w/FWD)
V8-351 CID
168 bhp @ 3800 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 5/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
15.206	69.9	69.8	69.3		67.6	68.9	69.1	
15.207	70.9	70.0	69.7		67.5	69.6	70.1	
15.208	70.9	70.7	71.5		69.7	69.9	70.3	
15.209	70.3	70.6	70.8		68.7	68.9	70.0	
15.210	70.6	70.5	70.2		69.1	69.3	70.0	
Average	70.5	70.3	70.3		68.5	69.3	69.9	
+/-	0.4 / 0.6	0.4 / 0.5	1.2 / 0.9	/	1.2 / 1.0	0.6 / 0.4	0.4 / 0.8	/

RUN#	Accel at 10D RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
16.36	.149	2114	20.8	- 7.0					66.0	1938	-29.4	-25
16.37	.143	2112	20.6	- 8.4					65.9	1948	-28.0	-25
16.39	.148	2114	20.7	- 9.1					65.6	1935	-30.8	-25
16.40	.142	2120	20.7	- 6.3					65.5	2073	-11.2	-25
Average	.146	2115	20.7	- 7.7					65.8	1974	-24.9	-
+/-	.003 / .004	5 / 3	0.1 / 0.1	1.4 / 1.4					0.2 / 0.3	99 / 39	13.7 / 5.9	

TEST VEHICLE: #016

Chevrolet Pickup
3-Speed Automatic
V8 - 350 CID
165 bhp @ 3800 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 5/2/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
16.36					66.0	65.7	65.0	
16.37					65.9	65.2	64.9	
16.39					65.6	65.3	65.0	
16.40					65.5	65.5	65.0	
Average					65.8	65.4	65.0	
+/-					0.2 / 0.3	0.3 / 0.2	0.0 / 0.1	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
18.305	.147	2171	23.5	-5.1	62.0	2171	-4.4	0	62.4	2118	-10.0	0
18.307	.149	2136	23.0	-1.6	61.5	2099	-3.0	0	63.8	2057	-10.7	-25
18.308	.145	2125	22.9	7.3	60.9	2125	7.3	0	61.7	2035	- 2.5	-25
18.310	.143	2312	23.0	4.0	62.2	2254	5.4	-25	62.4	2038	- 7.2	-25
18.311	.150	2168	23.2	3.8	63.3	2158	5.2	0	63.8	2168	3.8	0
Average	.147	2182	23.1	2.1	62.0	2161	2.1	--	62.8	2083	- 5.3	--
+/-	.003 / .004	130 / 57	0.4 / 0.2	5.2 / 7.2	1.3 / 1.1	93 / 62	5.2 / 6.5	-- / --	1.0 / 1.1	85 / 48	9.1 / 5.4	-- / --

TEST VEHICLE: #018

Buick Skylark
3-Speed Automatic
V6-231 CID
105 bhp @ 3200 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 6/13/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
18.305	60.8	62.0	59.9		61.8	62.4	60.3	
18.307	61.0	61.5	59.7		63.8	62.2	60.4	
18.308	60.6	60.9	59.9		61.7	61.3	61.2	
18.310	62.2	61.3	60.2		62.4	62.0	61.6	
18.311	63.2	63.3	61.4		63.2	63.8	62.3	
Average	61.6	61.8	60.2		62.6	62.3	61.2	
+/-	1.6 / 1.0	1.5 / 0.9	1.2 / 0.5	/	1.2 / 0.9	1.5 / 1.0	1.1 / 0.9	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
18.352	.145	2265	24.7	-0.4	71.8	2219	-6.0	-25	71.4	2231	-3.2	+25
18.353	.153	2293	25.1	-0.4	73.5	2282	-1.1	0	72.2	2249	-3.2	-25
18.354	.154	2290	25.2	-2.5	71.2	2234	-9.5	0	71.3	2271	-3.9	+25
18.355	.147	2367	25.9	-0.4	71.4	2284	-1.1	0	70.7	2271	-3.5	0
Average	.150	2304	25.2	-0.9	72.0	2255	-4.4	--	71.4	2256	-3.5	--
+/-	.004 / .005	63 / 39	0.7 / 0.5	0.5 / 1.6	1.5 / 0.8	29 / 36	3.3 / 5.1	-- / --	0.8 / 0.7	15 / 25	0.3 / 0.4	-- / --

TEST VEHICLE: #018

Buick Skylark
3-Speed Automatic
V6-231 CID
105 bhp @ 3200 RPM

TEST CONDITION: 1A (F)

Mic Distance - 50 ft.

TEST DATE: 6/13/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
18.352	71.6	70.9	70.3		69.9	70.5	71.4	
18.353	70.9	73.5	69.9		72.2	71.0	70.9	
18.354	70.5	71.2	70.1		70.4	70.7	71.3	
18.355	71.2	71.8	70.1		70.6	70.7	71.2	
Average	71.1	71.9	70.1		70.8	70.7	71.2	
+/-	0.5 / 0.6	1.6 / 1.0	0.2 / 0.2	/	1.4 / 0.9	0.3 / 0.2	0.2 / 0.3	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
19.205	.150	3360	19.1	-0.2	69.2	3090	-18.4	-25	66.4	3336	- 3.0	0
19.206	.153	3321	18.8	-2.3	68.9	3097	-16.3	-25	66.1	3290	- 1.6	0
19.207	.151	3368	19.0	0.5	69.1	3083	-16.3	-25	66.2	3368	3.3	0
19.208	.155	3297	18.6	-3.0	69.2	3133	2.6	0	66.0	3278	- 1.6	0
Average	.152	3337	18.9	-1.3	69.1	3101	-12.1	--	66.2	3318	- 0.7	--
+/-	.003 / .003	31 / 40	0.2 / 0.3	1.8 / 1.7	0.1 / 0.2	32 / 18	14.7 / 6.3	-- / --	0.2 / 0.2	50 / 40	4.0 / 2.3	-- / --

TEST VEHICLE: #019

Chevrolet Chevette
3-Speed Automatic
L4-97.6 CID
63 bhp @ 4800 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 6/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
19.205	69.2	69.1	68.3		65.5	66.4	64.9	
19.206	68.9	68.8	68.5		65.4	66.1	64.7	
19.207	69.1	68.9	68.0		65.7	66.2	65.1	
19.208	69.0	69.2	68.3		65.2	66.0	64.7	
Average	69.1	69.0	68.3		65.5	66.2	64.9	
+/-	0.1 / 0.2	0.2 / 0.2	0.2 / 0.3	/	0.2 / 0.3	0.2 / 0.2	0.2 / 0.2	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
19.209	.117	2893	25.8	-4.4	68.1	24.9	- 5.8	-25	64.2	25.2	-0.9	-25
19.210	.120	2897	25.5	-3.0	68.5	24.7	- 6.5	-25	64.3	25.1	-0.9	0
19.211	.122	2900	25.9	2.6	68.1	24.1	-10.2	-25	64.0	25.5	9.6	-25
19.212	.121	2900	25.8	-1.6	68.2	24.9	- 2.3	-25	64.6	24.9	-3.7	0
Average	.120	2898	25.8	-1.6	68.2	24.7	- 6.3	--	64.3	25.2	1.0	--
+/-	.002 / .001	2 / 5	0.1 / 0.3	4.2 / 2.8	0.3 / 0.1	0.2 / 0.5	4.0 / 4.4	-- / --	0.3 / 0.3	0.3 / 0.3	8.6 / 4.7	-- / --

TEST VEHICLE: #019

Chevrolet Chevette
3-Speed Automatic
L4-97.6 CID
63 bhp @ 4800 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 6/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
19.209	68.1	67.8	66.5		64.2	64.0	63.5	
19.210	68.5	68.0	66.5		64.1	64.3	63.7	
19.211	68.1	68.0	67.1		64.0	63.7	63.7	
19.212	68.2	67.6	66.5		64.5	64.6	64.5	
Average	68.2	67.9	66.7		64.2	64.2	63.9	
+/-	0.3 / 0.1	0.1 / 0.3	0.4 / 0.2	/	0.3 / 0.2	0.4 / 0.5	0.6 / 0.4	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
20.204	.152	18.8	4013	-5.8	67.7	3965	2.6	0	69.1	3965	2.6	+25
20.205	.158	18.8	3973	-0.2	68.0	3968	4.7	+25	69.0	3953	5.4	+25
20.206	.156	18.8	3968	1.2	67.8	3949	5.2	-25	69.2	3931	4.0	+25
20.207	.155	18.8	3982	0.5	68.0	3960	4.7	0	69.7	3953	8.2	+25
Average	.155	18.8	3982	-1.1	67.9	3961	4.3	--	69.3	3951	5.1	--
+/-	.003 / .003	0.0 / 0.0	29 / 16	2.3 / 4.5	0.1 / 0.2	7 / 12	0.9 / 0.7	-- / --	0.4 / 0.3	14 / 20	3.1 / 2.5	-- / --

TEST VEHICLE: #020

VW Rabbit
4-Speed Manual
L4-97 CID
78 bhp @ 5500 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 5/23/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
20.204	67.6	67.7	67.4		67.7	68.4	69.1	
20.205	67.3	67.8	68.0		67.9	68.6	69.0	
20.206	67.8	67.1	67.0		67.9	67.6	69.2	
20.207	67.7	68.0	66.9		68.0	67.8	69.7	
Average	67.6	67.7	67.3		67.9	68.1	69.3	
+/-	0.2 / 0.3	0.3 / 0.6	0.7 / 0.4	/	0.1 / 0.2	0.5 / 0.5	0.4 / 0.3	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
22.307	.152	16.9	4703	1.0	67.8	4151	- .4	-25	66.6	4086	-1.8	-25
22.308	.151	16.9	4710	6.6	68.3	4204	6.6	-25	66.3	4204	6.6	-25
22.309	.155	17.0	4572	4.5	67.3	4083	.3	-25	66.3	4202	4.5	-25
22.310	.154	16.9	4431	-1.1	67.6	4108	-3.2	-25	66.7	4190	-3.2	-25
22.311	.157	16.9	4438	- .8	67.6	4202	- .8	-25	66.8	4202	- .8	-25
22.312	.156	16.9	4392	-2.5	67.3	4211	-2.5	-25	66.8	4185	3.2	-25
Average	.154	16.9	4541	1.3	67.7	4160	0	--	66.6	4178	1.4	--
+/-	.003 / .003	0.1 / 0.0	169 / 149	5.3 / 3.8	0.6 / 0.4	51 / 77	6.6 / 3.2	-- / --	0.2 / 0.3	26 / 92	5.2 / 4.6	-- / --

TEST VEHICLE: #022

Fiat X 1/9
4-Speed Manual
L4-78.7 CID
62 bhp @ 5800 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 6/20/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
22.307	67.8	67.5	65.7		66.6	64.9	64.2	
22.308	68.3	67.0	65.4		66.3	64.6	65.7	
22.309	67.3	66.9	65.2		66.3	64.3	64.2	
22.310	67.6	66.8	64.5		66.7	64.2	64.4	
22.311	67.6	66.9	64.8		66.8	64.7	64.0	
22.312	67.3	66.7	64.6		66.8	65.1	63.8	
Average	67.7	67.0	65.0		66.6	64.6	64.4	
+/-	0.6 / 0.4	0.5 / 0.3	0.7 / 0.5	/	0.2 / 0.3	0.5 / 0.4	1.3 / 0.6	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
22.313	.151	17.1	4315	1.7	67.9	4199	1.7	-25	67.3	4107	-1.8	-25
22.314	.148	16.9	4399	-3.2	68.6	4189	-3.2	-25	67.0	4156	-3.9	-25
22.315	.151	17.0	4267	1.0	68.0	4160	- .4	-25	67.1	4209	-1.0	-25
22.316	.148	16.9	4268	1.0	67.9	4208	1.0	-25	66.9	4187	- .7	-25
Average	150	17.0	4337	0.1	68.1	4189	- .2	--	67.1	4165	-0.9	--
+/-	.001 / .002	0.1 / 0.1	62 / 70	1.6 / 3.3	0.5 / 0.2	19 / 29	1.9 / 2.8	-- / --	0.2 / 0.2	44 / 58	0.9 / 2.0	-- / --

TEST VEHICLE: #022

Fiat X1/9
4-Speed Manual
L4-78.7 CID
62 bhp @ 5800 RPM

TEST CONDITION: 1M (F)

Mic Distance - 50 ft.

TEST DATE: 6/20/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
22.313	67.9	67.6	65.5		67.3	65.0	65.0	
22.314	68.6	67.4	64.6		67.0	64.6	64.6	
22.315	68.0	67.4	65.5		67.1	64.7	64.7	
22.316	67.9	66.3	64.7		66.9	65.0	65.8	
Average	68.1	67.2	65.1		67.1	64.8	65.0	
+/-	0.5 / 0.2	0.4 / 0.9	0.4 / 0.5	/	0.2 / 0.2	0.2 / 0.2	0.8 / 0.4	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
23.318	.159	19.9	4486	2.4	71.3	4182	1.0	-25	70.2	4196	2.4	-25
23.319	.154	20.0	4399	3.8	71.5	4114	0.3	-25	70.4	4119	-0.4	-25
23.320	.157	19.8	4356	2.4	71.5	4122	-0.4	-25	69.9	4098	-1.8	-25
23.321	.157	19.8	4508	0.3	70.5	4190	0.3	-25	70.0	4096	-3.2	-25
Average	.157	19.9	4437	2.2	71.2	4152	0.3	--	70.2	4127	-0.8	--
+/-	.002 / .003	0.1 / 0.1	71 / 81	1.6 / 1.9	0.3 / 0.7	38 / 38	0.7 / 0.7	-- / --	0.2 / 0.3	69 / 31	3.2 / 2.4	-- / --

TEST VEHICLE: #023

Fiat 128
4-Speed Manual
L4-78.7 CID
62 bhp @ 6000 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 6/17/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
23.318	71.3	69.8	69.2		70.2	67.5	68.3	
23.319	71.5	69.8	68.8		70.4	67.1	68.9	
23.320	71.5	69.6	68.9		69.9	66.7	68.1	
23.321	70.5	69.7	68.7		70.0	67.0	68.7	
Average	71.2	69.7	68.9		70.1	67.1	68.5	
+/-	0.3 / 0.7	0.1 / 0.1	0.3 / 0.2		0.3 / 0.2	0.4 / 0.4	0.4 / 0.4	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
23.322	.143	20.0	4455	6.6	70.6	4074	1.4	-25	70.0	4208	6.6	-25
23.323	.150	20.0	4498	-0.4	70.2	4108	-4.6	-25	69.9	4108	-4.6	-25
23.324	.148	19.9	4411	0.3	70.8	4151	-1.8	-25	70.1	4151	-1.8	-25
23.325	.146	19.9	4426	0.3	71.0	4160	-1.1	-25	69.8	4199	0.3	-25
Average	.147	20.0	4448	1.7	70.7	4123	-1.5	--	70.0	4167	0.1	--
+/-	.003 / .004	0 / 0.1	50 / 37	4.9 / 2.1	0.3 / 0.5	37 / 49	2.9 / 3.1	-- / --	0.1 / 0.2	41 / 59	6.6 / 4.7	-- /

TEST VEHICLE: #023

Fiat 128
4-Speed Manual
L4-78.1 CID
62 bhp @ 6000 RPM

TEST CONDITION: 1M (F)

Mic Distance - 50 ft.

TEST DATE: 6/17/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
23.322	70.6	70.0	69.3		70.0	67.3	68.7	
23.323	70.2	69.7	68.1		69.7	66.9	67.6	
23.324	70.8	69.9	69.1		70.1	66.7	68.6	
23.325	71.0	69.6	69.0		69.8	67.2	68.3	
Average	70.7	69.8	68.9		69.9	67.0	68.3	
+/-	0.3 / 0.5	0.2 / 0.2	0.4 / 0.7	/	0.2 / 0.1	0.3 / 0.3	0.4 / 0.7	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
24.308*	.153	16.9	3156	+1.0	75.1	3141	-0.4	-16.4	75.1	3136	+0.3	-16.4
24.309**	.151	16.9	3155	+3.8	78.8	2977	-3.9	+16.4	77.4	3155	+3.8	-16.4
24.310**	.146	17.0	3146	+2.4	78.7	3131	+1.7	+16.4	77.8	3131	+1.7	-16.4
24.312*	.141	17.1	3153	+1.7	74.7	3110	-1.1	-16.4	75.3	3088	-1.8	-16.4
Average	.148	17.0	3153	2.2	76.8	3090	-0.9	-	76.4	3128	1.0	
+/-	.005 / .007	0.1 / 0.1	3 / 7	1.6 / 1.2	2.0 / 2.1	51 / 113	2.6 / 3.0		1.4 / 1.3	27 / 40	2.8 / 2.8	
*Ave.2 Runs	.147	17.0	3155	1.4	74.9	3126	-0.7		75.2	3112	-0.7	
+/-	.006 / .006	0.1 / 0.1	1 / 2	0.3 / 0.4	0.2 / 0.2	15 / 16	0.3 / 0.4		0.1 / 0.1	24 / 24	1.0 / 1.1	

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
24.308*	75.1	73.7	72.5		75.1	75.0	71.5	
24.309	76.6	77.2	78.8		77.4	76.7	75.8	
24.310	76.6	76.6	78.7		76.8	76.9	75.2	
24.312*	74.7	74.2	72.8		75.3	75.1	71.4	
Average	75.8	75.4	75.2		76.4	75.9	73.5	
+/-	0.8 / 1.1	1.3 / 1.7	3.6 / 2.7		1.4 / 1.3	1.0 / 0.9	2.3 / 2.1	
*Ave. 2 Runs	74.9	74.0	72.7		75.2	75.1	71.5	
+/-	0.2 / 0.2	0.2 / 0.3	0.1 / 0.2		0.1 / 0.1	0.0 / 0.1	0.0 / 0.1	

TEST VEHICLE: #024

Peugeot 504D
4-Speed Manual
L4 - 141 CID (Diesel)
71 bhp @ 4500 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 7/26/77

** Electric clutch fan on.

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
24.308 *	.153	16.9	3156	+1.0	68.6	3156	+1.0	0	72.4	3136	+0.3	+25
24.309 **	.151	16.9	3155	+3.8	73.1	3155	+3.8	+25	72.4	3085	+1.0	+25
24.310 **	.146	17.0	3146	+2.4	73.5	3146	+2.4	+25	73.2	3110	+1.0	+25
24.311 *	.141	17.1	3153	+1.7	68.6	3153	+1.7	0	69.7	3153	+1.7	0
Average	.148	17.0	3153	2.2	71.0	3153	2.2		71.9	3121	1.0	
+/-	.005 / .007	0.1 / 0.1	3 / 7	1.6 / 1.2	2.5 / 2.4	3 / 7	1.6 / 1.2		1.3 / 2.2	32 / 36	0.7 / 0.7	
*Ave. 2 Runs	.147	17.0	3155	1.4	68.6	3155	21.4		69.4	3155	1.4	
+/-	.006 / .006	0.1 / 0.1	2 / 1	0.4 / 0.3	0.0 / 0.0	2 / 1	0.4 / 0.3		0.4 / 0.3	2 / 1	0.4 / 0.3	

TEST VEHICLE: #024

Peugeot 504D
4-Speed Manual
L4 - 141 CID (Diesel)
71 bhp @ 4500 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 7/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
24.308 *		68.6	75.1			69.0	68.7	
24.309		72.4	73.1			70.6	72.4	
24.310		71.6	73.5			70.7	73.2	
24.311 *		68.6	67.7			69.7	68.7	
Average		70.3	70.6			70.0	70.8	
+/-		2.1 / 1.7	2.9 / 2.9			1.0 / 0.7	2.4 / 2.1	
*Ave. 2 Runs		68.6	68.6			69.4	68.7	
+/-		0.0 / 0.0	0.3 / 0.2			0.4 / 0.3	0.0 / 0.0	

** Electric clutch fan on.

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
24.313	.156	16.8	3141	-0.4	78.6	3141	-0.4	+16.4	77.2	3119	-1.1	0
24.214	.151	16.4	3155	+1.0	78.6	3131	+0.3	+16.4	77.1	3155	+1.0	-16.4
24.315	.138	17.0	3136	+0.3	79.2	3136	+0.3	+16.4	77.1	3117	-2.5	-16.4
24.316	.151	16.9	3141	+1.7	78.7	3141	+1.7	+16.4	77.6	3039	-3.2	-16.4
Average	.149	16.9	3143	0.7	78.8	3137	0.5		77.3	3108	-1.5	
+/-	.007 / .001	0.1 / 0	12 / 7.	1.0 / 1.1	0.4 / 0.2	4 / 5	1.2 / 0.9		0.3 / 0.2	47 / 69	2.5 / 1.7	

TEST VEHICLE: #024

Peugeot 504D
4-Speed Manual
L4 - 141 CID (Diesel)
71 bhp @ 4500 RPM

TEST CONDITION: 1M (F)

Mic Distance - 25 feet

TEST DATE: 7/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet		Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet	
24.313	76.6	76.7	78.6		76.7	77.2	74.6	
24.314	76.1	76.3	78.6		77.1	76.8	74.9	
24.315	77.0	77.1	79.2		77.1	76.9	75.4	
24.316	76.8	77.1	78.7		77.6	77.1	75.3	
Average	76.6	76.8	78.8		77.1	77.0	75.1	
+/-	0.4 / 0.5	0.3 / 0.5	0.4 / 0.2		0.5 / 0.4	0.2 / 0.2	0.3 / 0.5	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
24.313	.156	16.8	3141	-0.4	71.8	2854	-10.2	0	73.4	3093	-2.5	+25
24.314	.151	16.9	3155	+1.0	72.9	3155	+ 1.0	+25	72.8	3131	+0.3	+25
24.315	.138	17.0	3136	+0.3	73.5	3136	+ 0.3	+25	73.3	3136	+0.3	+25
24.316	.151	16.9	3141	+1.7	72.9	3141	+ 1.7	+25	73.5	3076	-1.8	+25
Average	.149	16.9	3143	0.7	72.8	3072	-1.8		73.3	3109	-0.9	
+/-	.007 / .011	0.1 / 0	12 / 7	1.0 / 1.1	1.0 / 0.7	13 / 18	3.5 / 8.4		0.2 / 0.5	2.7 / 33	1.2 / 0.9	

TEST VEHICLE: #024

Peugeot 504D
4-Speed Manual
L4 - 141 CID (Diesel)
71 bhp @ 4500 RPM

TEST CONDITION: 1M (F)

Mic Distance - 50 feet

TEST DATE: 7/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
24.313		71.8	71.7			70.8	73.4	
24.314		72.1	72.9			70.8	72.8	
24.315		72.1	73.5			70.7	73.3	
24.316		72.5	72.9			70.8	73.5	
Average		72.1	72.8			70.8	73.3	
+/-		0.4 / 0	0.7 / 1.1			0 / 0.1	0.2 / 0.5	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
25.309	.144	20.1	3849	+4.5	73.6	3835	+3.8	0	74.1	3830	+3.1	0
25.311	.163	20.1	3852	-3.2	73.6	3852	-3.2	-16.4	74.2	3825	-3.9	0
25.312	.160	20.0	3859	-3.2	74.1	3859	-3.2	0	74.5	3791	-5.3	0
25.313	.130	20.1	3852	+5.9	73.8	3852	+5.9	0	74.2	3845	+5.2	0
Average	.149	20.1	3853	1.0	73.8	3850	0.8		74.3	3823	-0.2	
-/+	.019 / .014	0.1 / 0	4 / 6	4.2 / 4.9	0.2 / 0.3	15 / 9	4.0 / 5.1		0.2 / 0.3	32 / 22	5.1 / 5.4	

TEST VEHICLE: #025

Triumph TR-7
5-Speed Manual
L4 - 122 CID
86 bhp @ 5500 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 7/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
25.309	73.2	73.6	73.5		--	74.1	71.5	
25.311	73.6	73.5	72.3		--	74.2	70.9	
25.312	73.8	74.1	73.0		--	74.5	71.1	
25.313	73.2	73.8	73.5		--	74.2	71.4	
Average	73.5	73.8	73.1			74.3	71.2	
-/+	0.3 / 0.4	0.3 / 0.4	0.8 / 0.4			0.2 / 0.3	0.3 / 0.3	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
25.309	.144	20.1	3849	+4.5	68.1	3830	+3.1	+25	68.2	3797	+1.0	0
25.311	.163	20.1	3852	-3.2	67.1	3763	-7.4	+25	67.2	3852	-3.2	+25
25.312	.160	20.0	3859	-3.2	67.3	3799	-6.0	+25	66.8	3791	-5.3	+25
25.313	.130	20.1	3852	+5.9	67.9	3845	+5.2	+25	67.9	3845	+5.2	+25
Average	.149	20.1	3853	1.0	67.6	3809	-1.3		67.5	3821	-0.6	
-/+	.019 / .014	0.1 / 0	4 / 6	4.2 / 4.9	0.5 / 0.5	46 / 36	6.1 / 6.5		0.7 / 0.7	30 / 31	4.7 / 5.8	

TEST VEHICLE: #025

Triumph TR-7
5-Speed Manual
L4 - 122 CID
86 bhp @ 5500 RPM

TEST CONDITION: .1M

Mic Distance - 50 feet

TEST DATE: 7/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
25.309		67.5	68.1			--	68.2	
25.311		66.8	67.1			--	67.2	
25.312		67.0	67.3			--	66.8	
25.313		67.9	67.9			--	67.9	
Average		67.3	67.6			--	67.5	
-/+		0.5 / 0.6	0.5 / 0.5				0.7 / 0.7	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
26.307	.170	3239	28.6	-2.5	71.4	24.7	-4.6	-16.4	71.8	25.0	-2.5	+16.4
26.308	.153	3368	27.7	+3.8	71.4	24.6	0.3	-16.4	71.3	24.4	-4.6	-16.4
26.309	.141	3244	28.4	+3.1	71.8	24.6	-1.8	-16.4	70.9	24.8	2.4	0
26.310	.154	3233	28.6	+3.8	71.7	24.8	+1.0	-16.4	70.9	24.6	-2.5	-16.4
Average	.155	3246	28.3	2.1	71.6	24.7	-1.3		71.2	24.7	-1.8	
+/-	.015 / .014	22 / 13	0.3 / 0.6	1.7 / 4.6	0.2 / 0.2	0.1 / 0.1	2.3 / 3.3		0.6 / 0.3	0.3 / 0.3	4.2 / 2.8	

TEST VEHICLE: #026

Jaguar XJ-12L
3-Speed Automatic
V12 - 326 CID
244 bhp @ 5250 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/3/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
26.307	71.4	70.4	69.2		70.8	71.8	68.7	
26.308	71.4	70.5	68.1		71.3	71.1	68.8	
26.309	71.8	70.5	69.6		70.5	70.9	68.5	
26.310	71.7	70.5	69.2		70.9	70.1	68.9	
Average	71.6	70.5	69.3		70.9	71.0	68.7	
+/-	0.2 / 0.2	0 / 0.1	0.3 / 0.2		0.4 / 0.4	0.8 / 0.9	0.2 / 0.2	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
26.307	.170	3239	28.6	-2.5	64.6	24.5	-7.4	0	65.0	25.0	-2.5	+15
26.308	.153	3368	27.7	+3.8	64.3	23.7	-10.9	0	65.3	24.9	+2.4	+15
26.309	.141	3244	28.4	+3.1	64.2	24.8	2.4	0	65.3	24.7	+1.0	+15
26.310	.154	3233	28.6	+3.8	64.5	24.7	0.3	0	65.3	26.0	3.8	0
Average	.155	3246	28.3	2.1	64.4	24.4	-3.4		65.2	24.9	1.2	
+/-	.015 / .014	22 / 13	0.3 / 0.6	1.7 / 4.6	0.2 / 0.2	0.4 / 0.7	6.3 / 7.0		0.1 / 0.2	0.1 / 0.2	2.6 / 3.7	

TEST VEHICLE: #026

Jaguar XJ - 12L
3-Speed Automatic
V12 - 326 CID
244 bhp @ 5250 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/3/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
26.307		64.6	64.2			64.5	65.0	
26.308		64.3	64.1			65.1	65.3	
26.309		64.1	63.8			65.1	65.3	
26.310		64.5	64.3			65.3	65.2	
Average		64.4	64.1			65.0	65.2	
+/-		0.2 / 0.2	0.2 / 0.3			0.3 / 0.5	0.1 / 0.2	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
27.313	.123	1674	27.7	+7.3	68.1	1661	1.7	-16.4	66.7	1674	0.3	0
27.314	.122	1658	27.7	+5.9	67.6	1644	-8.1	0	67.1	1656	5.2	0
27.315	.121	1675	28.1	+1.7	67.7	1655	-10.2	0	67.5	1648	-8.1	0
27.316	.122	1666	27.9	+4.5	67.6	1631	-14.4	-16.4	66.6	1643	-7.4	0
Average	.122	1668	27.9	4.9	67.8	1648	-7.8		67.0	1655	-2.5	
+/-	0.001 / 0.001	7 / 10	0.2 / 0.2	2.4 / 3.2	0.4 / 0.2	13 / 17	9.5 / 1.7		0.5 / 0.4	19 / 12	7.7 / 5.6	

TEST VEHICLE: #027

Mercury Cougar
3-Speed Automatic
V8 - 302 CID
130 bhp @ 3400 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 8/5/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
27.313	68.1	67.7	66.8		66.1	66.7	65.9	
27.314	67.1	67.6	66.6		66.5	67.1	65.8	
27.315	67.4	67.7	66.0		66.9	67.5	66.2	
27.316	67.6	67.3	66.4		66.3	66.6	65.3	
Average	67.6	67.6	66.5		66.5	67.0	65.8	
+/-	0.5 / 0.5	0.1 / 0.3	0.7 / 0.5		0.4 / 0.4	0.5 / 0.4	0.4 / 0.5	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
27.313	.123	1674	27.7	+7.3	61.5	1661	1.7	+25	61.4	1674	7.3	
27.314	.122	1658	27.7	+5.9	61.4	1667	3.8	+25	62.0	1663	4.5	
27.315	.121	1675	28.1	+1.7	61.9	1648	-8.1	0	62.3	1675	1.7	
27.316	.122	1666	27.9	+4.5	61.9	1666	2.4	+25	61.4	1654	3.1	
Average	.122	1668	27.9	4.9	61.7	1661	-0.1		61.8	1667	4.2	
+/-	0.001 / 0.001	7 / 10	0.2 / 0.2	2.4 / 3.2	0.2 / 0.3	8 / 13	3.9 / 5.0		0.5 / 0.4	8 / 13	3.2 / 2.5	

TEST VEHICLE: #027

Mercury Cougar
3-Speed Automatic
V8 - 302 CID
130 bhp @ 3400 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/5/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
27.313		61.4	61.5			60.6	61.4	
27.314		61.3	61.4			61.0	62.0	
27.315		61.9	61.6			61.1	62.3	
27.316		61.3	61.9			60.6	61.4	
Average		61.5	61.6			60.8	61.8	
+/-		0.4 / 0.2	0.3 / 0.2			0.3 / 0.2	0.5 / 0.4	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
28.306	.150	2338	24.0	2.4	72.3	2332	+0.3	0	71.4	2332	0.3	0
28.307	.152	2368	24.1	1.0	72.0	2355	-1.8	0	71.5	2314	-8.1	-16.4
28.308	.132	2216	22.7	-9.5	70.7	2211	-10.9	-16.4	70.4	2195	-15.1	-16.4
28.213	.145	2307	23.6	-4.6	71.5	2302	-6.0	-16.4	71.0	2300	-6.7	-16.4
Average	.145	2307	23.6	-2.7	71.6	2300	-4.9		71.1	2285	-7.4	
+/-	.007 / .003	61 / 91	0.5 / 0.9	5.1 / 6.8	0.7 / 0.9	55 / 89	4.9 / 6.3		0.4 / 0.7	47 / 90	7.7 / 7.7	

TEST VEHICLE: #028

Mercedes Benz 450 SEL
3-Speed Automatic
V8-276 CID
180 bhp @ 4750 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/1/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
28.306	72.0	72.3	69.9		71.1	71.4	69.5	
28.307	71.9	72.0	70.4		71.5	71.1	68.9	
28.308	70.7	70.0	67.3		70.4	69.3	67.1	
28.312	71.5	70.5	68.9		71.0	70.4	68.2	
Average	71.5	71.2	69.1		71.0	70.6	68.4	
+/-	0.5 / 0.8	1.1 / 1.2	1.3 / 1.8		0.5 / 0.6	0.9 / 1.3	1.1 / 1.3	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
28.306	.150	2338	24.0	2.4	66.2	2332	-1.8	0	66.4	2335	+1.7	+25
28.307	.152	2368	24.1	1.0	65.9	2366	-0.4	0	66.0	2366	-0.4	+25
28.308	.132	2216	22.7	-9.5	64.7	2216	-9.5	0	65.0	2216	-9.5	0
28.312	.145	2307	23.6	-4.6	65.5	2300	-6.7	0	65.6	2294	-8.1	0
Average	.145	2307	23.6	-2.7	65.6	2304	-4.6		65.8	2303	-4.1	
+/-	.007 / .003	61 / 91	0.5 / 0.9	5.1 / 6.8	0.6 / 0.9	62 / 88	4.2 / 4.9		0.7 / 0.8	63 / 87	5.8 / 5.4	

TEST VEHICLE: #028

Mercedes Benz 450 SEL
3-Speed Automatic
V8 - 276 CID
180 bhp @ 4700 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/1/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
28.306		66.2	64.9			65.5	66.4	
28.307		65.9	64.8			65.8	66.0	
28.308		64.7	63.4			65.0	64.2	
28.312		65.5	63.9			65.6	65.5	
Average		65.6	64.3			65.5	65.5	
+/-		0.6 / 0.9	0.7 / 0.9			0.3 / 0.5	0.9 / 1.3	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
29.303	.146	2108	20.1	6.6	64.0	2108	6.6	0	63.5	2101	5.9	+25
29.304	.152	2104	19.9	-1.1	63.2	2080	-3.9	0	62.9	2021	-8.8	-25
29.305	.150	2090	19.8	-1.8	63.9	2077	-2.5	0	63.1	2064	-3.9	+25
29.306	.147	2077	19.8	-1.1	63.9	2082	-1.8	0	63.2	1985	-10.9	-25
Average	.149	2095	19.9	0.7	63.8	2087	- .4	--	63.2	2043	-4.4	--
+/-	.003 / .003	13 / 18	0.2 / 0.1	5.9 / 2.5	0.2 / 0.6	21 / 10	7.0 / 3.5	-- / --	0.3 / 0.3	58 / 58	10.3 / 6.5	-- / --

TEST VEHICLE: #029

Dodge Aspen
3 Speed Automatic
L6-225 CID
100 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic. Distance - 50 ft.

TEST DATE: 6/23/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
29.303	63.0	64.0	63.1		63.0	63.0	63.5	
29.304	62.9	63.2	62.8		62.9	62.6	62.7	
29.305	62.8	63.9	62.5		63.0	62.5	63.1	
29.306	63.2	63.9	62.7		63.2	62.5	62.7	
Average	63.0	63.8	62.8		63.0	62.7	63.0	
+/-	0.2 / 0.2	0.2 / 0.6	0.3 / 0.3		0.2 / 0.1	0.3 / 0.2	0.5 / 0.3	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
29.316	.123	1800	25.4	-3.2	63.2	23.6	-19.3	-25	62.9	24.6	- 7.4	-25
29.317	.126	1818	26.0	-3.2	63.3	24.8	- 4.6	0	62.6	24.7	- 6.3	-25
29.318	.125	1812	25.9	2.4	63.9	24.8	- 0.4	0	62.4	23.2	-20.7	-25
29.319	.121	1816	26.5	3.1	63.9	24.9	.2.4	0	62.3	22.8	- 2.5	-25
Average	.124	1812	26.0	-0.2	63.6	24.5	- 5.5	--	62.6	23.8	- 9.2	--
+/-	.002 / .003	16 / 12	0.5 / 0.6	3.3 / 3.0	0.3 / 0.4	0.4 / 0.9	7.9 / 13.8	-- / --	0.3 / 0.3	0.9 / 1.0	6.7 / 11.5	-- / --

TEST VEHICLE: #029

Dodge Aspen
3-Speed Automatic
L6-225 CID
100 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 6/23/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at -25 feet	
29.316	63.2	63.1	62.4		62.9	61.9	61.7	
29.317	63.1	63.3	62.2		62.6	62.1	62.2	
29.318	63.3	63.9	62.5		62.4	62.1	61.8	
29.319	63.1	63.9	62.1		62.4	62.2	61.8	
Average	63.2	63.6	62.3		62.6	62.1	61.9	
+/-	0.1 / 0.1	0.3 / 0.5	0.2 / 0.2	/	0.3 / 0.2	0.1 / 0.2	0.3 / 0.2	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
30.306	.151	1835	21.9	4.7	65.1	1826	6.1	-25	65.1	1779	8.2	25
30.309	.145	1833	21.9	3.8	64.7	1818	-0.4	-25	63.7	1812	4.5	25
30.310	.148	1826	21.9	3.3	64.4	1809	-0.2	0	63.4	1812	-0.9	25
30.311	.148	1819	21.6	4.0	64.7	1802	6.1	0	64.0	1802	6.1	25
Average	.148	1828	21.8	4.0	64.7	1814	2.9	--	64.1	1801	4.5	--
+/-	0.003 / 0.003	7 / 9	0.1 / 0.2	0.7 / 0.7	0.4 / 0.3	12 / 12	3.2 / 3.3	-- / --	1.0 / 0.7	11 / 22	3.7 / 5.4	-- / --

TEST VEHICLE: #030

Chrysler Cordoba
3-Speed Automatic
V8-400 CID
190 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 6/15/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
30.306	65.1	64.5	64.7		63.7	63.1	65.1	
30.309	64.7	64.2	63.9		63.3	62.7	63.7	
30.310	64.3	64.4	63.0		63.3	62.3	63.4	
30.311	64.2	64.7	64.0		63.5	62.7	64.0	
Average	64.6	64.5	63.9		63.5	62.7	64.1	
+/-	0.5 / 0.4	0.2 / 0.3	0.8 / 0.9	/	0.2 / 0.2	0.4 / 0.4	1.0 / 0.7	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
30.319	.147	1855	22.2	-1.8	67.8	1797	- 9.5	0	66.5	1829	3.1	25
30.320	.156	1885	22.6	3.1	67.7	1838	- 3.9	0	67.3	1873	3.8	25
30.321	.152	1871	22.7	2.4	68.1	1793	-14.4	0	67.2	1846	-3.2	25
30.322	.142	1837	22.2	-2.5	67.9	1801	-10.2	0	66.5	1729	3.1	25
Average	.149	1862	22.4	0.3	67.9	1807	- 9.5	--	66.9	1819	1.7	--
+/-	.007 / .007	23 / 25	0.3 / 0.2	2.8 / 2.8	0.2 / 0.2	31 / 14	5.6 / 4.9	-- / --	0.4 / 0.4	54 / 90	2.1 / 4.9	-- / --

TEST VEHICLE: #030

Chrysler Cordoba
3-Speed Automatic
V8-400 CID
190 bhp @ 3600 RPM

TEST CONDITION: 1A (F)

Mic Distance - 50 ft.

TEST DATE: 6/15/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
30.319	66.7	67.8	66.6		65.9	65.8	66.5	
30.320	67.1	67.7	66.4		66.6	66.0	67.3	
30.321	67.4	68.1	67.0		65.9	66.2	67.2	
30.322	67.3	67.9	66.8		66.0	65.3	66.5	
Average	67.1	67.9	66.7		66.1	65.8	66.9	
+/-	0.3 / 0.4	0.2 / 0.2	0.3 / 0.3	/	0.5 / 0.2	0.4 / 0.5	0.4 / 0.4	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
31.305	.150	1932	19.9	7.3	68.1	1827	-5.3	0	68.4	1818	- 6.0	0
31.306	.157	1954	20.0	-0.4	68.7	1935	-1.8	0	69.7	1935	- 1.8	0
31.307	.148	1910	19.6	-0.4	68.4	1910	-0.4	0	68.7	1897	- 2.5	0
31.308	.146	1885	19.2	-1.8	68.5	1885	-1.8	0	68.8	1835	- 1.8	0
Average	.150	1920	19.7	1.2	68.4	1889	-2.3	--	68.9	1884	- 1.8	--
+/-	.007 / .004	34 / 35	0.3 / 0.5	6.1 / 3.0	0.2 / 0.3	46 / 62	1.9 / 3.0	-- / --	0.8 / 0.5	51 / 66	1.2 / 3.0	-- / --

TEST VEHICLE: #031

AMC Gremlin
3-Speed Automatic
L6-232 CID
88 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 25 ft.

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
31.305	67.3	68.1	67.3		67.1	68.4	66.2	
31.306	68.3	68.7	68.5		68.3	69.7	67.7	
31.307	67.9	68.4	68.4		67.8	68.7	67.1	
31.308	67.3	68.5	67.6		67.5	68.8	67.2	
Average	67.7	68.4	68.0		67.7	68.9	67.1	
+/-	0.6 / 0.4	0.3 / 0.3	0.5 / 0.7		0.6 / 0.6	0.8 / 0.5	0.6 / 0.9	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
31.305	.150	1932	19.9	7.3	62.3	1799	- 6.7	0	62.7	1827	- 5.3	+25
31.306	.157	1954	20.0	-0.4	63.7	1925	- 3.2	+25	64.1	1935	- 1.8	+25
31.307	.148	1910	19.6	-0.4	62.6	1871	- 3.9	+25	63.6	1894	- 3.2	+25
31.308	.146	1885	19.2	-1.8	62.0	1821	-10.2	0	64.2	1885	- 1.8	+25
Average	.150	1920	19.7	1.2	62.7	1854	- 6.0	--	63.7	1885	- 3.0	--
+/-	.007 / .004	34 / 35	0.3 / 0.5	6.1 / 3.0	1.0 / 0.7	71 / 55	2.9 / 4.2	-- / --	0.5 / 1.0	50 / 68	1.2 / 2.3	-- / --

TEST VEHICLE: #031

AMC Gremlin
3-Speed Automatic
L6-232 CID
88 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
31.305		62.3	62.1			62.0	62.7	
31.306		62.9	63.7			63.9	64.1	
31.307		62.1	62.6			62.7	63.6	
31.308		62.0	61.9			62.9	64.2	
Average		62.3	62.6			62.9	63.7	
+/-	/	0.6 / 0.3	1.1 / 0.7	/	/	1.0 / 0.9	0.5 / 1.0	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
31 .312	.119	1696	26.6	-6.7	67.3	24.7	-8.8	0	67.9	24.7	-8.8	0
31 .313	.112	1644	26.2	5.2	66.8	24.8	3.1	+16.4	67.4	24.5	-1.1	0
31 .316	.125	1695	26.3	1.0	67.2	25.0	1.0	0	68.3	24.9	-1.1	0
31 .317	.123	1711	26.3	2.4	67.4	24.9	1.7	0	68.2	24.5	-6.0	0
Average	.120	1687	26.4	0.4	67.1	24.9	-0.8	--	68.0	24.7	-4.3	--
+/—	.005 / .008	24 / 43	0.2 / 0.2	4.8 / 7.1	0.3 / 0.3	0.1 / 0.2	3.9 / 8.0	-- / --	0.3 / 0.6	0.2 / 0.2	3.2 / 4.5	-- / --

TEST VEHICLE: #031

AMC Gremlim
3-Speed Automatic
L6 - 232 CID
88 bhp @ 3400 RPM

TEST CONDITION: 2

Mic Distance - 25 ft.

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
31.312	66.7	67.3	66.0		67.5	67.9	65.8	
31.313	66.0	66.7	66.8		67.4	67.4	65.6	
31.316	66.3	67.2	67.0		68.0	68.3	66.4	
31.317	66.3	67.4	67.3		67.5	68.2	66.7	
Average	66.3	67.1	66.8		67.6	68.0	66.1	
+/—	0.4 / 0.3	0.3 / 0.4	0.5 / 0.8	/	0.4 / 0.2	0.3 / 0.6	0.6 / 0.5	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
31.312	.119	1696	26.6	-6.7	61.6	24.9	- 7.4	+25	62.5	24.9	- 8.1	0
31.313	.112	1644	26.2	5.2	61.2	24.4	- 4.6	+25	62.1	24.6	- 0.4	+25
31.316	.125	1695	26.3	1.0	61.8	25.0	1.0	+25	62.8	24.7	- 3.2	0
31.317	.123	1711	26.3	2.4	61.6	23.7	-15.8	0	63.1	23.8	-14.4	0
Average	.120	1687	26.4	0.4	61.6	24.5	- 6.7	--	62.6	24.5	- 6.5	--
+/-	.005 / .008	24 / 43	0.2 / 0.2	4.8 / 7.1	0.4 / 0.2	0.5 / 0.8	7.7 / 9.1	-- / --	0.5 / 0.5	0.4 / 0.7	6.1 / 7.9	-- / --

TEST VEHICLE: #031

AMC Gremlin
3-Speed Automatic
L6 - 232 CID
88 bhp @ 3400 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
31.312		61.4	61.6			62.5	61.8	
31.313		60.8	61.2			61.9	62.1	
31.316		61.4	61.8			62.8	62.8	
31.317		61.6	61.4			63.1	62.8	
Average		61.3	61.5			62.6	62.4	
+/-	/	0.3 / 0.5	0.3 / 0.3	/	/	0.5 / 0.7	0.4 / 0.6	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
32.307	.154	1866	20.8	+0.3	68.3	1848	-1.8	0	69.3	1824	-8.8	-16.4
32.308	.148	1874	20.8	+1.7	68.5	1862	-1.8	-16.4	69.1	1797	-11.6	-16.4
32.309	154	1875	20.9	+1.7	68.2	1838	-5.3	-16.4	69.0	1868	-0.4	-16.4
32.310	.155	1897	21.2	+2.4	68.3	1882	-5.3	-16.4	69.5	1824	-10.2	-16.4
Average	.153	1878	20.9	1.5	68.3	1858	-3.6		69.2	1828	-7.8	
-/+	.005 / .002	12 / 19	0.1 / 0.3	1.2 / 0.9	0.1 / 0.2	20 / 24	1.7 / 1.8		0.2 / 0.3	31 / 40	3.9 / 7.4	

TEST VEHICLE: #032

Plymouth Fury
3-Speed Automatic
V8-318 CID
145 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 7/27/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
32.307	68.1	68.3	66.3		69.3	68.8	66.0	
32.308	68.5	67.8	66.1		69.1	68.3	65.8	
32.309	68.2	67.9	65.9		69.0	68.6	65.9	
32.310	68.3	68.2	66.3		69.5	68.5	66.8	
Average	68.3	68.1	66.2		69.2	68.6	66.1	
-/+	0.2 / 0.2	0.3 / 0.3	0.3 / 0.2		0.2 / 0.3	0.3 / 0.3	0.3 / 0.7	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
32.307	.154	1866	20.8	+0.3	61.9	1854	-6.0	0	62.7	1866	+0.3	0
32.308	.148	1874	20.8	+1.7	61.8	1864	-1.1	0	63.1	1859	+1.0	+25
32.309	.154	1875	20.9	+1.7	62.1	1862	-1.8	0	62.7	1853	+0.3	0
32.310	.155	1897	21.2	+2.4	62.1	1882	-5.3	0	63.0	1880	-2.5	+25
Average	.153	1878	20.9	1.5	62.0	1866	-3.6		62.9	1864	-0.2	
-/+	.005 / .002	12 / 19	0.1 / 0.3	1.2 / 0.9	0.2 / 0.1	12 / 16	2.4 / 2.5		0.2 / 0.2	11 / 16	2.3 / 1.2	

TEST VEHICLE: #032

Plymouth Fury
3-Speed Automatic
V8 - 318 CID
145 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 7/27/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
32.307		61.9	61.4			62.7	62.4	
32.308		61.8	61.0			62.7	63.1	
32.309		62.1	61.2			62.7	62.3	
32.310		62.1	60.8			62.8	63.0	
Average		62.0	61.1			62.7	62.7	
-/+		0.2 / 0.1	0.3 / 0.3			0 / 0.1	0.4 / 0.4	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
32.317	.124	1598	26.9	+1.7	68.1	24.7	-1.8	0	68.1	24.4	-6.7	0
32.318	.125	1608	26.1	+0.3	67.7	24.8	-2.5	-16.4	68.0	24.9	-1.8	0
32.319	.126	1602	25.6	+2.4	67.9	24.7	-1.1	0	68.1	24.6	-3.2	-16.4
32.322	.127	1608	25.5	+8.0	6719	25.0	+8.0	0	68.5	24.7	4.5	0
Average	.125	1604	26.0	3.1	67.9	24.8	0.7		68.2	24.7	-1.8	
+/-	.001 / .001	4 / 6	0.9 / 0.5	4.9 / 2.8	0.2 / 0.2	0.2 / 0.1	7.3 / 3.2	/	0.3 / 0.2	0.3 / 0.3	6.3 / 4.9	/

TEST VEHICLE: #032

Plymouth Fury
3-Speed Automatic
V8 - 318 CID
145 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 7/27/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
32.317	67.5	68.1	65.9		68.0	68.1	65.0	
32.318	67.7	67.5	66.1		68.0	68.0	64.6	
32.319	67.1	67.9	65.8		68.1	67.9	65.2	
32.322	67.2	67.9	65.8		67.8	68.5	65.6	
Average	67.4	67.9	65.9		68.0	68.1	65.1	
+/-	0.3 / 0.3	0.2 / 0.4	0.2 / 0.1	/	0.1 / 0.2	0.4 / 0.2	0.5 / 0.5	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
32.317	.124	1598	26.9	+1.7	62.2	24.2	-10.2	0	62.8	24.5	-6.0	0
32.318	.125	1608	26.1	+0.3	61.3	25.0	+ 0.3	0	62.6	24.7	-4.6	0
32.319	.126	1602	25.6	+2.4	61.8	24.9	+ 1.0	0	62.0	24.9	+1.7	+25
32.322	.125	1608	25.5	+8.0	61.3	24.2	- 3.9	0	62.5	24.2	-2.5	0
Average	.125	1604	26.0	3.1	61.7	24.6	-3.2		62.5	24.6	-2.9	
+/-	.001 / .001	4 / 6	0.9 / 0.5	4.9 / 2.8	0.6 / 0.4	0.4 / 0.4	7.0 / 4.2		0.3 / 0.5	0.3 / 0.4	4.6 / 3.2	

TEST VEHICLE: #032

Plymouth Fury
3-Speed Automatic
V8 - 318 CID
145 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 7/27/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
32.317		62.2	60.6			62.8	62.6	
32.318		61.3	60.5			62.6	61.5	
32.319		61.8	60.7			62.0	62.0	
32.322		61.3	60.5			62.5	62.2	
Average		61.7	60.6			62.5	62.1	
+/-		0.6 / 0.4	0.1 / 0.1			0.3 / 0.5	0.5 / 0.6	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
33.333	.152	1890	18.2	-1.1	66.0	1851	- 8.1	+16.4	66.9	1837	-10.2	0
33.334	.162	1877	17.8	-3.9	64.5	1668	- 4.6	0	65.6	1843	- 8.8	0
33.335	.133	1853	18.1	-1.1	65.7	1843	- 6.0	0	66.5	1768	-14.3	0
33.336	.162	1868	18.0	-6.7	66.0	1814	-20.0	0	67.1	1814	-20.0	0
Average	.152	1872	18.0	-3.2	65.6	1844	- 9.7	--	66.5	1816	-13.3	--
+/-	.01 / .019	18 / 19	0.2 / 0.2	2.1 / 3.5	0.4 / 1.1	24 / 30	5.1 / 10.3	-- / --	0.6 / 0.9	27 / 48	4.5 / 6.7	-- / --

TEST VEHICLE: #033

Rolls Royce Silver Shadow
3-Speed Automatic
V8-412 CID
240 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 25 ft.

TEST DATE: 7/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet		Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet	
33.333		65.8	66.0		66.4	66.9	65.0	
33.334		64.5	64.1		65.6	65.5	63.5	
33.335		65.7	65.4		66.0	66.5	65.1	
33.336		66.0	65.2		66.5	67.1	64.5	
Average		65.5	65.2		66.1	66.5	64.5	
+/-		0.5 / 1.0	0.8 / 1.1		0.6 / 0.9	0.6 / 0.9	0.6 / 1.0	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
33.333	.152	1890	18.2	-1.1	61.1	1853	- 8.8	0	61.5	1837	-10.2	+25
33.334	.162	1877	17.8	-3.9	60.1	1857	- 6.0	0	60.2	1868	- 4.6	+25
33.335	.133	1853	18.1	-1.1	60.9	1848	- 5.3	0	61.8	1844	- 4.6	+25
33.336	.162	1868	18.0	-6.7	61.2	1823	-19.3	+25	61.6	1868	- 6.7	+25
Average	.152	1872	18.0	-3.2	60.8	1845	- 9.8	--	61.3	1854	- 6.5	--
+/-	.010 / .019	18 / 19	0.2 / 0.2	2.1 / 3.5	0.4 / 0.7	12 / 22	4.5 / 9.5	-- / --	0.5 / 1.1	14 / 17	1.9 / 3.7	-- / --

TEST VEHICLE: #033

Rolls Royce Silver Shadow
3-Speed Automatic
V8-412 CID
240 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 7/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
33.333		61.1	60.9			61.5	61.5	
33.334		60.1	59.2			--	60.2	
33.335		60.9	60.7			--	61.8	
33.336		61.0	61.2			--	61.6	
Average		60.8	60.5			--	61.3	
+/-		0.3 / 0.7	0.7 / 1.3			-- / --	0.5 / 0.9	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
33.307	.118	1781	26.6	8.7	67.5	24.3	-2.5	+16.4	67.7	24.8	6.6	0
33.308	.118	1766	26.7	-3.2	66.9	24.9	-3.9	0	67.3	24.1	-13.7	0
33.309	.120	1776	26.6	-1.8	67.8	25.0	-1.8	0	68.1	24.6	- 7.4	0
33.311	.121	1776	26.3	-3.9	67.7	24.9	-5.3	0	68.2	24.9	- 4.6	0
Average	.119	1775	26.6	-0.1	67.5	24.8	-3.4	--	67.8	24.6	- 4.8	--
+/-	.002 / .001	9 / 6	0.1 / 0.3	8.6 / 4.0	0.3 / 0.6	0.2 / 0.5	1.6 / 1.9	-- / --	0.4 / 0.5	0.3 / 0.5	11.4 / 8.9	-- / --

TEST VEHICLE: #033

Rolls Royce Silver Shadow
3-Speed Automatic
V8-412 CID
240 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 25 ft.

TEST DATE: 7/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet		Max Sl at Mic at -16.4 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +16.4 feet	
33.307		67.3	67.5		67.3	67.7	66.5	
33.308		66.9	66.2		67.1	67.3	66.0	
33.309		67.8	66.7		67.2	68.1	66.0	
33.311		67.7	67.3		67.6	68.2	66.9	
Average		67.4	66.9		67.3	67.8	66.4	
+/-	/	0.4 / 0.1	0.6 / 0.7	/	0.3 / 0.2	0.4 / 0.5	0.5 / 0.4	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
33.307	.118	1781	26.6	8.7	61.8	24.1	- 3.2	+25	62.9	24.4	0.3	+25
33.308	.118	1766	26.7	-3.2	61.6	24.3	-11.6	0	62.6	24.5	-9.5	0
33.309	.120	1776	26.6	-1.8	61.8	25.0	- 1.8	0	62.3	24.7	-5.3	+25
33.311*	.121	1766	26.3	-3.9	--	--	--	--	--	--	--	--
Average	.119	1775	26.6	-0.1	61.7	24.5	- 5.5	--	62.6	24.6	-4.8	--
+/-	.002 / .001	9 / 6	0.1 / 0.3	8.6 / 4.0	0.1 / 0.1	0.5 / 0.4	3.7 / 6.1	-- / --	0.3 / 0.3	0.2 / 0.2	5.1 / 4.7	-- / --

TEST VEHICLE: #033

Rolls Royce Silver Shadow
3-Speed Automatic
V8-412 CID
240 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 50 ft.

TEST DATE: 7/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
33.307		61.3	61.8			62.2	62.9	
33.308		61.6	61.3			62.6	62.3	
33.309		61.8	61.4			62.0	62.3	
33.311*		--	--			--	--	
Average		61.6	61.5			62.3	62.5	
+/-	/	0.2 / 0.3	0.3 / 0.2	/	/	0.3 / 0.3	0.4 / 0.2	/

*NOTE: SI levels not reported due to high background levels for Run #33.311 only.

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
34.304	.144	18.6	4233	8.7	68.2	3539	-3.9	0	66.8	3825	8.0	0
34.305	.145	18.6	4488	-1.1	69.0	3750	-6.0	-25	67.8	3763	-5.3	-25
34.306	.150	18.6	3982	-2.5	68.5	3852	-3.2	-25	67.7	3852	-2.5	+25
34.307	.158	18.6	4002	-3.2	68.3	3850	-3.2	-25	67.1	3738	-7.4	-25
Average	149	18.6	4176	0.5	68.5	3748	-4.1	--	67.4	3795	-1.8	--
+/-	.009 / .005	0.0 / 0.0	312 / 194	8.2 / 3.7	0.5 / 0.3	104 / 209	0.9 / 1.9	-- / --	0.4 / 0.6	57 / 57	9.8 / 5.6	-- / --

TEST VEHICLE: #034

Renault 12 SW
4-Speed Manual
L4-101 CID
72 bhp @ 5500 RPM

TEST CONDITION: 1M

Mic Distance - 50 ft.

TEST DATE: 6/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
34.304	67.6	68.2	68.1		66.0	66.8	66.7	
34.305	69.0	68.2	67.3		67.8	65.4	67.3	
34.306	68.5	68.5	67.2		67.6	65.0	67.7	
34.307	68.3	68.2	66.7		67.1	64.7	66.7	
Average	68.4	68.3	67.3		67.1	65.5	67.1	
+/-	0.6 / 0.8	0.2 / 0.1	0.8 / 0.6	/	0.7 / 1.1	1.3 / 0.8	0.6 / 0.4	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
34.308	.149	3855	3980	1.7	69.0	3855	1.7	-25	67.5	3832	1.0	+25
34.309	.140	3854	3975	0.3	69.1	3854	0.3	-25	67.9	3854	0.3	+25
34.310	.145	3866	4074	- .4	69.3	3797	-2.5	-25	68.3	3797	-2.5	+25
34.311	.144	3849	4031	2.4	69.2	3821	1.0	0	67.9	3849	2.4	-25
Average	.145	3856	4015	1.0	69.2	3832	0.1	--	67.9	3833	0.3	--
+/-	.004 / .005	10 / 7	59 / 40	1.4 / 1.4	0.1 / 0.2	23 / 35	1.6 / 2.6	-- / --	0.4 / 0.4	21 / 36	2.1 / 2.8	-- / --

TEST VEHICLE: #034

Renault 12 SW
4-Speed Manual
L4-101 CID
72 bhp @ 5500 RPM

TEST CONDITION: 1M (F)

Mic Distance - 50 ft

TEST DATE: 6/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
34.308	69.0	68.7	67.1		67.3	65.7	67.5	
34.309	69.1	68.9	67.3		67.7	66.1	67.9	
34.310	69.3	68.6	67.3		67.7	65.8	68.3	
34.311	68.9	69.2	67.7		67.9	66.5	67.6	
Average	69.1	68.9	67.4		67.7	66.0	67.8	
+/-	0.2 / 0.2	0.3 / 0.3	0.3 / 0.3	/	0.2 / 0.4	0.5 / 0.3	0.5 / 0.3	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
35.304	.144	2307	24.3	2.4	63.7	2303	1.7	-25	62.6	2303	1.7	+25
35.305	.144	2284	23.9	1.0	64.0	2216	-10.2	-25	63.4	2162	-17.2	+25
35.306	.159	2379	24.9	1.7	64.6	2373	1.0	-25	63.7	2368	0.3	+25
35.307	.162	2368	24.7	-0.4	64.1	2357	- 2.5	-25	63.1	2300	- 9.5	-25
Average	.152	2335	24.5	1.2	64.1	2312	- 2.5	--	63.2	2283	- 6.2	--
+/-	.010 / .008	44 / 51	0.4 / 0.6	1.2 / 1.6	0.5 / 0.4	61 / 96	4.2 / 7.7	-- / --	0.5 / 0.6	85 / 121	7.9 / 11.0	-- / --

TEST VEHICLE: #035

Chevrolet Caprice
3-Speed Automatic
V8-305 CID
145 bhp @ 3800 RPM

TEST CONDITION: 1A

Mic Distance - 50 ft.

TEST DATE: 6/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
35.304	63.7	63.6	62.5		62.2	61.7	62.6	
35.305	64.0	64.2	62.8		63.4	62.4	63.1	
35.306	64.6	64.6	63.2		63.1	62.9	63.7	
35.307	64.1	63.5	61.9		63.1	61.8	62.7	
Average	64.1	64.0	62.6		63.0	62.2	63.0	
+/-	0.5 / 0.4	0.6 / 0.5	0.6 / 0.7	/	0.4 / 0.8	0.7 / 0.5	0.7 / 0.4	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
35.322	.146	2345	24.7	3.1	71.0	2303	-6.0	0	69.6	2316	-3.2	+25
35.323	.160	2437	25.4	5.2	71.0	2384	-2.5	0	69.9	2419	1.0	+25
35.324	.146	2373	24.8	5.2	70.6	2318	-5.3	0	70.1	2352	- .4	+25
35.325	.151	2383	24.8	4.5	70.8	2329	-3.9	0	70.1	2375	3.1	+25
Average	.151	2385	24.9	4.5	70.9	2334	-4.4	--	69.9	2366	0.1	--
+/-	.009 / .005	52 / 40	0.5 / 0.2	0.7 / 1.4	0.1 / 0.3	50 / 31	1.9 / 1.6	-- / --	0.2 / 0.3	53 / 50	3.0 / 3.3	-- / --

TEST VEHICLE: #035

Chevrolet Caprice
3-Speed Automatic
V8-305 CID
145 bhp @ 3800 RPM

TEST CONDITION: 1A (F)

Mic Distance - 50 ft.

TEST DATE: 6/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
35.322	70.0	71.0	70.3		68.7	68.2	69.6	
35.323	70.3	71.0	70.3		69.1	68.9	69.9	
35.324	70.1	70.6	69.6		69.3	68.4	70.1	
35.325	70.8	70.8	70.1		68.9	69.2	70.1	
Average	70.3	70.9	70.1		69.0	68.7	69.9	
+/-	0.5 / 0.3	0.1 / 0.3	0.2 / 0.5	/	0.3 / 0.3	0.5 / 0.5	0.2 / 0.3	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
36.310	.168	1417	14.4	-4.6	62.7	1417	-4.6	0	61.3	1394	-8.1	0
36.311	.156	1382	14.2	-1.8	62.7	1370	-1.1	0	61.6	1382	-1.8	0
36.312	.133	1293	13.3	-1.1	60.7	1279	-0.4	0	60.3	1279	-0.4	0
36.313	.135	1301	13.5	-1.1	62.0	1301	-1.1	0	60.7	1301	-1.1	0
Average	.148	1348	13.9	-2.2	62.0	1342	-1.8		61.0	1339	-2.9	
+/-	.020 / .015	69 / 55	0.5 / 0.6	1.1 / 2.4	0.7 / 1.3	25 / 13	1.4 / 2.8	/	0.6 / 0.7	55 / 60	2.5 / 5.2	/

TEST VEHICLE: #036

Ford Granada
3-Speed Automatic
V8 - 302 CID
122 bhp @ 3200 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
36.310	62.6	62.7	60.1		61.3	61.3	59.4	
36.311	62.7	62.7	59.9		61.0	61.6	59.1	
36.312	60.5	60.7	58.9		60.1	60.3	58.2	
36.313	61.1	62.0	59.1		60.2	60.7	58.0	
Average	61.7	62.0	59.5		60.7	61.0	58.7	
+/-	1.0 / 1.2	0.7 / 1.3	0.6 / 0.6	/	0.6 / 0.6	0.6 / 0.7	0.7 / 0.7	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
36.310	.168	1417	14.4	-4.6	57.1	1401	-3.9	0	56.0	1398	-6.0	0
36.311	.156	1382	14.2	-1.8	56.6	1364	0.3	0	56.9	1382	-1.8	0
36.312	.133	1293	13.3	-1.1	55.7	1279	-0.4	0	54.5	1282	-1.8	+25
36.313	.135	1301	13.5	-1.1	55.4	1292	-3.9	0	54.2	1299	-3.2	0
Average	.143	1348	13.9	-2.2	56.2	1334	-2.0		55.3	1340	-3.2	
+/-	.020 / .015	69 / 55	0.5 / 0.6	1.1 / 2.4	0.9 / 0.8	67 / 55	2.3 / 1.9		1.1 / 1.1	53 / 58	1.4 / 2.8	

TEST VEHICLE: #036

Ford Granada
3-Speed Automatic
V8 - 302 CID
122 bhp @ 3200 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
36.310		57.1	55.3			56.0	55.8	
36.311		56.6	55.3			56.4	55.9	
36.312		55.7	53.9			54.3	54.5	
36.313		55.4	54.1			54.2	54.1	
Average		56.2	54.7			55.2	55.0	
+/-		0.9 / 0.8	0.6 / 0.8			1.2 / 1.0	0.8 / 0.9	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
36.314	.120	1578	28.0	+1.7	65.6	24.5	-6.0	-16.4	65.4	25.0	+1.0	0
36.315	.120	1560	27.7	+5.9	65.7	24.5	-2.5	-16.4	65.4	25.0	+5.2	0
36.316	.117	1564	28.2	-3.2	65.6	24.7	-6.0	-16.4	64.7	24.0	-17.2	-16.4
36.317	.117	1561	27.9	+3.8	65.6	24.4	-6.0	-16.4	65.3	25.0	+3.8	0
Average	.119	1560	28.0	2.1	65.6	24.5	-5.1		65.2	24.8	-1.8	
+/-	.001 / .002	18 / 20	0.3 / 0.3	3.9 / 5.3	0.1 / 0	0.2 / 0.1	8.4 / 0.9		0.2 / 0.5	0.2 / 0.8	7.0 / 15.4	

TEST VEHICLE: #036

Ford Granada
3-Speed Automatic
V8 - 302 CID
122 bhp @ 3200 RPM

TEST CONDITION: 2

Mic. Distance - 25 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
36.314	65.6	65.5	63.4		65.4	65.4	63.0	
36.315	65.7	65.5	64.2		65.0	65.4	63.6	
36.316	65.6	65.2	63.5		64.7	64.2	62.1	
36.317	65.6	65.2	64.5		64.8	65.3	62.8	
Average	65.6	65.4	63.9		65.0	65.1	62.9	
+/-	0.1 / 0	0.1 / 0.2	0.6 / 0.5		0.4 / 0.3	0.3 / 0.9	0.7 / 0.8	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
36.314	.120	1578	28.0	+1.7	60.2	24.3	-8.8	0	59.4	25.0	+1.7	
36.315	.120	1560	27.7	+5.9	61.1	24.5	-2.5	0	59.5	25.0	+5.9	
36.316	.117	1564	28.2	-3.2	59.8	24.1	-15.1	0	59.6	24.7	-6.0	
36.317	.117	1561	27.9	+3.8	60.2	24.8	+0.3	0	59.0	24.8	+0.3	
Average	.119	1560	28.0	2.1	60.3	14.4	-6.5		59.4	24.9	0.5	
+/-	.001 / .002	18 / 20	0.3 / 0.3	3.9 / 5.3	0.8 / 0.5	0.4 / 0.3	6.8 / 8.6		0.2 / 0.4	0.1 / 0.2	0.5 / 6.5	

TEST VEHICLE: #036

Ford Granada
3-Speed Automatic
V8 - 302 CID
122 bhp @ 3200 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
36.314		60.2	58.8			59.3	59.4	
36.315		61.1	58.8			59.3	58.5	
36.316		59.8	59.0			59.6	58.6	
36.317		60.2	59.6			59.0	58.9	
Average		60.3	58.8			59.3	59.1	
+/-		0.8 / 0.5	0.2 / 0.2			0.3 / 0.3	0.4 / 0.5	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE Max Sound Level	RIGHT SIDE RPM at Max Sound Level	RIGHT SIDE Veh. Position at Max Sound Level	RIGHT SIDE Mic. Pos. in feet	LEFT SIDE Max Sound Level	LEFT SIDE RPM at Max Sound Level	LEFT SIDE Veh. Position at Max Sound Level	LEFT SIDE Mic. Pos. in feet
37.305	.155	3372	26.1	-0.4	71.5	3239	-3.2	-16.4	74.7	3158	-10.2	-16.4
37.306	.152	3350	26.2	+2.4	72.0	3244	+1.0	-16.4	74.7	3141	-9.5	-16.4
37.307	.144	3322	25.8	+4.5	71.9	3194	+1.7	-16.4	74.4	3105	-9.5	-16.4
37.308	.156	3339	26.1	+2.4	72.4	3179	-2.5	0	74.3	3179	-2.5	0
Average	.156	3346	26.1	+2.2	72.0	3214	-0.8		74.5	3146	-7.9	
+/-	.009 / .008	26 / 24	0.3 / 0.1	2.3 / 2.6	0.4 / 0.5	30 / 35	2.5 / 2.4		0.2 / 0.2	33 / 41	5.4 / 2.3	

TEST VEHICLE: #037

Pontiac Astre
3-Speed Automatic
L4 - 151 CID
88 bhp @ 4400 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/16/77

RUN#	RIGHT SIDE Max SI at Mic at -16.4 feet	RIGHT SIDE Max SI at Mic at 0 feet	RIGHT SIDE Max SI at Mic at +16.4 feet		LEFT SIDE Max SI at Mic at -16.4 feet	LEFT SIDE Max SI at Mic at 0 feet	LEFT SIDE Max SI at Mic at +16.4 feet	
37.305	71.5	71.2	69.9		74.7	73.8	71.3	
37.306	72.0	71.4	70.1		74.7	73.8	70.6	
37.307	71.9	71.3	70.3		74.4	74.2	70.9	
37.308	72.0	72.4	70.0		74.3	74.3	70.8	
Average	71.9	71.6	70.1		74.5	74.0	70.9	
+/-	0.1 / 0.4	0.8 / 0.4	0.2 / 0.2		0.2 / 0.2	0.3 / 0.2	0.4 / 0.3	

NOTE: Maximum Sound Level Measured up to and Including 25 mph.

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
37.305	.155	3372	26.1	-0.4	65.5	3203	-6.7	0	68.2	3158	-10.2	0
37.306	.152	3350	26.2	+2.4	65.8	3201	-2.5	0	67.8	3138	-7.4	0
37.307	.144	3322	25.8	+4.5	65.4	3177	-1.8	0	67.7	3194	+1.7	0
37.308	.156	3339	26.1	+2.4	65.1	3138	-6.0	0	68.1	3150	-7.4	0
Average	.152	3346	26.1	+2.2	65.5	3180	-4.3		68.0	3160	-5.8	
+/-	.004 / .008	26 / 24	0.1 / 0.3	2.3 / 2.6	0.3 / 0.4	23 / 42	2.5 / 2.4		0.2 / 0.3	34 / 22	7.5 / 4.4	

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TEST VEHICLE: #037

Pontiac Astre
3-Speed Automatic
L4 - 151 CID
88 bhp @ 4400 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/16/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
37.305		65.5	-			68.2	66.8	
37.306		65.8	-			67.8	65.7	
37.307		65.4	-			67.7	65.9	
37.308		65.1	-			68.1	66.5	
Average		65.5	-			68.0	66.2	
+/-		0.3 / 0.4				0.2 / 0.3	0.6 / 0.5	

NOTE: Maximum Sound Level Measured up to and Including 25 mph

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
38.312	.115	2240	28.2	-7.4	69.9	24.8	-8.8	-16.4	68.5	25.0	-7.4	0
38.313	.112	2232	27.8	+1.7	69.2	23.5	-21.4	-16.4	69.0	24.9	-0.4	0
38.314	.121	2268	28.6	-8.8	71.0	24.8	-10.9	-16.4	69.0	25.0	-8.8	0
38.315	.127	2299	28.5	-6.7	70.8	24.8	-8.8	0	69.3	25.0	-6.7	0
Average	.119	2260	28.3	-5.3	70.2	24.5	-12.5		69.0	25.0	-5.8	
+/-	.008 / .007	39 / 28	.3 / :1	7.0 / 2.1	.8 / 1.0	.3 / 1.0	3.7 / 8.9		.3 / .5	0 / .1	5.4 / 3.0	

TEST VEHICLE: #038

Ford Pinto Station Wagon
3-Speed Automatic
L4 - 140 CID
89 bhp @ 4800 RPM

TEST CONDITION: 2

Mic. Distance - 25 ft.

TEST DATE: 8/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
38.312	69.9	68.7	66.5		68.4	68.5	67.1	
38.313	69.2	69.1	67.5		68.7	69.0	68.2	
38.314	71.0	70.2	67.7		68.9	69.0	67.2	
38.315	70.7	70.8	67.7		69.1	69.3	67.9	
Average	70.2	69.7	67.4		68.8	69.0	67.6	
+/-	.8 / 1.0	1.1 / .6	.3 / .9		.3 / .4	.3 / .5	.6 / .5	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
38.312	.115	2240	28.2	-7.4	63.5	24.7	-11.9	0	63.2	24.7	-9.5	0
38.313	.112	2232	27.8	+1.7	63.4	25.0	+1.7	0	63.5	24.8	-3.2	+25
38.314	.121	2268	28.6	-8.8	65.0	25.0	-10.2	0	63.4	25.0	-10.2	0
38.315	.127	2299	28.5	-6.7	64.9	24.8	-8.1	0	63.6	24.8	-8.1	0
Average	.119	2260	28.3	-5.3	64.2	24.9	-7.1	0	63.4	24.8	-7.8	0
+/-	.008 / .007	39 / 28	.3 / .1	7.0 / 2.1	.7 / .8	.1 / .2	8.8 / 4.8		.2 / .2	.2 / .1	4.6 / 2.5	

TEST VEHICLE: #038

Ford Pinto Station Wagon
3-Speed Automatic
L4 - 140 CID
89 bhp @ 4800 RPM

TEST CONDITION: 2

Mic. Distance - 50 ft.

TEST DATE: 8/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
38.312		63.5	62.1			63.2	62.5	
38.313		63.4	63.4			63.0	63.5	
38.314		65.0	63.2			63.4	63.0	
38.315		64.9	63.2			63.6	62.7	
Average		64.2	63.0			63.3	62.9	
+/-		.8 / .8	.4 / .9			.3 / .3	.6 / .4	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
39.303	.159	1481	13.4	-8.1	64.4	1452	-12.3	-16.4	65.0	1481	-8.1	0
39.304	.155	1468	13.4	-0.4	64.3	1468	- 0.4	-16.4	65.2	1468	-0.4	-16.4
39.305	.149	1462	13.4	-0.4	64.9	1455	- 1.1	0	65.0	1455	-1.1	0
39.308	.157	1484	13.7	-1.1	64.9	1478	- 5.3	-16.4	65.0	1466	-4.6	-16.4
Average	.155	1474	13.5	-2.5	64.6	1463	-4.8		65.1	1468	-3.6	
+/-	.003 / .001	10 / 12	0.2 / 0.1	2.1 / 5.6	0.3 / 0.3	15 / 11	4.4 / 7.5	/	0.1 / 0.1	13 / 13	2.5 / 4.5	/

TEST VEHICLE: #039

AMC Pacer
3-Speed Automatic
L6 - 258 CID
120 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 7/27/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
39.303	64.4	64.1	61.8		-	65.0	62.2	
39.304	64.3	64.0	63.0		65.2	64.1	62.0	
39.305	64.9	64.9	62.9		64.4	65.0	61.8	
39.308	64.9	64.0	63.0		65.0	64.5	62.4	
Average	64.6	64.3	62.7		64.9	64.7	62.1	
+/-	0.3 / 0.3	0.7 / 0.3	0.3 / 0.9	/	0.3 / 0.5	0.4 / 0.6	0.3 / 0.3	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
47.309	.152	3663	27.2	-1.8	73.7	2859	-6.0	0	73.5	2881	-3.9	0
47.310	.152	2999	26.4	+1.0	73.8	2889	+1.0	-16.4	73.5	2834	-6.0	0
47.311	.154	3028	26.6	-1.1	74.0	2848	-6.7	0	72.7	2848	-6.0	0
47.312	.150	2987	26.4	+1.0	73.3	2824	-5.3	0	73.2	2840	-2.5	0
Average	.152	3019	26.7	-0.2	73.7	2855	-4.3		73.2	2851	-4.6	
+/-	.002 / .002	44 / 32	0.5 / 0.3	1.2 / 1.6	0.3 / 0.4	34 / 31	5.3 / 2.5		0.3 / 0.5	30 / 17	2.1 / 1.4	

TEST VEHICLE: #047

Ford Pinto
3-Speed Automatic
V6 - 171 CID
93 bhp @ 4200 RPM

TEST CONDITION: 1A

Mic Distance: 25 feet

TEST DATE: 8/15/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
47.309	73.6	73.7	71.9		-	73.5	71.9	
47.310	73.8	73.6	72.2		-	73.5	71.2	
47.311	73.7	74.0	72.3		-	72.7	71.6	
47.312	73.2	73.3	71.9		-	73.2	71.0	
Average	73.6	73.7	72.1			73.2	71.4	
+/-	0.2 / 0.3	0.3 / 0.4	0.2 / 0.2			0.3 / 0.5	0.5 / 0.4	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
47.309	.152	3663	27.2	-1.8	67.8	2878	-3.2	0	62.6	2824	-9.5	0
47.310	.152	2999	26.4	+1.0	67.4	2848	-3.9	0	68.5	2851	-4.6	0
47.311	.154	3028	26.6	-1.1	67.5	2877	-2.5	0	68.7	2832	-9.5	0
47.312	.150	2987	26.4	+1.0	67.3	2823	-6.7	0	68.6	2774	-14.4	0
Average	.152	3019	26.7	-0.2	67.5	2857	-4.1		68.6	2820	-9.5	
+/-	.002 / .002	32 / 44	0.3 / 0.5	1.2 / 1.6	0.3 / 0.2	22 / 34	1.6 / 2.6	/	0.1 / 0.1	31 / 46	4.9 / 4.9	/

TEST VEHICLE: #047

Ford Pinto
3-Speed Automatic
V6 - 171 CID
93 bhp @ 4200 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/15/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
47.309		67.8	67.1			68.6	68 5	
47.310		67.4	67.1			68.5	67.5	
47.311		67.5	66.7			68.7	68.1	
47.312		67.3	66.9			68.6	67.8	
Average		67.5	67.0			68.6	68.0	
+/-	/	0.3 / 0.2	0.1 / 0.3	/	/	0.2 / 0.1	0.5 / 0.5	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
48.311	.148	2169	23.1	-3.9	70.3	2145	-5.3	0	70.7	2165	-5.3	0
48.312	.144	2152	23.3	+4.5	70.5	2124	-1.8	0	70.3	2143	+1.0	0
48.313	.153	2200	23.7	+0.3	70.8	2171	+1.7	0	71.2	2145	-8.1	0
48.314	.152	2175	23.4	+1.7	70.7	2164	-2.5	0	70.6	2101	-11.6	0
Average	.149	2174	23.4	+0.7	70.6	2151	-2.0	-	70.7	2134	-6.0	-
+/-	.005 / .004	26 / 22	0.3 / 0.3	2.8 / 4.6	0.2 / 0.3	20 / 27	3.7 / 3.3	/	0.5 / 0.4	11 / 33	7.0 / 5.6	/

TEST VEHICLE: #048

Ford Granada
3-Speed Automatic
L6 - 250 CID
98 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
48.311	69.6	70.3	68.9		69.5	70.7	68.4	
48.312	69.6	70.5	69.6		68.7	70.3	69.4	
48.313	70.3	70.8	69.8		69.9	71.2	68.8	
48.314	70.0	70.7	69.6		69.8	70.6	68.5	
Average	69.9	70.6	69.5		69.5	70.7	68.8	
+/-	0.4 / 0.3	0.2 / 0.3	0.3 / 0.6	/	0.4 / 0.8	0.5 / 0.4	0.6 / 0.4	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
48.311	.148	2169	23.1	-3.9	63.6	2109	-12.3	0	65.0	2168	-3.2	+25
48.312	.144	2152	23.3	+4.5	63.9	2124	-1.8	+25	65.0	2146	+3.1	+25
48.313	.153	2200	23.7	+0.3	64.3	2156	+2.4	0	65.4	2156	+2.4	+25
48.314	.152	2175	23.4	+1.7	64.0	2155	-3.2	+25	65.2	2174	+0.3	+25
Average	.149	2174	23.4	+0.7	64.0	2136	-3.7		65.2	2161	0.7	
+/-	.004 / .005	26 / 22	0.3 / 0.3	2.8 / 4.6	0.3 / 0.4	20 / 27	6.1 / 3.5		0.2 / 0.2	13 / 15	2.4 / 3.9	

TEST VEHICLE: #048

Ford Granada
3-Speed Automatic
L6 - 250 CID

98 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
48.311		63.6	63.6			64.1	65.0	
48.312		63.0	63.9			64.4	65.0	
48.313		64.3	64.1			64.5	65.4	
48.314		63.8	64.0			64.1	65.2	
Average		63.7	63.9			64.3	65.2	
+/-		0.6 / 0.7	0.2 / 0.3			0.2 / 0.2	0.2 / 0.2	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
50.305	.145	15.1	3972	-2.5	69.3	3635	-2.5	0	69.3	3616	-3.2	0
50.306	.151	15.1	3956	1.7	69.4	3563	-0.4	0	69.1	3375	-5.3	0
50.307	.150	15.2	3782	3.8	70.1	3645	3.8	0	69.1	3384	-3.2	0
50.308	.156	15.2	3768	1.7	70.1	3638	1.7	0	69.9	3638	1.7	0
Average	.151	15.2	3870	1.2	69.7	3620	0.7		69.4	3503	-2.5	
+/-	0.005 / 0.006	0.0 / 0.1	102 / 102	2.6 / 3.7	0.4 / 0.4	25 / 57	3.1 / 3.2		0.5 / 0.3	135 / 128	4.2 / 0.7	

TEST VEHICLE: #050

Subaru 4WD SW
4-Speed Manual
H4 - 97 CID
65 bhp @ 5200 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
50.305	68.4	69.3	67.7		68.4	69.3	66.3	
50.306	68.7	69.4	68.7		68.2	69.1	67.3	
50.307	68.7	70.1	68.9		68.5	69.1	68.1	
50.308	68.7	70.1	68.4		68.8	69.9	68.3	
Average	68.6	69.7	68.4		68.5	69.4	67.5	
+/-	0.1 / 0.2	0.4 / 0.4	0.5 / 0.7		0.3 / 0.3	0.5 / 0.3	0.8 / 1.2	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
50.305	.145	15.1	3972	-2.5	63.8	3527	-5.3	0	63.5	3616	-3.2	+25
50.306	.151	15.1	3956	1.7	63.7	3642	1.7	+25	64.0	3608	1.0	+25
50.307	.150	15.2	3782	3.8	63.2	3645	3.8	0	63.9	3645	3.8	+25
50.308	.156	15.2	3768	1.7	63.5	3638	1.7	+25	63.9	3638	1.7	+25
Average	.151	15.2	3870	1.2	63.6	3613	0.5		63.8	3627	0.8	
+/-	0.005 / 0.006	0.0 / 0.1	102 / 102	2.6 / 3.7	0.2 / 0.4	32 / 86	3.3 / 5.8		0.2 / 0.3	18 / 19	3.0 / 4.0	

TEST VEHICLE: #050

Subaru 4WD SW
4-Speed Manual
H4 - 97 CID
65 bhp @ 5200 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
50.305		63.8	63.0			63.3	63.5	
50.306		63.4	63.7			63.2	64.0	
50.307		63.2	63.2			63.0	63.9	
50.308		63.1	63.5			63.4	63.9	
Average		63.4	63.4			63.2	63.8	
+/-		0.4 / 0.3	0.3 / 0.4			0.2 / 0.2	0.2 / 0.3	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
50.309	.148	15.1	3857	2.4	69.9	3644	2.4	0	69.8	3644	2.4	0
50.310	.144	15.2	3760	2.4	69.5	3611	1.7	0	69.2	3589	0.3	0
50.312	.137	15.2	3832	3.1	69.5	3644	3.1	0	69.5	3644	3.1	0
50.313	.144	15.3	3902	2.4	70.3	3633	1.7	0	70.0	3647	2.4	0
Average	.143	15.2	3838	2.6	69.8	3633	2.2		69.6	3631	2.1	
+/-	.005 / .006	0.1 / 0.1	64 / 78.	0.5 / 0.2	0.5 / 0.3	11 / 23	0.9 / 0.5		0.4 / 0.4	16 / 42	0.7 / 1.8	

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TEST VEHICLE: #050

Subaru 4WD SW
4-Speed Manual
H4 - 97 CID
65 bhp @ 5200 RPM

TEST CONDITION: 1M (F)

Mic Distance - 25 feet

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
50.309	68.9	69.9	68.5		68.6	69.8	68.4	
50.310	68.7	69.5	68.8		68.1	69.2	68.0	
50.312	68.9	69.5	68.6		68.1	69.5	68.0	
50.313	69.1	70.3	68.8		68.8	70.0	68.9	
Average	68.9	68.8	68.7		68.4	69.6	68.3	
+/-	0.2 / 0.2	0.5 / 0.3	0.1 / 0.2		0.4 / 0.3	0.4 / 0.4	0.6 / 0.3	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
50.309	.148	15.1	3857	2.4	63.6	3589	1.0	0	64.8	3644	2.4	+25
50.310	.144	15.2	3760	2.4	63.3	3644	2.4	+25	64.4	3621	1.0	+25
50.312	.137	15.2	3832	3.1	63.3	3620	2.4	+25	64.1	3539	0.3	+25
50.313	.144	15.3	3902	2.4	64.4	3647	2.4	0	64.6	3647	2.4	+25
Average	.143	15.2	3838	2.6	63.7	3625	2.1		64.5	3613	1.5	
+/-	.005 / .006	0.1 / 0.1	64 / 78	0.5 / 0.2	0.7 / 0.4	22 / 36	0.3 / 1.1		0.3 / 0.4	34 / 74	0.9 / 1.2	

TEST VEHICLE: #050

Subaru 4WD SW
4-Speed Manual
H4 - 97 CID
65 bhp @ 5200 RPM

TEST CONDITION: 1M (F)

Mic Distance - 50 feet

TEST DATE: 7/21/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
50.309		63.6	63.4			64.2	64.8	
50.310		63.3	63.3			63.7	64.4	
50.312		63.3	63.3			63.7	64.1	
50.313		64.4	63.4			63.8	64.6	
Average		63.7	63.4			63.9	64.5	
+/-		0.7 / 0.4	0.0 / 0.1			0.3 / 0.2	0.3 / 0.4	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
51.304	.153	1777	20.5	-3.9	70.9	1777	-3.9	-16.4	69.8	1772	-4.6	0
51.305	.137	1736	20.0	3.1	70.6	1721	-3.2	-16.4	69.5	1628	-32.6	-16.4
51.306	.154	1854	21.4	3.8	71.0	1841	0.3	-16.4	70.4	1836	6.6	0
51.307	.154	1829	20.8	-2.5	71.5	1829	-2.5	-16.4	69.9	1815	-0.4	0
Average	.150	1799	20.7	0.1	71.0	1792	-2.3		69.9	1763	-7.8	
+/-	.005 / .013	55 / 63	0.7 / 0.7	3.7 / 4.0	0.5 / 0.4	49 / 21	2.6 / 1.6	/	0.5 / 0.4	73 / 135	14.4 / 24.9	/

TEST VEHICLE: #051

Chrysler Town & Country SW
3-Speed Automatic
V8 - 440 CID
195 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
51.304	70.9	68.8	67.9		69.8	69.8	-	
51.305	70.6	69.3	68.6		69.5	69.4	67.9	
51.306	71.0	69.9	69.7		70.0	70.4	69.5	
51.307	71.5	69.8	69.0		69.7	69.9	69.1	
Average	71.0	69.5	68.8		69.8	69.9	68.8	
+/-	0.5 / 0.4	0.5 / 0.7	0.9 / 0.9	/	0.3 / 0.3	0.5 / 0.5	0.7 / 0.9	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
51.304	.153	1777	20.5	-3.9	63.8	1764	-8.8	0	63.7	1777	-3.9	0
51.305	.137	1736	20.0	3.1	64.0	1711	-3.9	0	64.2	1716	-1.1	+25
51.306	.154	1854	21.4	3.8	64.3	1840	1.0	0	65.5	1851	5.9	+25
51.307	.154	1829	20.8	-2.5	64.2	1823	-1.8	0	64.9	1823	-1.8	+25
Average	.150	1799	20.7	0.1	64.1	1795	-3.4		64.6	1792	-0.2	
+/-	.005 / .013	55 / 63	0.7 / 0.7	3.7 / 4.0	0.2 / 0.3	55 / 74	4.4 / 5.4		0.9 / 0.9	59 / 76	6.1 / 3.7	

TEST VEHICLE: #051

Chrysler Town & Country SW
3-Speed Automatic
V8 - 440 CID
195 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
51.304		63.8	63.1			63.7	63.5	
51.305		64.0	62.9			63.5	64.2	
51.306		64.3	63.5			64.4	65.5	
51.307		64.2	63.6			64.8	64.9	
Average		64.1	63.3			64.1	64.5	
+/-		0.2 / 0.3	0.3 / 0.4			0.7 / 0.6	1.0 / 1.0	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
51.308	.120	1658	28.1	0.3	70.2	25.0	0.3	-16.4	69.3	24.5	-6.7	0
51.309	.125	1649	28.3	-2.5	70.9	25.0	-3.2	-16.4	70.1	24.6	-8.8	0
51.310	.123	1671	28.5	-6.0	70.5	24.8	-8.8	-16.4	69.8	25.0	-6.7	0
51.311	.117	1633	27.5	7.3	70.4	24.3	-3.9	-16.4	69.0	24.1	-7.4	0
Average	.121	1653	28.1	-0.2	70.5	24.8	-3.9		69.6	24.6	0.7	
+/-	.004 / .004	18 / 20	0.4 / 0.6	7.5 / 5.8	0.4 / 0.3	0.2 / 0.5	4.2 / 4.9	/	0.6 / 0.6	0.4 / 0.5	0.7 / 1.4	/

TEST VEHICLE: #051

Chrysler Town and Country SW
3-Speed Automatic
V8 - 440 CID
195 bhp @ 3600 RPM

TEST CONDITION: 2

Mic. Distance - 25 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
51.308	70.2	68.6	67.7		68.9	69.3	67.0	
51.309	70.9	68.6	67.4		69.4	70.1	67.3	
51.310	70.5	68.8	67.2		69.1	69.8	67.0	
51.311	70.4	69.4	68.5		68.6	69.0	68.1	
Average	70.5	68.9	67.7		69.0	69.6	67.4	
+/-	0.4 / 0.3	0.6 / 0.3	0.8 / 0.5	/	0.4 / 0.4	0.6 / 0.6	0.1 / 0.8	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
51.308	.120	1658	28.1	.0.3	63.1	24.7	-4.6	0	63.7	24.8	-3.2	+25
51.309	.125	1649	28.3	-2.5	63.5	25.0	-2.5	0	64.0	24.8	-6.0	+25
51.310	.123	1671	28.5	-6.0	63.4	25.0	-6.7	0	63.9	25.0	-7.4	+25
51.311	.117	1633	27.5	7.3	62.9	24.2	-5.3	0	63.7	25.0	-3.4	+25
Average	.121	1653	28.1	-0.2	63.2	24.7	-4.8		63.8	24.9	-5.0	
+/-	.004 / .004	18 / 20	0.4 / 0.6	7.5 / 5.8	0.3 / 0.3	0.3 / 0.5	2.3 / 1.9		0.2 / 0.1	0.1 / 0.1	1.8 / 2.4	

TEST VEHICLE: #051

Chrysler Town and Country SW
3-Speed Automatic
V8 - 440 CID
195 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/8/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
51.308		63.1	62.5			63.0	63.7	
51.309		63.5	62.4			63.5	64.0	
51.310		63.4	61.8			63.3	63.9	
51.311		62.9	62.6			62.9	63.7	
Average		63.2	62.3			63.2	63.8	
+/-		0.3 / 0.3	0.3 / 0.5			0.3 / 0.8	0.2 / 0.1	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
52.326	.149	1874	23.2	-6.7	68.4	1859	-13.0	-16.4	68.0	1859	-13.0	-16.4
52.327	.146	1885	23.4	4.5	69.4	1885	4.5	0	68.7	1788	-17.9	-16.4
52.328	.151	1895	23.4	1.7	69.4	1895	1.7	-16.4	68.5	1875	- 1.1	0
52.329	.154	1875	22.9	-6.7	68.8	1829	-16.5	-16.4	68.0	1802	-21.4	-16.4
Average	.150	1882	23.2	-1.8	69.0	1867	-5.8		68.3	1831	-13.4	
+/-	.004 / .004	13 / 8	0.2 / 0.3	6.3 / 4.9	0.4 / 0.6	28 / 38	10.3 / 10.7		0.4 / 0.3	44 / 43	12.3 / 8.1	

TEST VEHICLE: #052

Ford LTD
3-Speed Automatic
V8 - 351 CID
161 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/6/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
52.326	68.4	67.4	65.9		68.0	67.8	64.3	
52.327	69.4	69.4	66.3		68.7	68.3	65.8	
52 328	69.4	67.9	66.8		68.2	68.5	65.9	
52.329	68.8	67.6	64.4		68.0	67.5	64.5	
Average	69.0	68.1	65.9		68.2	68.0	65.1	
+/-	0.4 / 0.6	1.3 / 0.7	1.0 / 1.5		0.5 / 0.2	0.5 / 0.5	0.8 / 0.8	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
52.326	.149	1874	23.2	-6.7	63.0	1866	-8.8	0	62.1	1874	-6.7	0
52.327	.146	1885	23.4	4.5	62.8	1815	-8.8	0	62.7	1885	4.5	+25
52.328	.151	1895	23.4	1.7	62.6	1895	1.7	0	62.1	1815	-13.0	0
52.329	.154	1875	22.9	-6.7	62.9	1846	-12.3	0	62.5	1813	-20.7	0
Average	.150	1882	23.2	-1.8	62.8	1856	-7.1		62.4	1847	-9.0	
+/-	.004 / .004	13 / 8	0.2 / 0.3	6.3 / 4.9	0.2 / 0.2	39 / 38	8.8 / 5.3		0.4 / 0.3	38 / 34	13.5 / 11.7	

TEST VEHICLE: #052

Ford LTD
3-Speed Automatic
V8 - 351 CID
161 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/6/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
52.326		63.0	61.6			62.1	61.0	
52.327		62.9	62.0			62.2	62.7	
52.328		62.6	61.8			62.1	61.9	
52.329		62.9	61.2			62.5	61.5	
Average		62.8	61.7			62.2	61.8	
+/-		0.2 / 0.2	0.4 / 0.5			0.3 / 0.1	0.9 / 0.8	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
53.321	.150	2454	27.3	3.1	75.8	24.3	-6.0	-16.4	75.0	25.0	3.1	0
53.322	.145	2345	25.7	4.5	75.5	24.1	-6.0	-16.4	75.3	25.0	4.5	0
53.323	.152	2458	27.3	-1.8	75.7	24.7	-6.7	-16.4	75.0	24.9	-3.2	-16.4
53.328	.149	2379	26.3	+0.3	75.2	24.4	-6.7	-16.4	75.0	24.6	-4.6	-16.4
Average	.149	2409	26.7	1.5	75.6	24.4	-6.3		75.1	24.9	-0.1	
+/-	.003 / .004	49 / 64	0.6 / 1.0	3.0 / 3.3	0.3 / 0.4	0.3 / 0.3	0.3 / 0.4		0.2 / 0.1	0.1 / 0.3	4.6 / 4.5	

TEST VEHICLE: #053

Oldsmobile Delta 88
3-Speed Automatic
V8 - 350 CID (Diesel)
120 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/2/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
53.321	75.8	75.7	72.9		74.7	75.0	72.7	
53.322	75.5	75.4	72.9		74.7	75.3	72.1	
53.323	75.7	75.4	72.8		75.0	74.5	71.8	
53.328	75.2	75.0	72.8		75.0	74.2	71.3	
Average	75.6	75.4	72.9		74.9	74.8	72.0	
+/-	0.2 / 0.4	0.3 / 0.4	0.0 / 0.1		0.1 / 0.2	0.6 / 0.6	0.7 / 0.7	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
53.321	.150	2454	27.3	3.1	69.7	24.9	1.7	0	70.4	24.9	2.4	0
53.322	.145	2345	25.7	4.5	69.8	24.9	3.8	0	69.5	25.0	4.5	0
53.323	.152	2458	27.3	-1.8	69.1	24.7	-6.7	0	69.4	24.9	-3.9	0
53.328	.149	2379	26.3	0.3	69.1	24.2	-8.8	0	69.3	24.7	-1.8	0
Average	.149	2409	26.7	1.5	69.4	24.7	-2.5		69.7	24.9	0.3	
+/-	.003 / .004	49 / 64	0.6 / 1.0	3.0 / 3.3	0.4 / 0.3	0.2 / 0.5	6.3 / 6.3		0.8 / 0.4	0.1 / 0.2	4.2 / 4.2	

TEST VEHICLE: #053

Oldsmobile Delta 88
3-Speed Automatic
V8 - 350 CID (Diesel)
120 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/2/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
53.321		69.7	68.2			70.4	69.1	
53.322		69.8	68.7			69.5	69.5	
53.323		69.1	68.7			69.4	69.0	
53.328		69.1	68.4			69.3	68.2	
Average		69.4	68.5			69.7	69.0	
+/-		0.4 / 0.3	0.3 / 0.2			0.8 / 0.4	0.6 / 0.8	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
54.304	.144	-	-	-3.2	67.6	2883	-29.8	-16.4	68.3	3001	-12.3	-16.4
54.305	.155	-	-	-8.8	68.1	3086	-8.8	0	68.7	3033	-15.1	-16.4
54.306	.149	-	-	+1.7	67.6	3025	-0.4	0	68.1	2996	-10.2	-16.4
54.307	.148	-	-	+1.0	68.1	3044	-6.7	0	67.7	2974	-13.0	-16.4
Average	.149	-	-	-2.3	67.9	3010	-11.4		68.2	3001	-12 7	
+/-	.006 / .005			4.0 / 6.5	0.2 / 0.3	77 / 127	11.0 / 18.4		0.5 / 0.5	32 / 27	2.5 / 2.5	

TEST VEHICLE: #054

Honda Civic CVCC
2-Speed Automatic
L4 - 91 CID
60 bhp @ 5000 RPM

TEST CONDITION: 1A

Mic Distance = 25 feet

TEST DATE: 8/16/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
54.304	67.6	67.5	67.3		68.3	65.7	66.3	
54.305	68.1	68.1	66.3		68.7	66.2	66.3	
54.306	66.8	67.6	67.4		68.1	66.3	67.2	
54.307	67.9	68.1	67.3		67.7	66.2	67.3	
Average	67.6	67.8	67.1		68.2	66.1	66.8	
+/-	0.5 / 0.6	0.3 / 0.3	0.3 / 0.8		0.5 / 0.5	0.2 / 0.4	0.5 / 0.5	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
54.304	.144	-	-	-3.2	62.5	3004	-10.2	0	62.5	3004	-12.2	0
54.305	.155	-	-	-8.8	62.7	3057	-10.9	0	62.9	3086	-9.5	0
54.306	.149	-	-	+1.7	62.2	3025	-5.3	0	62.8	3013	-4.6	0
54.307	.148	-	-	+1.0	62.7	3040	-5.3	0	63.1	3088	+1.0	0
Average	.149	-	-	-2.3	62.5	3032	-7.9		62.8	3048	-5.8	
+/-	.006 / .005			4.0 / 6.5	0.2 / 0.3	26 / 28	2.6 / 3.0		0.3 / 0.3	40 / 44	6.8 / 4.4	

TEST VEHICLE: #054

Honda Civic CVCC
2-Speed Automatic
L4 - 91 CID
60 bhp @ 5000 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/16/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
54.303		62.5	61.4			62.5	62.2	
54.304		62.7	61.2			62.9	61.2	
54.305		62.2	61.9			62.8	62.5	
54.306		62.7	61.6			62.4	63.1	
Average		62.5	61.5			62.7	62.3	
+/-		0.2 / 0.3	0.4 / 0.3			0.2 / 0.3	0.8 / 1.1	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
55.310	.150	2375	21.3	-6.7	73.6	2302	-3.2	-16.4	68.6	2352	-5.3	0
55.311	.143	2379	21.2	-1.8	73.8	2313	-5.3	-16.4	68.9	2341	-8.1	0
55.312	.149	2397	21.4	-0.4	74.3	2385	-3.2	-16.4	68.9	2397	-0.4	0
55.313	.156	2415	21.5	-1.8	74.2	2410	-0.4	-16.4	69.0	2394	-5.3	0
Average	.150	2392	21.4	-2.7	74.0	2365	-3.0		68.9	2371	-4.8	
+/-	.006 / .007	23 / 17	0.1 / 0.2	2.3 / 4.0	0.3 / 0.4	45 / 63	2.6 / 2.3		0.1 / 0.3	26 / 30	4.4 / 3.3	

TEST VEHICLE: #055

Jeep Wagoneer (4 WD)
3-Speed Automatic
V8-360 CID
129 bhp @ 3700 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
55.310	73.6	70.0	68.1		-	68.6	65.1	
55.311	73.8	70.4	68.9		-	68.9	66.0	
55.312	74.3	70.3	69.0		-	68.9	66.4	
55.313	74.2	70.1	68.6		-	69.0	66.2	
Average	74.0	70.2	68.7			68.9	65.9	
+/-	0.3 / 0.4	0.2 / 0.2	0.4 / 0.6			0.1 / 0.3	0.5 / 0.8	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
55.310	.150	2375	21.3	-6.7	63.6	2338	-4.6	+25	64.0	2303	-16.5	0
55.311	.143	2379	21.2	-1.8	64.4	2325	1.7	+25	63.6	2277	-15.8	0
55.312	.149	2397	21.4	-0.4	64.3	2395	1.0	+25	63.5	2306	-12.3	0
55.313	.156	2415	21.5	-1.8	64.2	2372	1.7	+25	63.7	2300	-15.1	0
Average	.150	2392	21.4	-2.7	64.1	2358	-0.1		63.7	2297	-14.9	
+/-	.006 / .007	23 / 17	0.1 / 0.2	2.3 / 4.0	0.3 / 0.5	37 / 53	1.8 / 4.5		0.3 / 0.2	9 / 20	2.6 / 1.6	

TEST VEHICLE: #055

Jeep Wagoneer (4 WD)
3-Speed Automatic
V8 - 360 CID
129 bhp @ 3700 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
55.310		63.5	63.6			64.0	62.1	
55.311		63.6	64.4			63.6	62.4	
55.312		63.9	64.3			63.5	62.6	
55.313		63.7	64.2			63.7	62.9	
Average		63.7	64.1			63.7	62.5	
+/-		0.2 / 0.2	0.3 / 0.5			0.3 / 0.2	0.4 / 0.4	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
55.315	.127	1846	28.1	1.7	72.6	24.5	-6.7	-16.4	67.3	24.6	-6.0	0
55.316	.126	1860	28.3	-2.5	72.6	24.6	-8.1	-16.4	67.0	24.8	-6.0	0
55.317	.127	-	28.5	-5.3	70.1	24.7	-8.8	-16.4	66.5	25.0	-5.3	0
55.318	.119	1849	28.4	-6.7	72.7	24.9	-8.1	-16.4	66.6	24.8	-9.5	0
Average	.125	1852	28.3	-3.2	72.0	24.7	-7.9		66.9	24.8	-6.7	
+/-	.002 / .006	8 / 6	0.2 / 0.2	4.9 / 3.5	0.7 / 1.9	0.2 / 0.2	1.2 / 0.9		0.5 / 0.4	0.2 / 0.2	1.4 / 2.8	

TEST VEHICLE: #055

Jeep Wagoneer (4 WD)
3-Speed Automatic
V8 - 360 CID
129 bhp @ 3700 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 8/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
55.315	72.6	69.5	66.9		-	67.3	65.1	
55.316	72.6	68.3	66.7		-	67.0	63.4	
55.317	70.1	68.5	65.6		-	66.5	63.3	
55.318	72.7	68.4	65.9		-	66.6	62.4	
Average	72.0	68.7	66.3			66.9	63.6	
+/-	0.7 / 1.9	0.8 / 0.4	0.6 / 0.7			0.5 / 0.4	1.6 / 1.2	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
55.315	.127	1846	28.1	1.7	63.1	24.9	0.3	+25	61.4	24.6	-5.3	0
55.316	.126	1860	28.3	-2.5	62.4	24.7	-7.4	0	61.4	23.4	-23.5	+25
55.317	.127	-	28.5	-5.3	62.7	24.9	-7.4	0	61.6	24.6	-10.8	0
55.318	.119	1849	28.4	-6.7	62.0	25.0	-6.7	+25	61.5	25.0	-6.7	0
Average	.125	1852	28.3	-3.2	62.6	24.9	-5.3		61.5	24.4	-11.6	
+/-	.002 / .006	8 / 6	0.2 / 0.2	4.9 / 3.5	0.6 / 0.6	0.1 / 0.2	5.6 / 2.1		0.1 / 0.1	0.6 / 1.0	6.3 / 11.9	

TEST VEHICLE: #055

Jeep Wagoneer (4 WD)
3-Speed Automatic
V8 - 360 CID
129 bhp @ 3700 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max Sl at Mic at -25 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +25 feet		Max Sl at Mic at -25 feet	Max Sl at Mic at 0 feet	Max Sl at Mic at +25 feet	
55.315		62.8	63.1			61.4	61.0	
55.316		62.4	62.1			61.2	61.4	
55.317		62.7	62.2			61.6	60.5	
55.318		61.9	62.0			61.5	60.1	
Average		62.5	62.4			61.4	60.8	
+/-		0.4 / 0.6	0.8 / 0.4			0.2 / 0.2	0.7 / 0.7	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
56.304	.147	21.3	3835	5.9	73.0	3835	5.9	-16.4	74.0	3835	5.9	0
56.305	.162	21.3	3835	-3.9	73.0	3835	-3.9	0	70.9	3797	-5.3	0
56.306	.144	21.3	3852	0.3	73.1	3821	-1.8	0	73.3	3852	0.3	0
56.307	.138	21.2	3850	0.3	73.0	3850	0.3	0	73.6	3850	0.3	0
Average	.148	21.3	3843	0.7	73.0	3835	0.1		73.0	3834	0.3	
+/-	.014 / .010	0 / 0.1	9 / 8	5.3 / 4.6	0.1 / 0	15 / 14	5.8 / 4.0		1.1 / 2.1	18 / 37	5.6 / 5.6	

TEST VEHICLE: #056

Saab 99
4-Speed Manual
L4 - 121 CID
115 bhp @ 5500 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 8/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
56.304	73.0	72.4	70.6		-	74.0	70.3	
56.305	71.5	73.0	69.5		-	70.9	70.7	
56.306	72.3	73.1	69.8		-	73.3	71.2	
56.307	71.6	73.0	70.0		-	73.6	70.1	
Average	72.1	72.9	70.0			73.0	70.6	
+/-	0.9 / 0.5	0.2 / 0.5	0.6 / 0.5			1.1 / 2.1	0.6 / 0.5	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
56.304	.147	21.3	3835	5.9	66.1	3825	4.5	+25	69.2	3835	5.9	0
56.305	.162	21.3	3835	-3.9	67.2	3782	-7.4	0	68.0	3835	-3.9	0
56.306	.144	21.3	3852	0.3	67.2	3852	0.3	0	68.8	3852	0.3	0
56.307	.138	21.2	3850	0.3	65.8	3753	-4.6	+25	68.3	3850	0.3	0
Average	.148	21.3	3843	0.7	66.6	3803	-1.8		68.6	3843	0.7	
+/-	.014 / .010	0 / 0.1	9 / 8	5.3 / 4.6	0.6 / 0.8	49 / 50	6.3 / 5.6		0.6 / 0.6	9 / 8	5.3 / 4.6	

TEST VEHICLE: #056

Saab 99
4-Speed Manual
L4 - 121 CID
115 bhp @ 5500 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 8/10/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
56.304		65.9	66.1			69.2	64.9	
56.305		67.2	64.6			68.0	65.8	
56.306		67.2	65.3			68.8	66.8	
56.307		65.6	65.8			68.3	65.7	
Average		66.5	65.5			68.6	65.8	
+/-		0.7 / 0.9	0.7 / 0.9			0.6 / 0.6	1.0 / 0.9	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
57.304	.154	2297	23.3	-3.2	69.7	2289	-1.8	-16.4	70.4	2289	+1.0	0
57.305	.149	2275	23.3	-1.1	69.7	2268	+0.3	-16.4	70.0	2257	-4.6	0
57.306	.149	2289	23.6	+3.8	69.5	2119	-22.8	-16.4	69.7	2234	+6.6	0
57.307	.141	2279	23.7	-1.1	69.7	2275	-0.4	-16.4	70.3	2269	-3.2	0
Average	.148	2285	23.7	-0.4	69.7	2238	-6.2		70.1	2262	-0.1	
+/-	.006 / .007	12 / 10	0.2 / 0.2	4.2 / 2.8	0 / 0.2	51 / 119	6.5 / 16.6		0.3 / 0.4	27 / 28	6.7 / 4.5	

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TEST VEHICLE: #057

Oldsmobile Omega
3-Speed Automatic
V8 - 260 CID
110 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/16/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
57.304	69.7	67.8	66.8		69.7	70.4	68.7	
57.305	69.7	67.3	66.2		69.2	70.0	68.4	
57.306	69.5	67.8	67.7		69.1	69.7	69.3	
57.307	69.7	67.8	66.6		69.6	70.3	68.9	
Average	69.7	67.7	66.8		69.4	70.1	68.8	
+/-	0 / 0.2	0.1 / 0.4	0.9 / 0.6		0.3 / 0.3	0.3 / 0.4	0.5 / 0.4	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
57.304	.154	2297	23.3	-3.2	62.2	2250	-8.8	0	63.7	2277	-5.3	0
57.305	.149	2275	23.3	-1.1	62.0	2231	-8.1	0	63.7	2233	-8.8	0
57.306	.149	2289	23.6	+3.8	62.0	2240	-5.3	0	64.3	2206	-10.9	0
57.307	.141	2279	23.7	-1.1	61.4	2273	+0.3	+25	63.3	2206	+2.4	+25
Average	.148	2285	23.5	-0.4	61.9	2249	-5 5		63.8	2231	-5.7	
+/-	.006 / .007	12 / 10	0.2 / 0.2	4.2 / 2.8	0.3 / 0.5	25 / 18	5.8 / 3.3		0.5 / 0.5	47 / 25	8.1 / 5.3	

TEST VEHICLE: #057

Oldsmobile Omega
3-Speed Automatic
V8 -260 CID
110 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/16/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
57.304		62.2	61.8			63.7	63.7	
57.305		62.0	61.8			63.1	63.2	
57.306		62.0	61.5			64.3	63.3	
57.307		61.3	61.4			63.2	63.3	
Average		61.9	61.6			63.7	63.4	
+/-		0.3 / 0.6	0.2 / 0.2			0.6 / 0.5	0.3 / 0.2	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
58.303	.154	1552	16.5	-2.5	64.9	1456	+6.6	+16.4	64.6	1550	-3.9	+16.4
58.304	.156	1549	16.1	-1.1	65.4	1515	+7.3	+16.4	65.5	1503	-8.1	0
58.305	.141	1493	15.3	-0.4	64.2	1460	-7.4	0	64.3	1455	-8.1	0
58.306	.148	1528	16.1	+3.8	64.6	1522	+4.5	+16.4	64.6	1521	+5.9	+16.4
Average	.150	1531	16.0	+0.5	64.8	1488	+2.8		64.8	1507	-3.6	
+/-	.006 / .009	22 / 38	0.5 / 0.7	3.3 / 2.0	0.6 / 0.6	34 / 32	4.6 / 4.7	/	0.7 / 0.5	43 / 52	9.5 / 4.6	/

TEST VEHICLE: #058

Dodge B200 Van
3-Speed Automatic
V8-360 CID
175 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/17/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at +16.4 Ft	Max SI at Mic at 0 feet	Max SI at Mic at -16.4 ft		Max SI at Mic at +16.4 Ft	Max SI at Mic at 0 feet	Max SI at Mic at -16.4 Ft	
58.303	64.1	64.3	64.9		64.0	64.4	64.6	
58.304	64.5	65.2	65.4		64.7	65.5	65.3	
58.305	63.1	64.2	64.0		63.5	64.3	63.9	
58.306	62.7	63.9	64.6		63.8	63.8	64.6	
Average	63.6	64.4	64.7		64.0	64.5	64.6	
+/-	0.9 / 0.9	0.8 / 0.5	0.7 / 0.7	/	0.7 / 0.5	1.0 / 0.7	0.7 / 0.7	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
58.303	.154	1552	16.5	-2.5	59.5	1550	-3.9	+25	59.6	1510	-15.1	0
58.304	.156	1549	16.1	-1.1	60.6	1543	+1.7	+25	60.4	1543	-1.8	+25
58.305	.141	1493	15.3	-0.4	59.0	1484	+1.7	+25	59.6	1461	+6.6	+25
58.306	.148	1528	16.1	+3.8	59.5	1511	+7.3	+25	59.3	1522	+4.5	+25
Average	.150	1531	16.0	+0.5	59.7	1522	+1.7		59.7	1509	-1.5	
+/-	.006 / .009	22 / 38	0.5 / 0.7	3.3 / 2.0	0.9 / 0.7	28 / 38	5.6 / 5.6	/	0.7 / 0.4	34 / 48	7.1 / 13.7	/

TEST VEHICLE: #058

Dodge B200 Van
3-Speed Automatic
V8 - 360 CID
175 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/17/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
58.303		58.5	59.5			59.6	59.4	
58.304		59.5	60.6			60.1	60.4	
58.305		58.1	59.0			59.1	59.6	
58.306		58.0	59.5			59.2	59.3	
Average		58.5	59.7			59.5	59.7	
+/-	/	1.0 / 0.5	0.9 / 0.7	/	/	0.6 / 0.4	0.7 / 0.4	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
58.308	.122	1597	27.6	+8.7	67.1	24.9	+7.3	+16.4	67.1	24.4	+2.4	0
58.309	.118	1587	28.1	+1.0	67.0	24.7	-4.6	0	67.3	24.8	-1.8	0
58.310	.121	1583	28.3	-3.9	67.2	24.7	-8.1	0	67.3	25.0	-3.9	0
58.311	.123	1597	27.9	+1.7	66.8	25.0	+1.7	+16.4	67.3	24.7	-3.9	0
Average	.121	1591	28.0	+1.9	67.0	24.8	-0.9		67.3	24.7	-1.8	
+/-	.002 / .003	6 / 8	0.3 / 0.4	6.8 / 5.8	0.2 / 0.2	0.2 / 0.1	6.4 / 7.2		0 / 0.2	0.3 / 0.3	4.2 / 2.1	

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TEST VEHICLE: #058

Dodge B200 Van
3-Speed Automatic
V8 - 360 CID
175 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 8/17/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
58.308	66.2	66.9	67.1		66.7	67.1	66.9	
58.309	62.2	67.0	65.9		67.2	67.3	67.1	
58.310	66.2	67.2	65.1		67.1	67.3	65.8	
58 311	66.5	66.8	66.8		66.9	67.3	66.9	
Average	66.3	67.0	66.2		67.0	67.3	66.7	
+/-	0.2 / 0.1	0.2 / 0.2	0.9 / 1.1		0.2 / 0.3	0 / 0.2	0.2 / 0.9	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
58.308	.122	1597	27.6	+8.7	62.1	24.9	+7.3	+25	62.3	25.0	+8.7	+25
58.309	.118	1587	28.1	+1.0	61.5	24.8	-3.2	+25	62.5	24.8	-3.2	+25
58.310	.121	1583	28.3	-3.9	61.1	24.8	-5.3	+25	61.6	25.0	-4.6	+25
58.311	.123	1597	27.9	+1.7	61.6	24.9	+1.0	+25	62.6	24.8	+0.3	+25
Average	.121	1591	28.0	+1.9	61.6	24.9	-0.1		62.3	24.9	+0.3	
+/-	.002 / .003	6 / 8	0.3 / 0.4	6.8 / 5.8	0.5 / 0.5	0. / 0.1	5.4 / 7.2		0.3 / 0.7	0.1 / 0.1	8.4 / 4.9	

TEST VEHICLE: #058

Dodge B200 Van
3-Speed Automatic
V8 - 360 CID
175 bhp @ 4000 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/17/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
58.308		60.7	62.1			61.4	62.3	
58.309		61.0	61.5			61.7	62.5	
58.310		60.8	61.1			61.6	61.6	
58.311		60.7	61.6			61.3	62.6	
Average		60.8	61.6			61.5	62.3	
+/-		0.2 / 0.1	0.5 / 0.5			0.2 / 0.2	0.3 / 0.7	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
59.303	.134	3379	26.9	-1.1	82.1	3126	-3.9	-16.4	83.5	3163	-1.1	0
59.304	.131	3387	26.8	+1.0	82.2	3066	-8.1	-16.4	82.7	3114	-5.3	0
59.305	.125	3252	25.6	+2.4	81.7	3086	-6.0	-16.4	82.3	3112	-2.5	0
59.306	.127	3285	25.9	+0.3	81.8	3115	-3.9	-16.4	84.5	3115	-3 9	0
Average	.129	3326	26.3	+0.7	82.0	3098	-5.5		83.3	3126	-3.2	
+/-	.005 / .004	61 / 74	0.6 / 0.7	1.7 / 1.8	0.2 / 0.3	28 / 32	1.6 / 2.6		1.2 / 1.0	37 / 14	2.1 / 2.1	

TEST VEHICLE: #059

International Scout Terra
3-Speed Automatic
L6 - 198 CID (Diesel)
92 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
59.303	82.1	79.2	80.1		-	83.5	81.0	
59.304	82.2	79.7	80.5		81.0	82.7	80.8	
59.305	81.7	79.8	80.5		80.5	82.3	81.4	
59.306	81.8	79.8	80.8		81.5	84.5	81.3	
Average	82.0	79.6	80.5		81.0	83.3	81.1	
+/-	0.2 / 0.3	0.2 / 0.4	0.3 / 0.4		0.5 / 0.5	1.2 / 1.0	0.3 / 0.3	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
59.303	.134	3379	26.9	-1.1	75.1	3145	-3.2	+25	76.2	3127	-3.3	+25
59.304	.131	3387	26.8	+1.0	74.8	3163	-0.4	+25	75.7	3122	-3.9	+25
59.305	.125	3252	25.6	+2.4	74.9	3090	-3.9	+25	75.9	3138	+1.0	+25
59.306	.127	3285	25.9	+0.3	75.1	3134	-1.8	+25	76.1	3102	-4.6	+25
Average	.129	3326	26.3	+0.7	75.0	3133	-2.3		76.0	3122	-2.2	
+/-	.005 / .004	61 / 74	0.6 / 0.7	1.7 / 1.8	0.1 / 0.2	30 / 43	1.9 / 1.6		0.2 / 0.3	16 / 20	3.7 / 1.9	

TEST VEHICLE: #059

International Scout Terra
3-Speed Automatic
L6 - 198 CID (Diesel)
92 bhp @ 4000 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
59.303		74.2	75.1			75.3	76.2	
59.304		73.6	74.8			74.8	75.7	
59.305		73.7	74.9			74.9	75.9	
59.306		74.3	75.1			75.0	76.1	
Average		74.0	75.0			75.0	76.0	
+/-		0.3 / 0.4	0.1 / 0.2			0.3 / 0.2	0.2 / 0.3	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max. Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
60.303	.160	17.6	4573	-3.2	73.5	3502	-3.2	0	74.9	3502	-3.2	0
60.304	.148	17.6	4399	+4.5	73.4	3280	-4.6	0	75.2	3462	+3.8	-16.4
60 305	.154	17.4	4510	-0.4	73.6	3524	-0.4	0	74.8	3524	-0.4	0
60.306	.154	17.8	4560	-2.5	73.5	3280	-10.2	-16.4	74.6	3483	-2.5	0
Average	.154	17.6	4511	-0.4	73.5	3397	-4.6		74.9	3493	-0.6	
+/-	.006 / .006	0.2 / 0.2	63 / 112	4.9 / 2.8	0.1 / 0.1	128 / 117	4.2 / 5.6		0.3 / 0.3	31 / 31	4.4 / 2.6	

TEST VEHICLE: #060

VW Rabbit
4-Speed Manual
L4 - 89.7 CID (Diesel)

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 8/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
60.303	73.2	73.5	70.4		74.4	74.9	73.8	
60.304	72.8	73.4	71.6		75 2	74.7	74.3	
60.305	72.6	73.6	70.8		73.3	74.8	74.7	
60.306	73.5	72.8	70.5		73.5	74.6	73.2	
Average	73.0	73.3	70.8		74.1	74.8	74.0	
+/-	0.5 / 0.4	0.3 / 0.5	0.8 / 0.4		1.1 / 0.8	0.1 / 0.2	0.7 / 0.8	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
60.303	.160	17.6	4573	-3.2	66.7	3438	-6.0	0	69.4	3473	-3.9	+25
60.304	.148	17.6	4399	+4.5	67.7	3514	+4.5	0	69.5	3514	+4.5	+25
60.305	.154	17.4	4510	-0.4	66.8	3524	-0.4	0	69.1	3524	-0.4	+25
60.306	.154	17.8	4560	-2.5	65.9	3483	-2.5	0	68.7	3483	-2.5	+25
Average	.154	17.6	4511	-0.4	66.8	3490	-1.1		69.2	3499	-0.6	
+/-	.006 / .006	0.2 / 0.2	63 / 112	4.9 / 2.8	0.9 / 0.9	34 / 52	5.6 / 4.9		0.3 / 0.5	26 / 26	5.1 / 3.3	

TEST VEHICLE: #060

VW Rabbit
4-Speed Manual
L4 - 89.7 CID (Diesel)

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 8/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
60.303		66.7	66.0			68.4	69.4	
60.304		67.7	67.0			68.5	69.5	
60.305		66.8	66.7			68.7	69.1	
60.306		65.9	65.2			68.2	68.7	
Average		66.8	66.2			68.5	69.2	
+/-		0.9 / 0.9	0.8 / 1.0			0.2 / 0.3	0.3 / 0.5	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
61.307	.174	14.5	3070	-9.5	71.6	2137	-9.5	-16.4	71.1	2137	-9.5	0
61.308	.162	14.5	2996	-8.1	70.2	2136	-8.1	-16.4	70.2	2057	-11.6	-16.4
61.309	.155	14.4	2952	-7.6	69.9	2139	-7.4	-16.4	70.0	2065	-10.9	-16.4
61.310	.161	14.4	2965	-6.7	69.7	2023	-11.6	-16.4	69.8	2064	-9.5	-16.4
Average	.163*	14.5	2996	-8.0	70.4	2109	-9.2		70.3	2081	-10.4	
+/-	.011 / .008	0 / 0.1	74 / 44	0.4 / 1.5	1.2 / 0.7	30 / 86	2.4 / 1.8		0.8 / 0.4	56 / 24	1.2 / 0.9	

*Acceleration 0.003g outside tolerance.

TEST VEHICLE: #061

AMC Jeep CJ-5
3-Speed Manual
L6 - 232 CID
90 bhp @ 3050 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 8/18/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
61.307	71.6	70.0	69.0		70.7	71.1	68.2	
61.308	70.2	68.6	68.3		70.2	69.2	68.0	
61.309	69.9	69.0	68.4		70.0	69.4	68.1	
61.310	69.7	68.7	68.0		69.8	69.0	67.8	
Average	70.4	69.1	68.4		70.2	69.7	68.0	
+/-	1.2 / 0.7	0.9 / 0.5	0.6 / 0.4		0.5 / 0.4	1.4 / 0.7	0.2 / 0.2	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
61.307	.174	14.5	3070	-9.5	64.3	2137	-9.5	0	64.9	2137	-9.5	0
61.308	.162	14.5	2996	-8.1	63.1	2136	-8.1	+25	63.7	2108	-10.2	0
61.309	.155	14.4	2952	-7.6	63.2	2139	-7.6	+25	63.7	2102	-8.8	0
61.310	.161	14.4	2965	-6.7	63.1	2109	-7.4	+25	63.7	2104	-8.1	0
Average	.163*	14.5	2996	-8.0	63.4	2130	-8.2		64.0	2113	-9.2	
+/-	.011 / .008	0 / 0.1	74 / 44	0.4 / 1.5	0.9 / 0.3	9 / 21	1.3 / 0.8		0.9 / 0.3	24 / 11	1.0 / 1.1	

*Acceleration 0.003g outside tolerance.

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
61.307		64.3	63.6			64.9	64.0	
61.308		63.1	63.1			63.7	63.3	
61.309		63.0	63.2			63.7	62.6	
61.310		63.0	63.1			63.7	63.3	
Average		63.4	63.3			64.0	63.3	
+/-		0.9 / 0.4	0.3 / 0.2			0.9 / 0.3	0.7 / 0.7	

TEST VEHICLE: #061

AMC Jeep CJ-5
3-Speed Manual
L6 - 232 CID
90 bph @ 3050 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 8/18/77

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
62.304	.149	2062	21.6	-6.7	71.2	2052	-8.1	0	71.1	2052	-6.0	+16.4
62.305	.150	2052	21.4	-8.8	71.5	1945	-29.1	-16.4	71.3	2026	-17.2	0
62.306	.145	2090	21.9	+5.9	71.8	2086	-4.5	+16.4	71.9	2050	-1.8	+16.4
62.307	.151	2084	21.9	+2.4	71.5	2076	-3.2	0	72.0	2072	-2.5	+16.4
Average	.149	2072	21.7	-1.8	71.5	2040	-9.0	-	71.6	2050	-6.9	-
+/-	.002 / .004	18 / 20	0.2 / 0.3	7.7 / 7.0	0.3 / 0.3	46 / 95	13.5 / 20.1		0.4 / 0.5	22 / 24	5.1 / 10.3	

TEST VEHICLE: #062

AMC Matador SW
3-Speed Automatic
V8 - 304 CID
126 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
62.304	70.9	71.2	70.8		-	70.8	71.1	
62.305	71.5	71.0	70.4		-	71.3	71.2	
62.306	70.9	70.8	71.8		-	70.7	71.9	
62.307	70.9	71.5	71.3		-	71.2	72.0	
Average	71.1	71.1	71.1		-	71.0	71.6	
+/-	0.4 / 0.2	0.4 / 0.3	0.7 / 0.7			0.3 / 0.3	0.4 / 0.5	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
62.304	.149	2062	21.6	-6.7	65.6	2028	-12.3	+25	66.0	2059	-5.3	+25
62.305	.150	2052	21.4	-8.8	65.6	2032	-12.3	+25	66.0	2026	-6.0	+25
62.306	.145	2090	21.9	+5.9	66.0	2061	-1.1	+25	66.7	2072	+3.1	+25
62.307	.151	2084	21.9	+2.4	65.8	2064	-5.3	+25	67.0	2040	+1.0	+25
Average	.149	2072	21.7	-1.8	65.8	2046	-7.8		66.4	2059	-1.8	
+/-	.002 / .004	18 / 20	0.2 / 0.3	7.7 / 7.0	0.2 / 0.2	18 / 18	6.7 / 4.6	/	0.6 / 0.4	21 / 33	5.1 / 4.2	/

TEST VEHICLE: #062

AMC Matador SW
3-Speed Automatic
V8 - 304 CID
126 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
62.304		64.9	65.6			65.8	66.0	
62.305		65.1	65.6			65.7	66.0	
62.306		64.3	66.0			65.6	66.7	
62.307		64.8	65.8			66.3	67.0	
Average		64.5	65.8			65.9	66.4	
+/-	/	0.4 / 0.2	0.2 / 0.2	/	/	0.4 / 0.2	0.6 / 0.4	/

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
62.308	.127	1858	28.2	+0.3	70.1	24.9	-2.5	-16.4	70.5	24.4	-6.7	0
62.309	.119	1813	27.8	+4.5	70.5	22.7	-24.7	-16.4	69.9	24.8	+2.4	+16.4
62.310	.118	1799	28.1	-1.1	70.0	23.6	-20.3	-16.4	69.8	24.9	-3.2	+16.4
62.311	.119	1804	27.9	+2.2	69.8	23.0	-21.4	-16.4	70.8	24.7	+0.3	+16.4
Average	.125	1819	28.0	+1.5	70.1	23.6	-17.3		70.3	24.7	-1.8	
+/-	.006 / .003	39 / 20	0.2 / 0.2	3.0 / 2.6	0.4 / 0.3	1.3 / 0.9	4.8 / 7.6		0.5 / 0.5	0.2 / 0.3	4.2 / 4.9	

TEST VEHICLE: #062

AMC Matador SW
3-Speed Automatic
V8 - 304 CID
126 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 8/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
62.308	70.1	70.1	69.5		-	70.5	69.8	
62.309	70.5	69.4	69.1		-	69.3	69.9	
62.310	70.0	68.9	69.8		-	69.4	69.8	
62.311	69.8	69.4	69.4		-	69.4	70.8	
Average	70.1	69.5	69.5		-	69.7	70.1	
+/-	0.4 / 0.3	0.6 / 0.6	0.3 / 0.4			0.8 / 0.3	0.7 / 0.3	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
62.308	.127	1858	28.2	+0.3	64 4	23.9	-15.8	+25	65.6	22.7	-21.0	0
62.309	.119	1813	27.8	+4.5	63.6	24.0	-8.1	+25	64.8	24.4	-0.4	+25
62.310	.118	1799	28.1	-1.1	63.9	24.6	-5.3	+25	64.9	25.0	+1.7	+25
62.311	.119	1804	27.9	+2.2	64.0	24.7	+1.0	+25	64.7	24.8	+1.7	+25
Average	.121	1819	28.0	+5.0	64.0	24.3	-7.1		65.0	24.2	-6.0	
+/-	.006 / .003	39 / 20	0.2 / 0.2	3.0 / 2.6	0.4 / 0.4	0.4 / 0.4	8.1 / 8.8		0.6 / 0.3	0.8 / 1.5	7.7 / 0.9	

TEST VEHICLE: #062

AMC Matador SW
3-Speed Automatic
V8 - 304 CID
126 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/19/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
62.308		64.0	64.4			65.6	65.2	
62.309		63.3	63.4			64.4	64.8	
62.310		63.0	63.9			64.6	64.9	
62.311		63.0	64.0			64.7	64.7	
Average		63.3	64.0			64.8	64.9	
+/-		0.7 / 0.3	0.4 / 0.4			0.8 / 0.4	0.3 / 0.2	

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
63.303	.154	2361	25.1	+8.0	74.5	2351	+5.2	-16.4	77.2	2316	+2.4	0
63.304	.146	2335	24.7	+1.7	76.1	2203	-17.2	-16.4	75.7	2279	-8.1	0
63.305	.150	2332	24.8	-3.9	79.2	2276	-14.4	-16.4	78.7	2271	-13.0	-16.4
63.306	.149	2329	24.7	-3.9	77.9	2284	-13.7	-16.4	77.0	2272	-13.0	-16.4
Average	.150	2339	24.8	+0.5	76.9	2279	-10.0		77.2	2285	-7.9	
+/-	.004 / .004	22 / 10	0.3 / 0.1	8.5 / 3.4	2.3 / 2.4	73 / 76	5.2 / 7.2		1.5 / 1.5	32 / 14	10.3 / 5.1	

TEST VEHICLE: #063

Chevrolet Nova
3-Speed Automatic
L6 - 250 CID
110 bhp @ 3800 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
63.303	74.5	74.1	73.2		75.0	77.2	73.9	
63.304	76.1	75.9	74.7		75.0	75.7	75.3	
63.305	79.2	75.2	71.8		78.7	75.0	72.5	
63.306	77.9	76.3	71.9		77.0	75.2	71.1	
Average	76.9	75.4	72.9		76.4	75.8	73.2	
-/-	2.3 / 2.4	0.9 / 1.3	1.8 / 1.1		2.3 / 1.4	1.4 / 0.8	2.1 / 2.1	

NOTE - Variable Noise Level Scatter Due to Vehicle Resonances.

RUN #	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Vehicle Position at Max Sound Level	Mic. Pos. in feet
63.303	.154	2361	25.1	+8.0	68.8	2313	+1.7	0	71.5	2309	+1.0	
63.304	.146	2335	24.7	+1.7	70.2	2310	+1.0	0	70.4	2313	+4.5	
63.305	.150	2332	24.8	-3.9	74.4	2294	-10.2	0	75.8	2301	-10.9	
63.306	.149	2329	24.7	-3.9	74.5	2309	-6.7	0	75.0	2307	-8.8	
Average	.150	2339	24.8	+0.5	72.0	2307	-3.6		73.2	2308	-3.6	
+/-	.004 / .004	22 / 10	0.1 / 0.3	8.5 / 3.4	2.5 / 3.2	7 / 13	5.3 / 6.7		2.6 / 2.8	6 / 7	8.1 / 7.4	

TEST VEHICLE: #063

Chevrolet Nova
3-Speed Automatic
L6-250 CID
110 bhp @ 3800 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/22/77

RUN #	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
63.303		68.8	68.1			71.5	68.4	
63.304		70.2	69.3			69.9	70.4	
63.305		74.4	68.1			75.8	67.0	
63.306		74.5	67.1			75.0	66.7	
Average		72.0	68.2			73.1	68.1	
+/-		2.5 / 3.2	1.1 / 1.1			2.7 / 3.2	2.3 / 1.4	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max. Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
64.303	.147	18.7	4845	-1.8	72.4	3926	-1.8	-16.4	75.2	3926	-1.8	0
64.304	.143	18.5	4739	+3.1	73.2	3678	-6.7	-16.4	76.2	3914	+3.1	0
64.305	.147	18.7	4860	+2.5	72.8	3820	-6.7	-16.4	75.2	3929	+2.5	0
64.306	.149	18.6	4883	-2.5	72.3	3850	-6.0	-16.4	75.0	3912	-3.2	0
Average	.147	18.6	4832	+0.3	72.7	3819	-5.3		75.4	3920	-1.1	
+/-	.002 / .004	0.1 / 0.1	51 / 93	2.8 / 2.8	0.5 / 0.4	108 / 141	3.5 / 1.4	/	0.8 / 0.4	9 / 8	4.2 / 2.1	/

TEST VEHICLE: #064

Datsun 620 Pickup
4-Speed Manual
L4 - 119 CID
97 bhp @ 5600 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 8/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
64.303	72.4	71.6	71.5		74.9	75.2	72.4	
64.304	73.2	72.4	72.4		76.0	76.2	73.8	
64.305	72.8	71.8	71.3		75.1	75.2	72.5	
64.306	72.3	71.4	70.7		75.0	75.0	71.5	
Average	72.7	71.8	71.5		75.3	75.4	72.6	
+/-	0.6 / 0.4	0.9 / 0.8	0.3 / 0.2	/	0.7 / 0.4	0.8 / 0.4	1.2 / 1.1	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
64.303	.147	18.7	4845	-1.8	66.6	3890	-2.5	+25	70.1	3890	-2.5	0
64.304	.143	18.5	4739	+3.1	68.2	3914	+3.1	+25	70.4	3905	+1.7	0
64.305	.147	18.7	4860	+2.5	66.3	3820	-6.7	+25	70.3	3888	-3.2	0
64.306	.149	18.6	4883	-2.5	66.4	3924	-2.5	0	70.4	3912	-3.2	0
Average	.147	18.6	4832	+0.3	66.9	3887	-2.2		70.3	3899	-1.8	
+/-	.002 / .004	0.1 / 0.1	51 / 93	2.8 / 2.8	1.3 / 0.6	37 / 67	5.8 / 4.6		0.1 / 0.2	13 / 11	3.5 / 1.4	

TEST VEHICLE: #064

Datsun 620 Pickup
4-Speed Manual
L4 - 119 CID
97 bhp @ 5600 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 8/22/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
64.303		66.4	66.6			70.1	69.0	
64.304		66.7	68.2			70.4	69.9	
64.305		66.2	66.3			70.3	68.9	
64.306		66.4	66.4			70.4	68.7	
Average		66.4	66.9			70.3	69.1	
+/-		0.3 / 0.2	1.8 / 0.6			0.1 / 0.2	0.8 / 0.4	

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
65.303	.151	2113	25.7	+9.4	68.5	2056	+4.5	-16.4	69.9	2003	-5.3	0
65.304	.148	2096	25.4	+4.5	67.8	2080	+2.4	-16.4	69.1	2080	+2.4	0
65.305	.158	2174	26.1	-8.8	68.0	2072	-15.1	-16.4	68.0	2083	-9.5	0
65.306	.133	2035	24.7	+7.3	66.7	2030	-3.2	-16.4	67.5	1971	+3.8	0
Average	.149	2105	25.5	+3.1	67.8	2060	-2.9		68.6	2034	-2.2	
+/-	.009 / .011	70 / 70	0.6 / 0.8	6.3 / 11.9	0.9 / 1.1	21 / 30	7.4 / 12.3		1.3 / 1.1	49 / 63	6.0 / 7.3	

TEST VEHICLE: #065

Cadillac Seville
3-Speed Automatic
V8 - 350 CID
180 bhp @ 4400 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/23/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
65.303	68.5	67.8	67.5		68.2	69.9	68.3	
65.304	67.8	67.7	66.6		68.0	69.1	66.8	
65.305	68.0	66.3	64.7		67.6	68.0	64.5	
65.306	66.7	66.0	64.4		67.3	67.5	65.5	
Average	67.8	67.0	65.8		67.8	68.6	66.3	
+/-	0.7 / 1.1	0.8 / 1.0	1.7 / 1.4		0.4 / 0.5	1.3 / 1.1	2.0 / 1.8	

RUN #	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Vehicle Position at Max Sound Level	Mic. Pos. in feet
65.303	.151	2113	25.7	+9.4	61.8	1997	-4.6	0	63.2	2073	+9.4	+25
65.304	.148	2096	25.4	+4.5	61.3	2076	+1.7	0	62.2	2064	+1.0	0
65.305	.158	2174	26.1	-8.8	61.7	2058	-15.8	0	62.4	2079	-12.3	0
65.306	.138	2035	24.7	+7.3	59.9	2035	+1.0	0	61.4	1995	-8.8	0
Average	.149	2105	25.5	+3.1	61.2	2042	-4 4		62.3	2053	-2.7	
+/-	.009 / .011	70 / 70	0.6 / 0.8	6.3 / 11.9	0.6 / 1.5	35 / 45	6.1 / 11.4		0.9 / 0.9	26 / 58	12.1 / 9.6	

TEST VEHICLE: #065

Cadillac Seville
3-Speed Automatic
V8 - 350 CID
180 bhp @ 4400 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/23/77

RUN #	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
65.303		61.8	61.8			63.1	63.2	
65.304		61.3	60.3			62.2	62.2	
65.305		61.7	60.2			62.4	60.0	
65.306		59.9	59.8			61.4	60.7	
Average		61.2	60.5			62.3	61.5	
+/-		0.6 / 1.3	1.3 / 0.7			0.8 / 0.9	1.7 / 1.5	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
66.309	.148	1935	16.3	+2.4	75.4	1899	-1.1	-16.4	77.5	1899	-1.1	-16.4
66.310	.159	1957	16.5	+2.4	67.3	1934	+0.3	-16.4	67.0	1851	-6.7	-16.4
66.311	.148	1902	16.0	+2.4	67.0	1902	+2.4	0	66.7	1857	-1.8	-16.4
66.312	.146	1902	16.1	+4.5	73.6	1831	-3.2	-16.4	75.2	1897	+3.1	-16.4
Average	.150	1924	16.2	+2.9	70.8	1892	-0.4		71.6	1876	-1.6	
+/-	.009 / .004	33 / 22	0.3 / 0.2	1.6 / 0.5	4.6 / 3.8	43 / 61	2.8 / 2.8		5.9 / 4.9	23 / 25	4.7 / 5.1	

TEST VEHICLE: #066

Chevrolet K-5 Blazer
3-Speed Automatic
V8 - 400 CID
175 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
66.309	75.4	73.9	74.2		77.5	74.7	74.9	
66.310	67.3	66.3	65.4		67.0	66.9	66.1	
66.311	66.8	67.0	64.9		66.7	66.4	66.3	
66.312	73.6	73.2	72.9		75.2	73.5	73.4	
Average	70.8	70.1	69.4		71.6	70.4	70.2	
+/-	4.6 / 4.0	3.8 / 3.8	4.8 / 3.5		5.9 / 4.9	4.3 / 4.0	4.7 / 4.1	

NOTE - Vehicle Noise Level Scatter Due to Vehicle Passengers

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
66.309	.148	1935	16.3	+2.4	68.7	1915	+1.0	+25	69.7	1873	-3.2	+25
66.310	.159	1957	16.5	+2.4	61.5	1919	-0.4	0	61.3	1947	+1.7	0
66.311	.148	1902	16.0	+2.4	61.5	1882	+3.1	0	61.1	1868	-1.1	+25
66.312	.146	1902	16.1	+4.5	67.6	1890	+3.8	0	68.4	1890	+3.8	0
Average	.150	1924	16.2	+2.9	64.8	1902	+1.9		65.1	1895	+0.3	
+/-	.009 / .004	33 / 22	0.3 / 0.2	1.6 / 0.5	3.9 / 3.3	18 / 20	1.9 / 2.3		4.6 / 4.0	53 / 27	3.5 / 3.5	

TEST VEHICLE: #066

Chevrolet K-5 Blazer
3-Speed Automatic
V8-400 CID
175 bhp @ 3600 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
66.309		68.6	68.7			69.3	69.7	
66.310		61.5	60.6			61.3	61.1	
66.311		61.5	60.3			60.8	61.1	
66.312		67.6	66.7			68.4	67.5	
Average		64.8	64.1			65.0	64.9	
+/-		3.8 / 3.3	4.6 / 3.8			4.3 / 4.2	4.8 / 3.8	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
66.316	.121	1926	27.9	+0.3	73.8	24.8	-3.2	-16.4	73.9	24.8	-5.3	+16.4
66.317	.120	1929	28.1	-6.7	68.1	25.0	-7.4	-16.4	68.7	24.6	-12.3	-16.4
66.318	.111	1914	28.0	-1.8	75.3	25.0	-3.2	-16.4	76.5	25.0	-3.9	-16.4
66.319	.116	1919	27.6	+3.8	73.2	24.4	-4.6	-16.4	72.7	24.4	-7.4	-16.4
Average	.117	1922	27.9	-1.1	72.6	24.8	-4.6		73.0	24.7	-7.2	
+/-	.004 / .006	7 / 8	0.2 / 0.3	4.9 / 5.6	2.2 / 4.5	0.2 / 0.4	1.4 / 2.5		3.5 / 4.3	0.3 / 0.3	3.3 / 5.1	

TEST VEHICLE: #066

Chevrolet K-5 Blazer
3-Speed Automatic
V8-400 CID
175 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 8/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
66.316	73.8	72.4	72.4		73.6	73.9	73.9	
66.317	68.1	67.2	65.3		68.7	67.3	65.8	
66.318	75.3	73.1	72.8		76.5	74.2	74.4	
66.319	73.2	71.3	71.4		72.7	72.1	72.4	
Average	72.6	71.0	70.5		72.9	71.9	71.6	
+/-	2.7 / 4.5	2.1 / 3.8	2.3 / 5.2		3.6 / 4.2	2.3 / 4.6	2.3 / 5.8	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
66.316	.121	1926	27.9	+0.3	67.4	24.9	-1.8	0	68.3	23.3	-24.9	+25
66.317	.120	1929	28.1	-6.7	62.3	25.0	-7.4	0	62.5	25.0	-8.8	0
66.318	.111	1914	28.0	-1.8	68.2	25.0	-3.2	+25	69.1	23.9	-9.3	0
66.319	.116	1919	27.6	+3.8	66.5	24.9	+2.4	+25	66.8	24.6	-3.9	+25
Average	.117	1922	27.9	-1.1	66.1	25.0	-2.5		66.7	24.2	-11.7	
+/-	.004 / .006	7 / 8	0.2 / 0.3	4.9 / 5.6	2.1 / 3.8	0 / 0.1	4.9 / 4.9		2.4 / 4.2	0.8 / 0.9	7.8 / 13 2	

TEST VEHICLE: #066

Chevrolet K-5 Blazer
3-Speed Automatic
V8-400 CID
175 bhp @ 3600 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
66.316		67.4	67.0			67.6	68.3	
66.317		62.3	60.4			62.5	61.3	
66.318		67.6	68.2			69.1	69.0	
66.319		66.2	66.5			66.7	66.8	
Average		65.9	65.5			66.5	66.4	
+/-		1.7 / 3.6	2.7 / 5.1			2.6 / 4.0	2.6 / 5.1	

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
67.303	.157	2509	26.9	-4.6	69.3	2287	-8.8	-16.4	69.1	2300	-6.7	-16.4
67.304	.150	2520	27.5	+3.8	70.9	2200	-14.4	-16.4	70.6	2169	-16.5	-16.4
67.305	.154	2468	26.8	+1.7	71.5	2194	-16.5	-16.4	70.3	2196	-20.0	-16.4
67.306	.158	2465	26.6	+1.0	70.3	2197	-15.8	-16.4	71.0	2202	-19.3	-16.4
Average	.155	2491	27.0	+0.5	70.5	2220	-13.9		70.3	2217	-15.6	
+/-	.003 / .005	30 / 26	0.5 / 0.4	3.3 / 5.1	1.0 / 1.2	68 / 26	5.1 / 2.6	/	0.7 / 1.2	83 / 48	8.9 / 4.4	/

TEST VEHICLE: #067

Oldsmobile Delta 88
3-Speed Automatic
V6 - 231 CID
105 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
67.303	69.3	67.3	65.8		69.1	67.1	64.7	
67.304	70.9	69.1	66.4		70.6	69.4	66.4	
67.305	71.5	69.4	66.0		70.3	69.5	66.0	
67.306	70.3	68.1	66.3		71.0	68.3	65.9	
Average	70.5	68.5	66.1		70.3	68.6	65.8	
+/-	1.0 / 1.2	0.9 / 1.2	0.3 / 0.3	/	0.7 / 1.2	0.9 / 1.5	0.6 / 1.1	/

RUN#	Accel at 22 MPH	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
67.303	.157	2509	26.9	-4.6	62.9	2300	-6.0	0	63.1	2326	-5.3	0
67.304	.150	2520	27.5	+3.8	63.7	2212	-13.0	0	65.2	2169	-16.5	0
67.305	.154	2468	26.8	+1.7	63.3	2306	-0.4	0	63.2	2190	-15.8	0
67.306	.158	2465	26.6	+1.0	62.7	2275	-7.4	0	63.3	2225	-15.1	0
Average	.155	2491	27.0	+0.5	63.2	2273	-6.7		63.7	2228	-13.2	
+/-	.003 / .005	30 / 26	0.5 / 0.4	3.3 / 5.1	0.5 / 0.5	33 / 61	6.3 / 6.3		1.5 / 0.6	99 / 59	7.9 / 3.3	

TEST VEHICLE: #067

Oldsmobile Delta 88
3-Speed Automatic
V6 - 231 CID
105 bhp @ 3400 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/25/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
67.303		62.9	60.0			63.1	60.8	
67.304		63.7	61.7			65.2	62.3	
67.305		63.3	60.9			63.2	61.6	
67.306		62.7	60.5			63.3	61.1	
Average		63.2	60.8			63.7	61.5	
+/-		0.5 / 0.5	0.9 / 0.8			1.5 / 0.6	0.8 / 0.7	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
68.304	.149	23.5	3469	+3.8	73.0	2938	+3.8	0	73.7	2876	-2.5	-16.4
68.305	.146	23.4	3454	+1.0	72.9	2873	-2.5	-16.4	73.3	2875	-1.8	-16.4
68.306	.152	23.3	3479	-3.2	73.1	2895	-5.3	-16.4	73.4	2945	-3.2	-16.4
68.307	.151	23.3	3502	+0.3	73.4	2888	-3.9	-16.4	73.4	2929	-0.4	-16.4
Average	.149	23.4	3476	+0.5	73.1	2899	-1.9		73.5	2906	-1.9	
+/-	.003 / .003	0.1 / 0.1	26 / 22	3.3 / 3.7	0.3 / 0.2	39 / 26	5.7 / 3.4	/	0.2 / 0.2	39 / 31	1.5 / 1.3	/

TEST VEHICLE: #068

VW Bus
4-Speed Manual
L4-102.2 CID
67 bhp @ 4200 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 8/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
68.304	72.9	73.0	70.9		73.7	73.1	70.7	
68.305	72.9	72.4	70.6		73.3	72.6	70.5	
68.306	73.1	72.1	69.4		73.4	72.1	69.0	
68.307	73.4	72.4	70.7		73.4	72.7	70.1	
Average	73.1	72.5	70.4		73.5	72.6	70.1	
+/-	0.3 / 0.2	0.5 / 0.4	0.5 / 1.0	/	0.2 / 0.2	0.5 / 0.5	0.6 / 1.1	/

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
68.304	.149	23.5	3469	+3.8	66.9	2938	+3.8	0	66.8	2938	+3.8	0
68 305	.146	23.4	3454	+1.0	66.9	2943	+1.0	0	66.5	2825	-7.4	0
68.306	.152	23.3	3479	-3.2	67.0	2885	-6.0	0	67.5	2895	-5.3	0
68 307	.151	23.3	3502	+0.3	66.7	2929	-0.4	0	66.3	2820	-9.5	0
Average	.149	23.4	3476	+0.5	66.9	2924	-0.3		66.8	2870	-4.5	
+/-	.003 / .003	0.1 / 0.1	26 / 22	3.3 / 3.7	0.1 / 0.2	19 / 39	4.1 / 5.7		0.7 / 0.5	68 / 50	8.3 / 5.0	

TEST VEHICLE: #068

VW Bus
4-Speed Manual
L4 - 102.2 CID
67 bhp @ 4200 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 8/26/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
68.304		66.9	65.9			66.8	65.5	
68.305		66.9	66.0			66.5	64.8	
68.306		67.0	65.4			67.5	64.2	
68.307		66.7	65.5			66.3	64.6	
Average		66.9	65.7			66.8	64.8	
+/-		0.1 / 0.2	0.3 / 0.3			0.7 / 0.5	0.7 / 0.6	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
69.303	.149	20.3	2673	+3.8	74.7	2216	+1.7	0	74.2	2216	+1.7	0
69.304	.126	20.2	2634	+3.1	74.1	2162	-4.6	-16.4	74.2	2227	+1.7	0
69.305	.154	20.2	2748	-6.0	75.2	2143	-13.0	-16.4	73.3	2238	-6.0	0
69.306	.160	20.2	2754	-5.3	74.6	2127	-15.4	-16.4	73.0	2206	-7.4	0
Average	.147	20.2	2700	-1.0	74.7	2162	-7.7		73.7	2222	-2.4	
+/-	.013 / .021	0.1 / 0.0	48 / 66	4.8 / 5.0	0.5 / 0.6	54 / 35	9.4 / 7.7		0.5 / 0.7	16 / 16	4.1 / 5.0	

TEST VEHICLE: #069

Ford Pick-Up F-100
3-Speed Manual
L6 - 300 CID
122 bhp @ 3200 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 8/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
69.303	74.4	74.7	73.5		71.9	74.2	73.2	
69.304	74.1	73.6	73.4		72.0	74.2	72.6	
69.305	75.2	74.0	72.1		73.0	73.3	72.7	
69.306	74.6	73.9	72.0		72.6	73.0	72.9	
Average	74.6	74.1	72.8		72.4	73.7	72.9	
+/-	0.6 / 0.5	0.6 / 0.5	0.7 / 0.8		0.6 / 0.5	0.5 / 0.7	0.3 / 0.3	

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
69.303	.149	20.3	2673	+3.8	67.8	2232	+3.1	0	66.7	2133	-5.3	0
69.304	.126	20.2	2634	+3.1	68.1	2155	-3.9	0	67.7	2227	+1.7	0
69.305	.154	20.2	2748	-6.0	68.6	2146	-12.3	0	67.6	2238	-6.0	0
69.306	.160	20.2	2754	-5.3	68.3	2147	-11.6	0	67.5	2218	-6.0	0
Average	.147	20.2	2700	-1.0	68.2	2170	-6.1		67.4	2204	-3.8	
+/-	.013 / .021	0.1 / 0	48 / 66	4.8 / 5.0	0.4 / 0.4	62 / 24	9.2 / 6.2		0.3 / 0.7	34 / 71	5.5 / 2.2	

TEST VEHICLE: #069

Ford Pick-Up F-100
3-Speed Manual
L6 - 300 CID
122 bhp @ 3200 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 8/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
69.303		67.8	67.7			66.7	66.9	
69.304		68.1	67.0			67.7	66.7	
69.305		68.6	68.0			67.6	67.2	
69.306		68.3	67.5			67.5	67.2	
Average		68.2	67.6			67.4	67.0	
+/-		0.4 / 0.4	0.4 / 0.6			0.3 / 0.7	0.2 / 0.3	

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
70.303	.150	1599	10.6	+0.3	67.2	1554	-4.6	-16.4	64.7	1597	-0.4	-16.4
70.304	.145	1610	11.0	+5.2	68.7	1500	-8.1	-16.4	67.5	1609	+4.5	+16.4
70.305	.146	1605	10.8	+1.7	68.1	1591	+2.4	-16.4	65.8	1591	+2.4	+16.4
70.306	.146	1648	11.3	+3.1	68.7	1548	-8.1	-16.4	66.0	1646	+2.4	+16.4
Average	.147	1616	10.9	+2.6	68.2	1548	-4.6		66.0	1611	+2.2	
+/-	.003 / .002	33 / 17	0.4 / 0.3	2.6 / 2.3	0.5 / 1.0	43 / 48	6.9 / 3.6	/	1.5 / 1.3	35 / 20	2.3 / 2.6	/

TEST VEHICLE: #070

Ford Box Van
3-Speed Automatic
V8 - 460 CID
245 bhp @ 4200 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
70.303	67.2	67.0	65.4		64.7	64.7	64.6	
70.304	68.7	68.3	67.5		65.7	66.2	67.5	
70.305	68.1	67.7	65.9		65.7	65.7	65.8	
70.306	68.7	67.5	66.0		65.4	65.6	66.0	
Average	68.2	67.6	66.2		65.4	65.6	66.0	
+/-	0.5 / 1.0	0.7 / 0.6	1.3 / 0.8	/	0.3 / 0.7	0.6 / 0.9	1.5 / 1.4	/

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
70.303	.150	1599	10.6	+0.3	62.1	1554	-4.6	0	59.4	1575	+3.8	0
70.304	.145	1610	11.0	+5.2	63.4	1552	+7.3	+25	62.2	1602	+5.9	+25
70.305	.146	1605	10.8	+1.7	62.6	1508	-9.5	0	61.7	1560	-2.5	+25
70.306	.146	1648	11.3	+3.1	63.1	1545	-8.8	0	60.5	1565	-6.0	+25
Average	.147	1616	10.9	+2.6	62.8	1540	-3.8		61.0	1576	+0.3	
+/-	.003 / .002	33 / 17	0.4 / 0.3	2.6 / 2.3	0.6 / 0.7	14 / 32	11.1 / 5.7		1.2 / 1.6	27 / 16	5.6 / 6.3	

TEST VEHICLE: #070

Ford Box Van
3-Speed Automatic
V8 - 460 CID
245 bhp @ 4200 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
70.303		62.1	61.3			59.4	59.3	
70.304		63.3	63.4			60.2	62.2	
70.305		62.6	61.6			59.5	61.7	
70.306		63.1	62.2			59.3	60.5	
Average		62.8	62.1			59.6	60.9	
+/-		0.5 / 0.7	1.3 / 0.8			0.6 / 0.3	1.3 / 1.6	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
70.308	.127	2172	28.2	-0.4	75.9	24.1	-10.2	-16.4	73.5	25.0	-0.4	-16.4
70.309	.124	2177	28.3	-0.4	75.1	24.7	-5.3	-16.4	72.8	24.8	-1.8	-16.4
70.310	.133	2190	28.5	-3.2	75.9	24.7	-7.4	-16.4	72.2	24.7	-6.7	-16.4
70.311	.132	2188	28.1	+2.4	74.9	24.4	-6.0	-16.4	72.2	24.9	+2.4	-16.4
70.312	.127	2194	28.4	-1.8	75.7	24.6	-8.1	-16.4	72.5	25.0	-1.8	-16.4
Average	.129	2184	28.3	-0.7	75.5	24.5	-7.4		72.6	24.9	-1.7	
+/-	.004 / .005	10 / 12	0.2 / 0.2	3.1 / 2.5	0.4 / 0.6	0.2 / 0.4	2.1 / 2.8		0.9 / 0.4	0.1 / 0.1	4.1 / 5.0	

TEST VEHICLE: #070

Ford Box Van
3-Speed Automatic
V8-460 CID
245 bhp @ 4200 RPM

TEST CONDITION: 2

Mic Distance - 25 feet

TEST DATE: 8/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
70.308	75.9	74.6	72.0		73.5	72.2	70.9	
70.309	75.1	74.1	71.8		72.8	72.1	71.0	
70.310	75.9	74.2	71.3		72.2	72.1	70.5	
70.311	74.9	74.8	72.5		72.2	71.8	71.3	
70.312	75.7	74.3	71.9		72.5	72.0	70.4	
Average	75.5	74.4	71.9		72.6	72.0	70.8	
+/-	0.4 / 0.6	0.4 / 0.3	0.6 / 0.6		0.9 / 0.4	0.2 / 0.2	0.5 / 0.4	

RUN#	Accel at 25 MPH	RPM at 25 MPH	Max Speed for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	Speed at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
70.308	.127	2172	28.2	-0.4	68.8	24.9	+0.3	0	66.8	24.5	-6.7	0
70.309	.124	2177	28.3	-0.4	68.5	24.9	-0.4	0	65.8	24.9	-3.2	+25
70.310	.133	2190	28.5	-3.2	69.6	24.7	-6.7	0	65.8	24.6	-8.1	0
70.311	.132	2188	28.1	+2.4	68.6	24.8	-1.1	0	66.3	24.9	+2.4	+25
70.312	.127	2194	28.4	-1.8	68.8	24.7	-7.4	0	66.1	24.7	-7.4	0
Average	.129	2184	28.3	-0.7	68.9	24.8	-3.1		66.2	24.7	-4.6	
+/-	.004 / .005	10 / 12	0.2 / 0.2	3.1 / 2.5	0.7 / 0.4	0.1 / 0.1	3.4 / 4.3		0.6 / 0.4	0.2 / 0.2	7.0 / 3.5	

TEST VEHICLE: #070

Ford Box Van
3-Speed Automatic
V8-460 CID
245 bhp @ 4200 RPM

TEST CONDITION: 2

Mic Distance - 50 feet

TEST DATE: 8/29/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
70.308		68.8	67.5			66.8	66.0	
70.309		68.5	67.8			65.7	65.8	
70.310		69.6	67.7			65.8	65.1	
70.311		68.6	67.3			66.1	66.3	
70.312		68.8	67.1			66.1	65.4	
Average		68.9	67.5			66.1	65.7	
+/-		0.7 / 0.4	0.3 / 0.4			0.7 / 0.4	0.6 / 0.3	

RUN#	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
71.304	.148	-	-	+5.0	78.2	-	+4.0	0	80.8	-	+5.0	0
71.305	.146	3680	4300	+2.0	77.4	4170	+1.5	0	80.6	3680	+2.0	0
71.306	.146	3660	4300	-1.0	76.8	4120	-5.0	0	78.4	4160	-1.0	0
71.308	.146	3680	4300	+4.0	77.4	4190	+4.0	0	80.4	4190	+4.0	0
Average	.146	3673	4300	+2.5	77.5	4160	+1.1		80.1	4010	+2.5	
+/-	.002 / 0	7 / 13	0 / 0	3.5 / 2.5	0.7 / 0.7	30 / 40	2.9 / 6.1	/	0.7 / 1.7	180 / 330	2.5 / 3.5	/

TEST VEHICLE: #071

Porsche 911S
5-Speed Manual
H6-164 CID
157 bhp @ 5800 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 9/1/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
71.304		78.2				80.8		
71.305		77.4				80.6		
71.306		76.8				78.4		
71.308		77.4				80.4		
Average		77.5				80.1		
+/-	/	0.7 / 0.7	/	/	/	0.7 / 1.7	/	/

RUN #	Accel at 22 MPH	RPM at 22 MPH	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Vehicle Position at Max Sound Level	Mic. Pos. in feet
71.304	.148	-	-	+5.0	72.3	-	+5.0	0	73.8	-	+5.0	0.
71.305	.146	3680	4300	+2.0	71.6	3980	-11.0	0	74.6	4150	+1.5	0
71.306	.146	3660	4300	-1.0	71.8	4160	-1.0	0	74.0	4160	-1.0	0
71.308	.146	3680	4300	+4.0	71.5	4180	+4.0	0	74.2	4160	+3.0	0
Average	.146	3673	4300	+2.5	71.8	4107	-0.7		74.2	4157	+2.1	
+/-	.002 / 0	7 / 13	0 / 0	2.5 / 3.5	0.5 / 0.3	73 / 127	5.7 / 10.3		0.4 / 0.4	3 / 7	2.9 / 3.1	

TEST VEHICLE: #071

Porsche 911S
5-Speed Manual
H6-164 CID
157 bhp @ 5800 RPM

TEST CONDITION: 1M.

Mic Distance - 50 feet

TEST DATE: 9/1/77

RUN #	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
71.304		72.3				73.8		
71.305		71.6				74.6		
71.306		71.8				74.0		
71.308		71.5				74.2		
Average		71.8				74.2		
+/-		0.5 / 0.3				0.4 / 0.4		

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
72.303	.149	2940	21.7	+1.5	70.1	2940	+1.5	0	73.1	2880	+2.0	0
72.305	.134	2900	21.6	+1.0	70.9	2900	+1.0	0	72.4	2800	+5.0	0
72.306	.148	2920	21.6	-1.0	69.6	2910	0	0	72.8	2910	0	0
72.307	.147	2930	21.8	+1.0	70.5	2920	0	0	73.4	2910	+3.0	0
Average	.144	2923	21.7	+0.6	70.3	2918	0.6		72.9	2875	2.5	
+/-	.005 / .01	17 / 23	0.1 / 0.1	0.9 / 1.6	0.6 / 0.7	22 / 18	0.9 / 0.6		0.5 / 0.5	35 / 75	2.5 / 2.5	

TEST VEHICLE: #072

Pontiac Ventura
3-Speed Automatic
L4 - 151 CID
88 bhp @ 4400 RPM

TEST CONDITION: 1A

Mic Distance - 25 feet

TEST DATE: 8/31/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
72.303		70.1				73.1		
72.305		70.9				72.4		
72.306		69.6				72.8		
72.307		70.5				73.4		
Average		70.3				72.9		
+/-		0.6 / 0.7				0.5 / 0.5		

RUN#	Accel at 100 RPM Prior to Max RPM at Shift	Max RPM at Shift Point	Speed at Max RPM	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
72.303	.149	2940	21.7	+1.5	64.5	2880	-5.0	0	66.5	2940	+1.5	0
72.305	.134	2900	21.6	+1.0	64.0	2850	-7.0	0	66.0	2820	-10.0	0
72.306	.148	2920	21.6	-1.0	64.5	2920	-1.0	0	66.6	2920	-1.0	0
72.307	.147	2930	21.8	+1.0	64.8	2800	-15.0	0	67.0	2920	+2.0	0
Average	.144	2923	21.7	+0.6	64.5	2863	-6.9		66.5	2900	-1.8	
+/-	.005 / .001	17 / 23	0.1 / 0.1	0.9 / 1.6	0.3 / 0.5	57 / 63	5.9 / 8.1		0.5 / 0.5	40 / 80	3.8 / 8.2	

TEST VEHICLE: #072

Pontiac Ventura
3-Speed Automatic
L4 - 151 CID
83 bhp @ 4400 RPM

TEST CONDITION: 1A

Mic Distance - 50 feet

TEST DATE: 8/31/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
72.303		64.5				66.5		
72.305		64.0				66.0		
72.306		64.5				66.6		
72.307		64.8				67.0		
Average		64.5				66.5		
+/-		0.3 / 0.5				0.5 / 0.5		

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max. Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
73.303	.159	17.7	3800	-2.0	74.4	3080	-2.0	0	75.6	3080	-2.0	0
73.305	.156	17.8	3560	+9.0	73.0	3080	+9.0	0	75.9	3080	+9.0	0
73.306	.150	17.8	3740	+9.5	73.2	2870	+1.0	0	76.6	2860	0	0
73.307	.154	17.8	3950	+4.0	74.0	2950	-1.0	0	76.7	2950	-1.0	0
Average	.155	17.8	3763	+5.1	73.7	2995	+1.8		76.2	2993	+1.5	
+/-	.004 / .005	0 / 0.1	187 / 203	4.4 / 7.1	0.7 / 0.7	85 / 125	7.2 / 3.8		0.5 / 0.6	87 / 133	7.5 / 3.5	

TEST VEHICLE: #073

Pontiac Sunbird
5-Speed Manual
L4 - 151 CID
88 bhp @ 4400 RPM

TEST CONDITION: 1M

Mic Distance - 25 feet

TEST DATE: 9/2/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet		Max SI at Mic at -16.4 feet	Max SI at Mic at 0 feet	Max SI at Mic at +16.4 feet	
73.303		74.4				75.6		
73.305		73.0				75.9		
73.306		73.2				76.6		
73.307		74.0				76.7		
Average		73.7				76.2		
+/-		0.7 / 0.7				0.5 / 0.6		

RUN#	Accel at 70% Rated RPM	Speed at 70% Rated RPM	Max RPM for Run	Vehicle Position at End Condition	RIGHT SIDE				LEFT SIDE			
					Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet	Max Sound Level	RPM at Max Sound Level	Veh. Position at Max Sound Level	Mic. Pos. in feet
73.303	.159	17.7	3800	-2.0	68.5	2900	-9.0	0	69.2	2880	-9.5	0
73.305	.156	17.8	3560	+9.0	66.0	3080	+9.0	0	69.0	3080	+9.0	0
73.306	.150	17.8	3740	+9.5	65.4	3080	+9.5	0	68.6	3080	+9.5	0
73.307	.154	17.8	3950	+4.0	67.8	3080	+4.0	0	67.9	2820	-8.0	0
Average	.155	17.8	3763	+5.1	66.9	3035	+3.4		68.7	2965	+0.3	
+/-	.004 / .005	0 / 0.1	187 / 203	4.4 / 7.1	1.6 / 1.5	45 / 135	6.1 / 12.4		0.5 / 0.8	115 / 145	9.2 / 9.8	

TEST VEHICLE: #073

Pontiac Sunbird
5-Speed Manual
L4 - 151 CID
88 bhp @ 4400 RPM

TEST CONDITION: 1M

Mic Distance - 50 feet

TEST DATE: 9/2/77

RUN#	RIGHT SIDE				LEFT SIDE			
	Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet		Max SI at Mic at -25 feet	Max SI at Mic at 0 feet	Max SI at Mic at +25 feet	
73.303		68.5				69.2		
73.305		66.0				69.0		
73.306		65.4				68.6		
73.307		67.8				67.9		
Average		66.9				68.7		
+/-		1.6 / 1.5				0.5 / 0.8		