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September 4, 1973

H.3.24

MEMORANDUM TO: J. R. Harbison  
State Highway Engineer  
Chairman, Research Committee

SUBJECT: Research Report No. 375, "Vehicle Noise Survey in Kentucky;" KYP-72-24,  
HPR-1(9), Part III

Motion generates sound or noise; unless the sound is audible, motion seen nearby seems either stealthy or illusionary. Pitch, or frequency, is associated with speed. Loudness is associated with distance and the power of the generator. Loud noises are awesome and ominous. Music remains inexplicable. Sound pressure is proportional to the number of generators.

Noise from motor vehicles is generated by engine accessories, exhaust, engine knock, air flow, rattles, and tires on the pavement. A few years ago, considerable study was devoted to the squeal of tires while cornering, braking, and accelerating. Indeed, the squeal has been abated. Knobby tires, bald tires, and studded tires generate more noise than ribbed and siped tires. Knobbly treads generate vibrations in the casing of the tire. Tires in traction cause the tread rubber to stretch (shear) in proportion to the force; slippage and "snap-back" likely occurs. Air pocketed in tread cavities and compressed under the footprint of the tire may induce whistles or pops. When there is water on the pavement, it seems that certain noises diminish or else are obscured by splash and spray.

It was recognized, by us and others, many years ago that Kentucky Rock Asphalt surfaces were distinctly quieter (generated least tire noise) than other surfaces. This was attributed to its sand texture and high porosity (10 to 15%). It was also noted that those surfaces generated less splash and spray during a rain. Internal drainage has been sought in the design of sand-asphalts (to minimize hydroplaning, etc.). Only recently has the attendant quietude of porous pavement surfacing become a potential design consideration (cf. FHWA letter, August 15, 1973; Re: Implementation Division Alert - IDA No. 11; Noise Levels Associated with Plant Mix Seals). Whereas knobby pavement surfaces generate more noise in the same way that knobby tires do, there seems to be some relationship between texture and porosity and noise level. We had considered this to be a unique property of porous sand-asphalts; however, FHWA (referring to work in Colorado, *op. cit.*), ascribes a similar quality to Open-Graded Plant Mix Seals -- nominal maximum size of aggregate is 3/8 in.

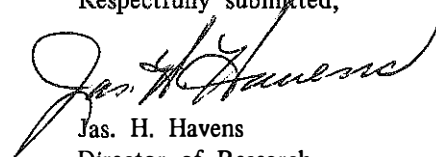
As a future design consideration, there is a distinct possibility that fine-grained, porous surfaces will not only minimize the tire-pavement generated noise but will also dampen or deaden other noises generated by the vehicle. This could supplant the need for sound barriers and otherwise enable a highway project to qualify under noise pollution regulations. The data presented in the attached report represent only the more conventional, asphalt and portland cement concrete pavements. In the future, measurements

will be made on roads surfaced with porous sand-asphalt and Open-Graded Seals; and the results and comparisons will be reported later.

The data reported in this issue provides a unique data bank and statistical analyses in terms of vehicle type. These represent one of the most extensive noise level compilations of which we are aware.

Originally, the purpose of this study was to test and verify, if possible, noise-level prediction models (equations) or, if needed, to develop weighting factors which would improve the accuracy of the model equations. Some discrepancies have been found; but we are not prepared at this time to recommend specific revisions in the model. Nevertheless, the data should be of interest to those concerned with the establishment of noise-level regulations.

Respectfully submitted,



Jas. H. Havens  
Director of Research

JHH:dw  
attachment  
cc's: Research Committee

1. Report No.		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle  Vehicle Noise Survey in Kentucky				5. Report Date September 1973	
				6. Performing Organization Code	
7. Author(s)  K. R. Agent and R. L. Rizenbergs				8. Performing Organization Report No.  375	
9. Performing Organization Name and Address Division of Research Kentucky Bureau of Highways 533 South Limestone Lexington, Kentucky 40508				10. Work Unit No.	
				11. Contract or Grant No. KYP-72-24	
12. Sponsoring Agency Name and Address				13. Type of Report and Period Covered  Interim	
				14. Sponsoring Agency Code	
15. Supplementary Notes  Study Title: Noise Abatement					
16. Abstract  Individual noise measurements were obtained on 10,500 motor vehicles operating on Kentucky highways. The roadways were selected to represent varied geometric and environmental conditions and posted speed limits. Percentages of automobiles and trucks exceeding a given level of noise were determined. As expected, noise levels of trucks were significantly higher than for automobiles, and larger trucks produced higher noise levels than smaller trucks. For any vehicle type, noise increased with an increase in speed limit.					
17. Key Words Vehicle Noise Automobile Noise Levels Truck Noise Levels Highway Noise				18. Distribution Statement	
19. Security Classif. (of this report)  Unclassified		20. Security Classif. (of this page)  Unclassified		21. No. of Pages	22. Price

Research Report  
375

**VEHICLE NOISE SURVEY IN KENTUCKY**

KYP-72-24, HPR-1(9), Part III

by

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Bureau of Highways. This report does not constitute a standard, specification, or regulation.

September 1973

## INTRODUCTION

Studies in several major American and European cities have shown that, despite the noise produced by aircraft, surface traffic, which includes automobiles, buses, trucks, and motorcycles, is the predominant and most widespread source of noise. Traffic noise, while recognized in the past as a nuisance by those subjected to it, has reached such levels in some urban areas that it is considered a major pollutant of the environment. It has been shown (1) that noise levels in certain areas are increasing at the rate of 1 decibel (dB) per year, a result of increasing traffic flow. Increased traffic volume and construction of high speed highways within densely populated areas in particular has aroused public concern. The rural dweller, as well, has shown concern in the disruptive effects to his environment as a result of locating major highways nearby. The highway engineer, therefore, is called upon to consider the consequences of added noise upon the community in the design, location, and construction of highways while satisfying the needs and demands for improved transportation facilities.

Highway-generated traffic noise emanates primarily from vehicle engine exhausts and from tire-pavement interaction. Under normal operating conditions, an automobile generates as much noise from the tire-pavement interface as from engine exhaust. Large diesel trucks are much noisier than automobiles and, even with maximum muffling, would be expected to produce significantly higher noise levels than automobiles at the same road speed due to the larger contact areas under the tire. Noise produced in the tire-pavement interface, in particular, is speed dependent and varies with pavement texture. Coarse-textured pavements are noisier than fine-textured pavements. Very smooth, glassy, non-porous surfaces tend to generate air noises and squeal and to reflect the sound. The noise level at a particular highway site depends on the traffic speed, distribution of vehicle types, traffic density, roadway characteristics (e.g. grade, intersections, elevated or depressed roadway), noise attenuation barriers such as trees and shrubs, and distance from the traffic stream.

Abatement and control of noise within an environment involves the direct control of noise emitted by individual vehicles, traffic routing, and highway design. The highway engineer is primarily concerned with the last two categories since he can exert some degree of control. Limiting or controlling vehicular engine and exhaust noise, however, remains in the hands of vehicle designers and manufacturers, subject to possible legislative control. Several states (2) have enacted legislation which sets limits on noise levels for

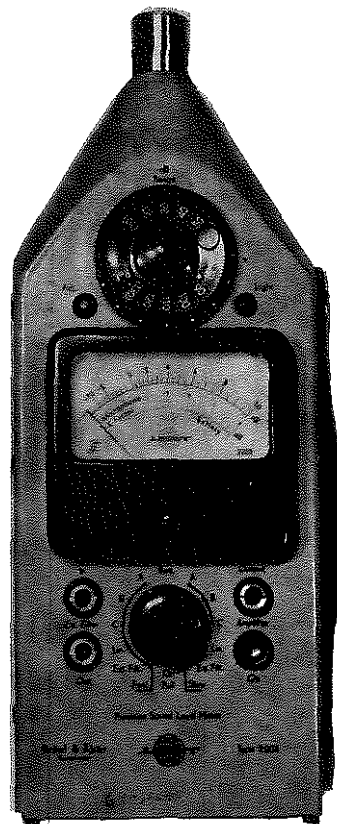
motor vehicles. With the passage of the Noise Control Act of 1972 (3) by Congress, the Federal Government has taken an active role in promulgating noise emission standards for motor vehicles.

A study was conducted by the Division of Research, Kentucky Bureau of Highways, to determine noise levels generated by individual automobiles and trucks operating on Kentucky highways. A total of 10,500 noise measurements were made on roadways representing varied geometric and environmental conditions and posted speed limits. Percentages of each vehicle type exceeding a given level of noise were calculated. The findings are presented in this report.

## PROCEDURES

Data collection consisted of the measurement of individual automobile and truck noise levels with a Bruel and Kjaer precision sound level meter (Type 2203) as shown in Figure 1, employing the A-weighting network in the meter. All measurements were taken at a distance of 50 ft (15 m) from the center of the traffic lane (Figure 2) and approximately 4 ft (1.2 m) above the roadbed. The data were recorded manually by the operator as a vehicle passed. Measurements were taken only when the noise emitted by a single vehicle could be clearly isolated or distinguished from the noise of the traffic stream. The operator and the meter were stationed at the same horizontal plane as the traffic lane, but locations were varied to represent different geometric conditions -- that is, level roadways, plus or minus grades, straight or curved sections. Roadways were also selected on the basis of posted speed limits ranging from 35 mph (15 m/s) to 70 mph (31 m/s) (see APPENDIX A). Vehicle speeds were not measured. A set of truck noise data (500 trucks) were obtained at locations with posted speed limits of 70 mph (31 m/s) to distinguish between various classes of trucks.

**Figure 1. BRUEL and KJAER Precision Sound Level Meter (Type 2203) Used in Monitoring Vehicle Noise Levels.**



**Figure 2. Typical Field Monitoring Arrangement Used in Data Collection.**

## FINDINGS

The noise survey was conducted in 1972 and 1973 and involved 8,000 automobiles and 2,500 trucks, as shown in Table 1. A few motorcycle noise measurements were also obtained. The data are presented graphically in APPENDIX B. These histograms show number of automobiles and trucks at each noise level for several speed limits. The speeds refer to the speed limit, not the speed at which the vehicles were operating.

### AUTOMOBILES

Influences of speed on automobile-generated noise is clearly evident in Figure 3, which shows the percentage of automobiles at or below a certain noise level. The lowest reading was 60 dBA in a 35-mph (16-m/s) speed zone and the highest was 90 dBA on a 70-mph (31-m/s) road. The median levels ranged between 67 dBA and 77 dBA. On highways with the same speed limit, the ranges in noise levels were rather small and may be indicative of uniform traffic speed.

Table 2 shows the percentage of automobiles which exceeded a given noise level. For example, in 35-mph (16-m/s) zones, only 0.4 percent of the automobiles gave noise levels above 76 dBA while 65 percent of the automobiles exceeded this level on roads with posted speed limits of 70 mph (31 m/s).

TABLE 1

#### NUMBER OF INDIVIDUAL AUTOMOBILES AND TRUCKS MEASURED

POSTED SPEED LIMIT (mph)	POSTED SPEED LIMIT (m/s)	NUMBER OF AUTOMOBILES*	NUMBER OF TRUCKS
70	31	2000	1250**
60	27	2000	665
50	22	1000	335
45	20	1000	100
35	16	2000	150
Totals:		8000	2500

\*Includes pick-up trucks (four-wheeled)

\*\*500 by truck type

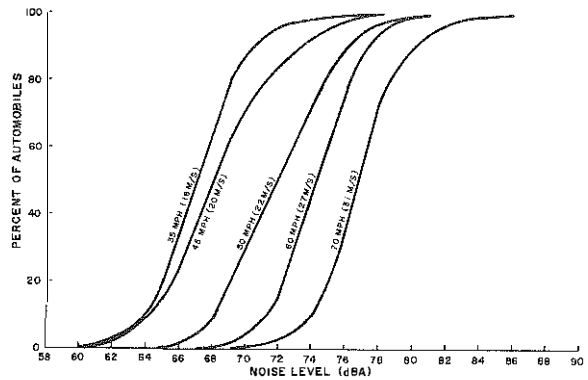


Figure 3. Cumulative Percentage of Automobiles with Increasing Range of Noise Levels for Roadways with Differing Posted Speed Limits.

TABLE 2

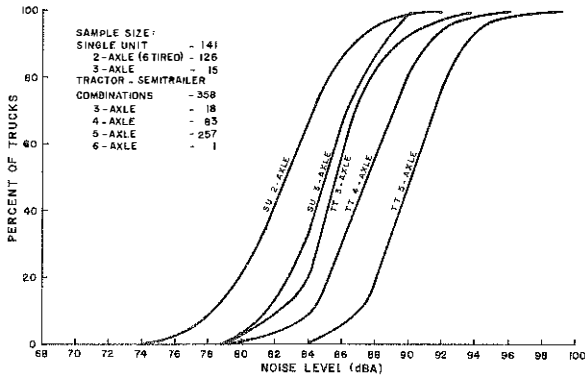
#### PERCENTAGE OF AUTOMOBILES EXCEEDING A GIVEN NOISE LEVEL

NOISE LEVEL (dBA)	PERCENTAGE OF AUTOMOBILES				
	35 mph (16 m/s)	45 mph (20 m/s)	50 mph (22 m/s)	60 mph (27 m/s)	70 mph (31 m/s)
90					0
89					0.1
88					0.2
87					0.3
86					0.2
85					0.3
84				0	0.6
83				0.1	1.6
82			0	0.2	2.9
81			0.4	0.6	5.2
80		0	0.8	1.4	9.9
79	0	0.1	1.3	2.7	17.7
78	0.1	0.2	2.2	5.2	27.2
77	0.2	0.7	5.7	11.6	45.4
76	0.4	1.5	9.8	22.0	65.1
75	0.7	2.9	19.2	37.4	79.2
74	1.1	7.1	26.9	55.0	92.2
73	2.3	12.6	37.9	73.8	96.8
72	3.7	15.9	46.9	85.3	98.4
71	6.4	21.8	57.7	93.8	99.0
70	12.2	28.1	69.8	96.6	99.4

**TRUCKS**

Noise emitted by trucks ranged between 64 dBA and 102 dBA. The higher noise levels were associated with the higher posted speed limits, as shown in Figure 4. The median noise level was 73 dBA in 35-mph (16-m/s) speed zones and 88 dBA on 70-mph (31-m/s) roads. Oddly, truck noise on roadways with 50-mph (22-m/s) and 60-mph (27-m/s) posted speed limits exhibited a difference of only 1 dBA. Apparently the difference in average truck speeds were less than 10 mph. However, in the absence of corresponding data on vehicle speeds, statements regarding running speed, particularly in contrast to posted speed limits, may be inappropriate.

Percentage of trucks exceeding a given noise level are cited in Table 3. Less than one percent of the trucks produced noise levels exceeding 86 dBA in 35-mph (16-m/s) speed zones. On roads with high speed limits, 97 dBA was exceeded by less than one percent of the trucks operating under a 60-mph (27-m/s) speed limit. However, truck sizes determined generated noise levels. The larger trucks generated more noise. This is clearly evident from Figure 5 displaying data for trucks operating on interstate roads (70-mph (31-m/s) speed limit). About half of the five-axle, tractor-semitrailer combination vehicles exceeded 90 dBA, but less than one percent of two-axle, single unit trucks exceeded this level of noise. Table 4 presents the percentage of various classes of trucks which exceeded a given level of noise.



**Figure 4. Cumulative Percentage of Trucks with Increasing Range of Noise Levels for Roadways with Differing Posted Speed Limits.**

**TABLE 3**

**PERCENTAGE OF TRUCKS EXCEEDING A GIVEN NOISE LEVEL**

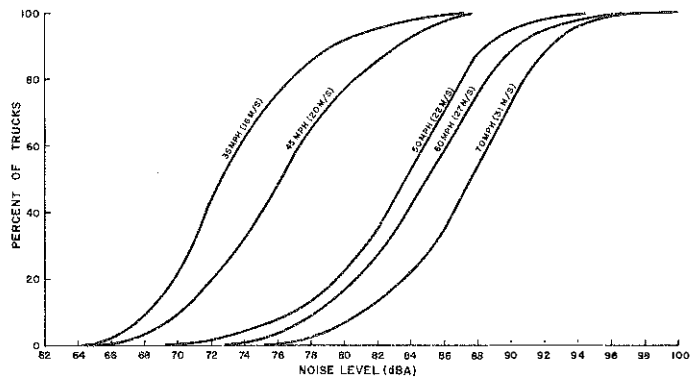
NOISE LEVEL (dBA)	PERCENTAGE OF TRUCKS				
	35 mph (16 m/s)	45 mph (20 m/s)	50 mph (22 m/s)	60 mph (27 m/s)	70 mph (31 m/s)
100				0.3	0
99				0.5	0.2
98				0.6	0.2
97				0.8	0.3
96			0	1.4	0.8
95			0.6	1.8	2.0
94			0.9	2.7	3.5
93	0		2.1	3.8	7.7
92	0.7		2.4	4.5	11.8
91	0.7		3.9	7.3	20.0
90	0.7		6.0	11.1	26.6
89	0.7	0	10.1	17.3	38.8
88	0.7	2.0	12.5	24.5	47.6
87	0.7	2.0	21.5	31.6	57.3
86	0.7	2.0	29.3	39.4	65.0
85	2.0	6.0	39.1	49.3	72.6
84	2.7	8.0	48.1	57.5	78.8
83	3.3	15.0	58.5	67.4	72.5
82	4.7	15.0	65.1	73.4	75.8
81	6.7	21.0	72.2	78.7	90.6
80	8.7	23.0	78.2	82.9	93.2

**TABLE 4**

**PERCENTAGES OF VARIOUS TRUCK TYPES EXCEEDING A GIVEN NOISE LEVEL (70-mph (31-m/s) POSTED SPEED LIMIT)**

NOISE LEVEL (dBA)	PERCENTAGE OF TRUCKS				
	SU 2-Axle*	SU 3-Axle	TT 3-Axle**	TT 4-Axle	TT 5-Axle
100					0
99					0.4
98					0.8
97				0	1.2
96				1.2	1.6
95				1.2	3.3
94			0	2.4	6.2
93			5.6	3.6	14.0
92	0		5.6	6.0	22.4
91	0.8		5.6	14.5	35.8
90	0.8	0	5.6	19.3	48.2
89	3.3	13.3	11.1	33.8	60.3
88	4.8	13.3	16.7	43.4	81.3
87	6.3	20.0	27.8	61.4	87.5
86	12.7	33.3	44.4	69.9	94.6
85	27.0	46.7	72.2	77.2	98.8
84	38.1	66.7	83.3	91.2	100.0
83	46.8	73.3	83.3	96.4	100.0
82	54.0	86.7	88.9	97.6	100.0

\*SU - Single unit trucks  
\*\*TT - Tractor-semitrailer trucks



**Figure 5. Cumulative Percentage of Trucks (by Classification) with Increasing Range of Noise Levels for Interstate Roads (70-mph (31 m/s) Speed Limit).**



## MOTORCYCLES

No attempt was made in this study to collect a large sample of motorcycle noise data, but their noise levels were recorded at every opportunity. Table 5 lists the readings obtained. Even though the sample size was extremely small, the values may be indicative of noise levels peculiar to motorcycles.

TABLE 5

MOTORCYCLE NOISE DATA		
POSTED SPEED LIMIT		NOISE LEVEL (dBA)
(mph)	(m/s)	
70	31	91, 89, 86
60	27	90, 83, 82, 82
50	22	79, 78
45	20	76
35	16	79, 76, 75, 72

## SUMMARY AND DISCUSSION

A considerable number of automobiles and trucks were included in this study to obtain representative data on noise associated with moving motor vehicles. The survey was conducted on roadways representing varied geometric and environmental conditions and posted speeds. The findings cited here, therefore, reasonably reflect noise levels of vehicles operating on Kentucky highways.

As expected, noise levels of trucks were significantly higher than for automobiles, and noise increased with increases in posted speed limit, as summarized in Table 6. The lowest recorded reading was 60 dBA (automobiles in 35-mph (16-m/s) speed limit zones) and the highest was 102 dBA (a single truck on a 60-mph (27-m/s) road). Also, trucks consistently yielded a wider range in noise levels for a given speed limit than automobiles (shown in Figure 3 and Figure 4). However, slopes of the cumulative percentage curves for individual truck types (Figure 5) were similar to those for automobiles (Figure 3). The noise levels of vehicles, therefore, were primarily related to vehicle size and speed. The data collected on motorcycles, even though limited, clearly indicated that motorcycle noise levels were comparable to those for trucks.

Several states have established limits on noise for motor vehicles as a means to protect and to improve the environment. This information is summarized in APPENDIX C.

In 1972, Congress enacted the Noise Control Act of 1972. The act directs the Environmental Protection Agency (EPA) to promulgate noise emission standards for motor vehicles sold in interstate commerce and for motor carriers engaged in interstate commerce. Section 18, cited in APPENDIX D, is particularly noteworthy since it deals with noise emissions resulting from operation of any motor carrier engaged in interstate commerce. Any standards set by the state, therefore, must be as restrictive as those established by EPA.

The purpose for this report was to present data and to cite findings on vehicle noise rather than to recommend or to suggest specific limits. The information contained here, however, may guide in the consideration and establishment of noise standards to the extent that undue burden will not befall automobile or truck owners and operators or destroy commerce and travel in Kentucky. In this regard, the following suggestions and comments may be helpful:

1. Separate noise limits are warranted for automobiles and trucks because of the vast difference in noise generated by each vehicle type.
2. Noise emitted by vehicles depends upon the operating speed. The higher noise levels were associated with the higher running speeds. Therefore, separate limits should be set for vehicles operating in various speed-limit zones.
3. On roadways with posted speed limits greater than 35 mph (16 m/s), a single, but higher noise limit may suffice. As evident from Table 2 and Table 3, however, the practical consequences would be that the higher limit would largely affect those vehicle operators using roadways with a posted speed limit of 70 mph (31 m/s) (interstate and parkway roads). Perhaps a separate limit is warranted for 70-mph (31-m/s) roads and another limit for all roadways having posted speed limits between 40 mph (18 m/s) and 60 mph (27 m/s).

TABLE 6

### SUMMARY OF VEHICLE NOISE LEVELS

POSTED SPEED LIMIT		MEDIAN NOISE LEVEL (dBA)	
(mph)	(m/s)	AUTOMOBILES	TRUCKS
35	16	67	73
45	20	68	76
50	22	72	84
60	27	74	85
70	31	77	88

## REFERENCES

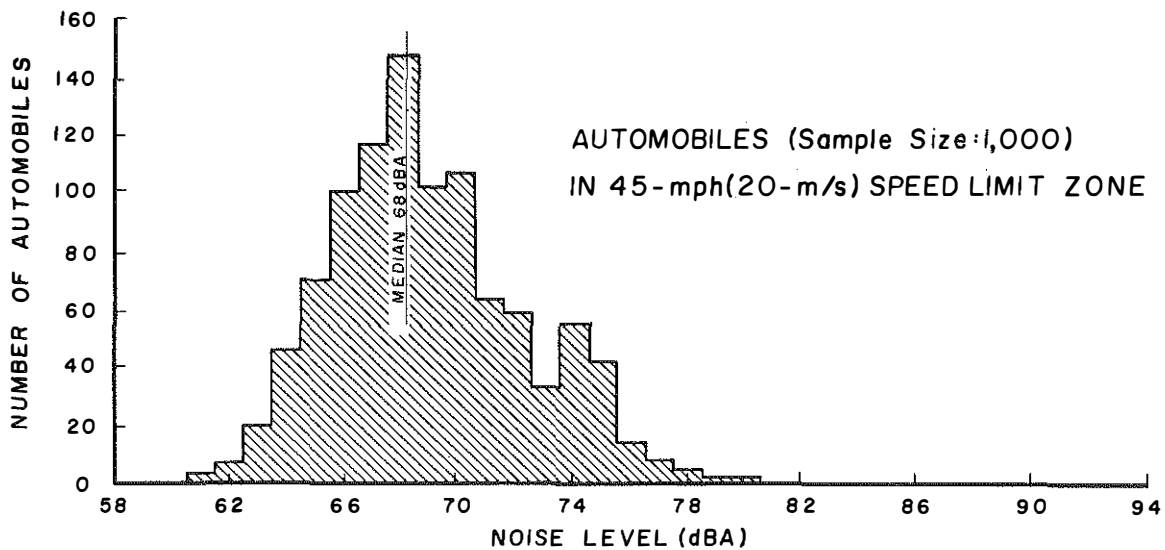
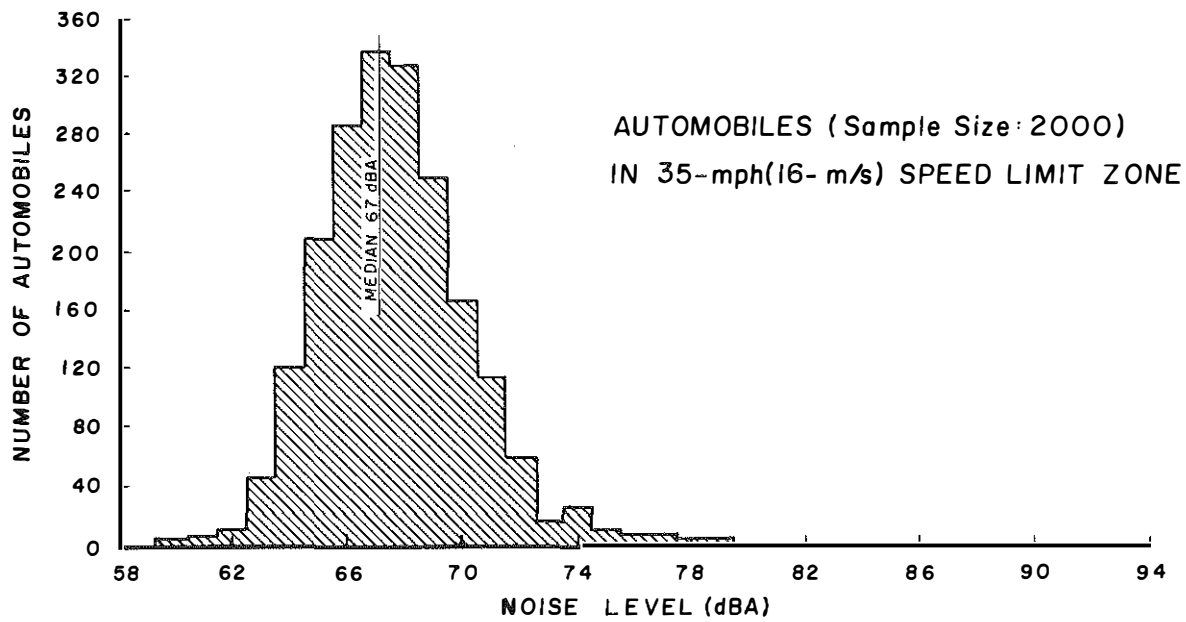
1. Donley, R., *Community Noise Regulation, Sound and Vibration*, February 1959.
2. Foss, Rene N., *Vehicle Noise Study*, Washington State Highway Commission, June 30, 1972.
3. **Noise Control Act of 1972 - Public Law 92-574**, Congressional Record -- Senate, October 18, 1972.

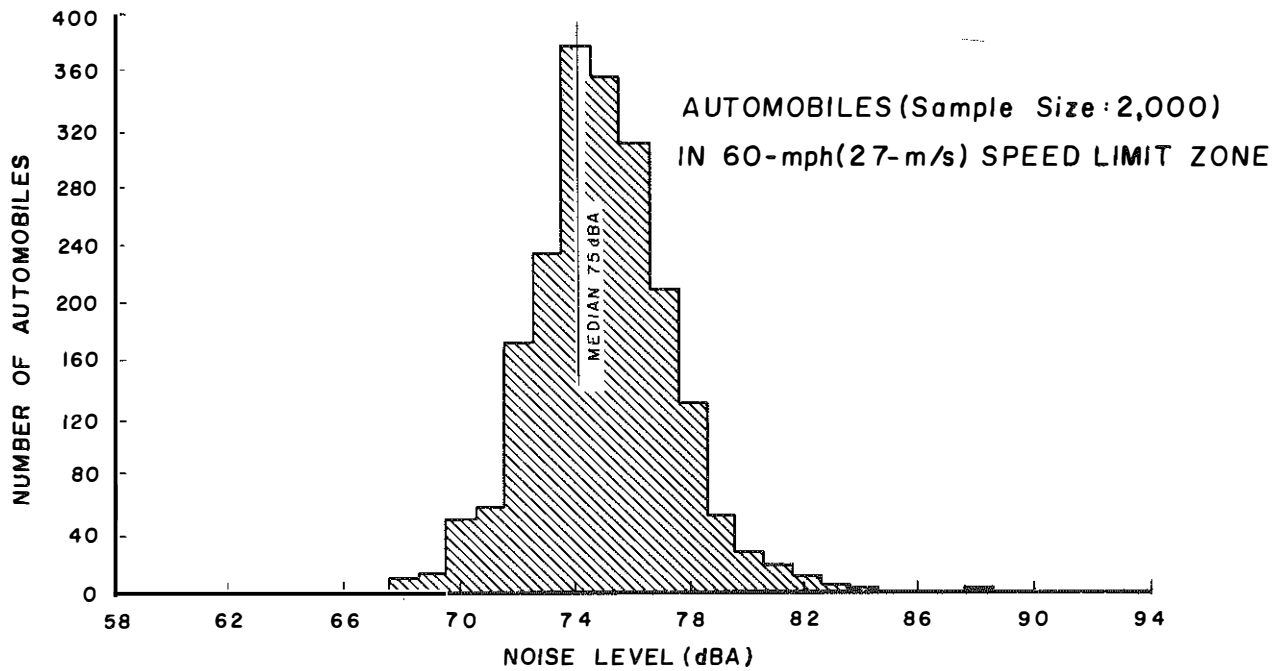
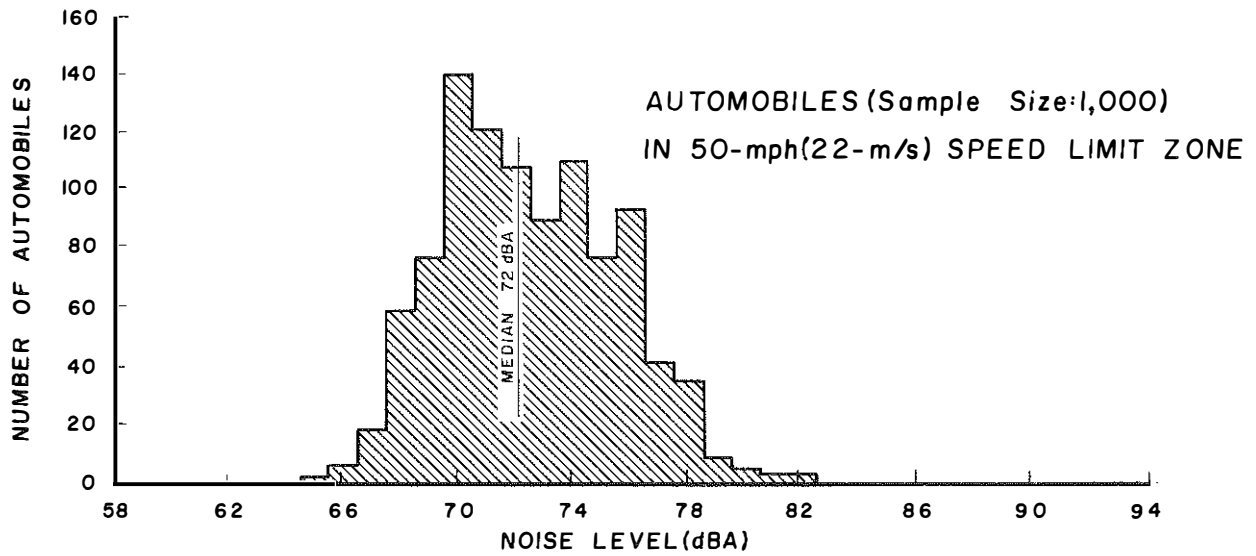
**APPENDIX A**  
**NOISE MEASUREMENT LOCATIONS**

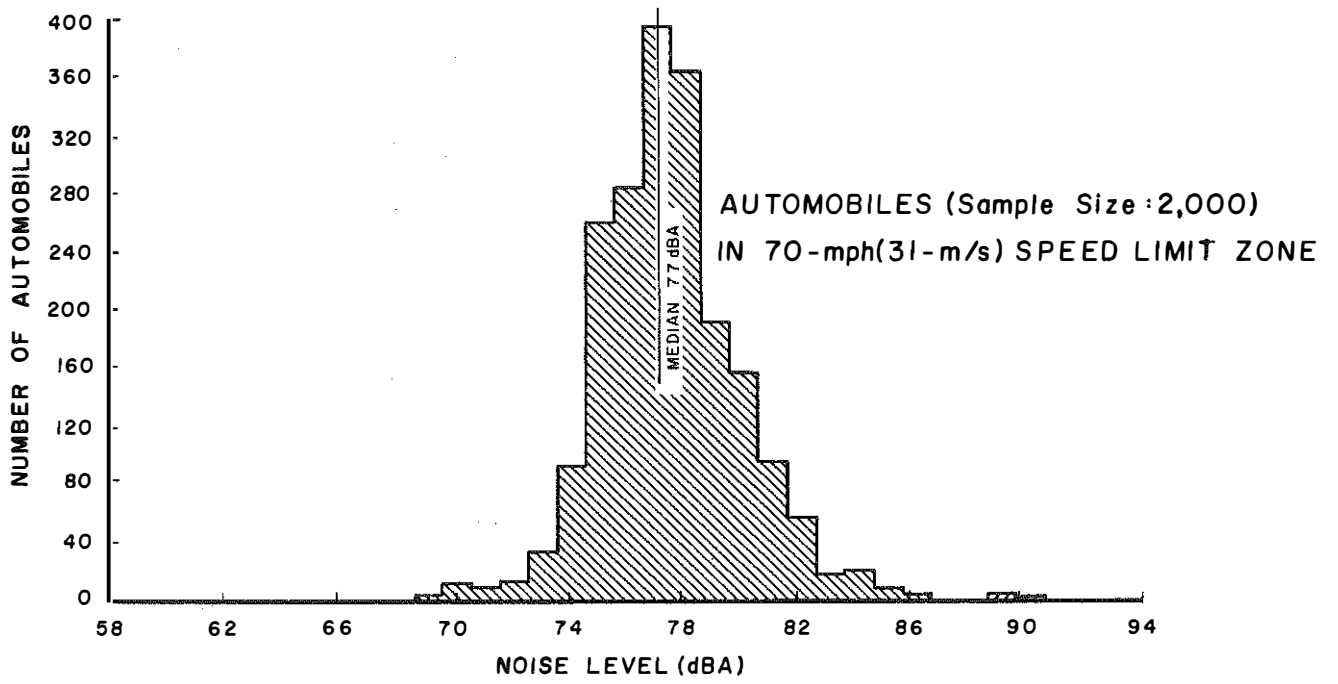
NOISE MEASUREMENT LOCATIONS

SPEED LIMIT	DATE	TIME	LOCATION	DESCRIPTION
35 mph (56 m/s)	2-16-72	2:15 - 2:45 pm	US 27 (South Limestone Street), Lexington	
	4-13-72	2:35 - 3:00 pm	US 27 (South Limestone Street), Lexington	
	5-26-72	9:30 - 10:15 am	Russell Cave Road at KY 353, Lexington	
	5-26-72	11:00 - 11:45 am	US 60 (Versailles Road) at G. V. Vaughn Co., Lexington	
	5-26-72	1:55 pm	Lane Allen Road, Lexington	
	5-31-72	10:00 am	US 68 (North Broadway) at Twelfth Street, Lexington	
	6-19-72	9:10 am	Lane Allen Road, Lexington	
	6-19-72	2:20 pm	US 25 (Richmond Road) at Henry Clay Home, Lexington	
	6-19-72	3:30 pm	Russell Cave Road, IBM Building 988, Lexington	
	6-21-72	2:55 pm	Russell Cave Road, Lexington	
	6-22-72	9:00 am	Mason Headley Road by Par 3 Golf Course, Lexington	
	6-22-72	10:05 am	Eucled Avenue at Transylvania Park, Lexington	
	6-22-72	1:35 pm	Cooper Drive, Lexington	
	6-23-72	9:00 am	US 27 (South Limestone Street), Lexington	
6-23-72	10:15 am	Cooper Drive, Lexington		
6-23-72	2:40 pm	US 60 (Versailles Road) at G. V. Vaughn Co., Lexington		
45 mph (72 m/s)	5-4-72	9:30 - 10:00 am	KY 1974 (Tates Creek Road) across from Lansdowne Shopping Center, Lexington	
	5-4-72	1:30 pm	US 27 (Nicholasville Road) at K-Mart, Lexington	
	5-4-72	3:00 pm	KY 4 at Yates School, Lexington	
	5-5-72	2:15 pm	KY 1974 (Tates Creek Road), Lexington	
	5-5-72	2:50 pm	KY 1974 (Tates Creek Road) at Immanuel Baptist Church, Lexington	
	5-10-72	9:00 - 9:25 am	KY 1974 (Tates Creek Road) across from Lansdowne Shopping Center, Lexington	
	5-10-72	9:35 - 9:50 am	KY 1974 (Tates Creek Road) at Immanuel Baptist Church, Lexington	
	5-15-72	10:45 - 11:10 am	US 27 (Nicholasville Road) at Zandale Shopping Center, Lexington	
	6-13-72	10:50 am	KY 4 at Yates School, Lexington	
	6-13-72	1:50 pm	US 27 (Nicholasville Road) at K-Mart, Lexington	
6-19-72	10:45 am	US 68 (North Broadway) across from Pickard Co., Lexington (trucks only)		
50 mph (82 m/s)	4-19-72	2:05 - 2:40 pm	US 25 (Richmond Road) across from Lakeside Golf Course, Lexington (trucks only)	
	4-20-72	10:00 - 10:25 am	US 25 (Richmond Road) 1.0 mile (1.6 km) N of I 75 (trucks only)	
	4-24-72	2:05 - 2:30 pm	US 27 (Nicholasville Road) at Jan Mar Farm entrance (trucks only)	
	5-16-72	9:20 - 10:05 am	US 60 (Versailles Road) at Bluegrass Parkway	
	5-18-72	9:20 am	US 60 (Versailles Road) at Bluegrass Parkway	
	5-18-72	10:30 am	US 60 (Versailles Road) at the Airport Motel, Lexington	
	5-23-72	9:55 am	US 60 (Versailles Road)	
	5-23-72	11:25 am	US 60 (Versailles Road) across from Calumet Farm, Lexington	
	5-24-72	1:30 pm	US 60 (Versailles Road) at Bluegrass Parkway	
	5-24-72	10:15 - 10:40 am	US 60 (Versailles Road) at Bluegrass Parkway	
5-24-72	3:25 pm	US 25 (Richmond Road) at Coleman's Antiques, Lexington (trucks only)		
60 mph (97 m/s)	4-17-72	9:25 - 10:00 am	US 60 between Versailles and Frankfort	
	4-17-72	2:15 - 2:45 pm	KY 4 (New Circle Road) 0.3 mile (0.5 km) W of Harrodsburg Road, Lexington	
	4-18-72	9:40 - 10:10 am	US 60 between Versailles and Frankfort	
	4-18-72	2:00 pm	KY 4 (New Circle Road) between Harrodsburg Road and Versailles Road, Lexington	
	4-19-72	8:55 - 9:25 am	US 60 1.5 mile (2.4 km) W of Versailles	
	4-19-72	2:05 - 2:40 pm	US 25 (Richmond Road) across from Lakeside Golf Course, Lexington (cars only)	
	4-20-72	10:00 - 10:25 am	US 25 (Richmond Road) 1.0 mile (1.6 km) N of I 75, Lexington (cars only)	
	4-20-72	1:55 - 2:20 pm	KY 4 (New Circle Road) between Harrodsburg Road and Versailles Road, Lexington	
	4-21-72	2:30 - 2:55 pm	KY 4 (New Circle Road) between Harrodsburg Road and Versailles Road, Lexington	
	4-24-72	10:10 - 10:40 am	US 60 between Versailles and Frankfort	
	4-24-72	2:05 - 2:30 pm	US 27 (Nicholasville Road) at Jan Mar Farm entrance (cars only)	
	4-25-72	9:00 - 9:30 am	US 60 1.0 mile (1.6 km) E of I 64	
	4-26-72	9:00 am	US 60 between Versailles and Frankfort	
	4-27-72	10:35 - 11:10 am	US 60 1.5 mile (2.4 km) E of I 64	
	4-27-72	2:30 - 3:00 pm	KY 4 (New Circle Road) 0.5 mile (0.8 km) W of Harrodsburg Road, Lexington	
	4-28-72	9:30 - 10:00 am	US 60 between Versailles and Frankfort	
	4-28-72	10:10 - 10:50 am	US 60 between Versailles and Frankfort	
4-28-72	2:15 - 2:45 pm	KY 4 (New Circle Road) 0.2 mile (0.3 km) W of Harrodsburg Road, Lexington		
5-1-72	10:30 - 11:00 am	US 60 1.5 mile (2.4 km) W of Versailles		
5-1-72	1:30 pm	US 60 1.5 mile (2.4 km) W of Versailles		
5-23-72	12:45 - 1:30 pm	US 60 between Frankfort and Versailles (trucks only)		
5-24-72	3:25 pm	US 25 (Richmond Road) at Coleman's Antiques, Lexington (cars only)		
70 mph (113 m/s)	2-14-72	1:45 - 2:30 pm	I 75 NB 0.3 mile (0.5 km) S of MP 117	
	2-16-72	9:30 - 10:00 am	I 75 NB 0.3 mile (0.5 km) S of MP 117	
	2-17-72	9:15 - 10:45 am	I 75 NB 0.3 mile (0.5 km) S of MP 117	
	2-22-72	1:35 - 2:05 pm	I 75 NB 0.3 mile (0.5 km) S of MP 117	
	2-28-72	10:00 - 10:35 am	I 75 NB 0.3 mile (0.5 km) S of MP 117	
	2-29-72	9:30 - 10:15 am	I 75 SB 0.2 mile (0.3 km) S of MP 117	
	3-6-72	1:45 - 2:15 pm	I 75 SB 1.1 mile (1.8 km) S of MP 117	
	3-7-72	1:30 - 1:50 pm	I 75 SB 0.2 mile (0.3 km) S of MP 119	
	3-13-72	9:38 - 10:08 am	I 75 NB 1.0 mile (1.6 km) N of Exit 18	
	3-13-72	10:48 - 11:04 am	I 75 SB 1.3 mile (2.1 km) S of Exit 15	
	3-13-72	2:25 pm	I 75 NB 1.3 mile (2.1 km) S of Exit 15	
	3-15-72	9:25 - 10:00 am	I 75 SB 1.3 mile (2.1 km) S of Exit 15	
	3-16-72	2:00 - 2:30 pm	I 75 SB 1.3 mile (2.1 km) S of Exit 15	
	3-28-72	9:36 - 9:56 am	I 75 SB 1.3 mile (2.1 km) S of Exit 15	
	3-30-72	2:30 - 3:00 pm	I 75 SB 1.1 mile (1.8 km) S of Exit 15	
	4-3-72	10:45 am	I 75 NB 1.4 mile (2.3 km) S of Exit 15	
	1-26-73	9:00 am	I 75 0.2 mile (0.3 km) S of Exit 15 (trucks only)	
	1-26-73	2:30 pm	I 75 SB 1.0 mile (1.6 km) S of Winchester Road exit (trucks only)	
	2-7-73	9:00 am	I 75 NB 0.5 mile (0.8 km) N of Newtown Pike (trucks only)	
	2-7-73	10:00 am	I 75 SB 0.1 mile (0.2 km) S of Fayette County Line (trucks only)	
2-13-73	1:30 pm	I 75 SB 1.0 mile (1.6 km) S of Fayette County Line (trucks only)		
3-6-73	2:30 pm	I 75 NB 0.5 mile (0.8 km) N of White Hall exit, Richmond (trucks only)		
3-6-73	3:00 pm	I 75 NB 1.0 mile (1.6 km) S of Exit 15 (trucks only)		
3-13-73	1:30 pm	I 75 SB 0.5 mile (0.8 km) S of Broadway (trucks only)		
3-13-73	2:30 pm	I 75 SB and NB between Winchester Road and Richmond Road exits (trucks only)		
3-14-73	9:00 am	I 75 SB 1.0 mile (1.6 km) S of Exit 15 (trucks only)		

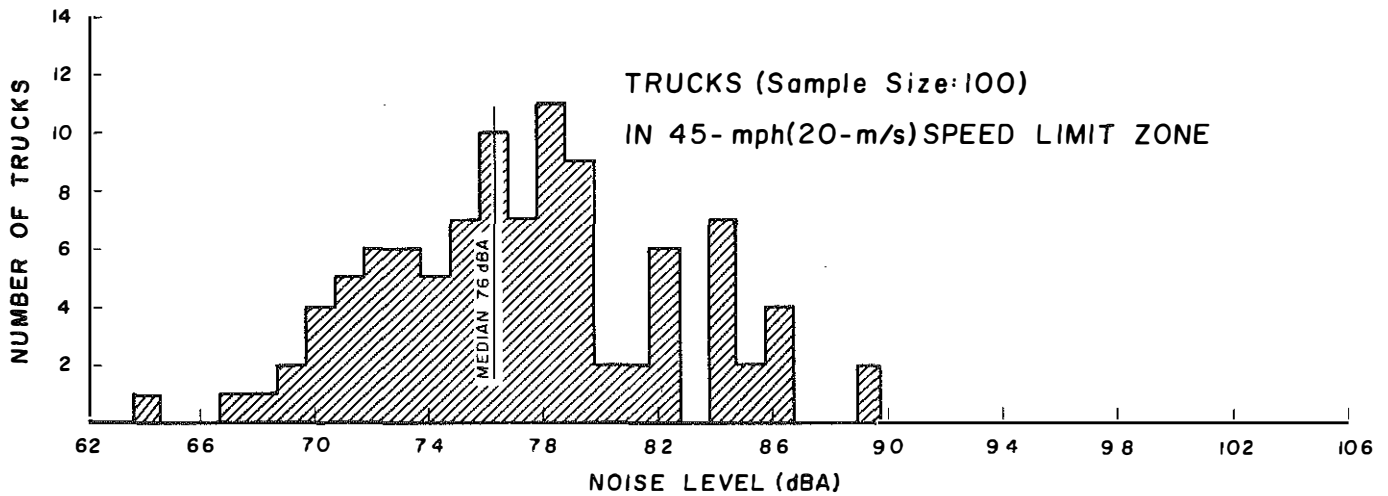
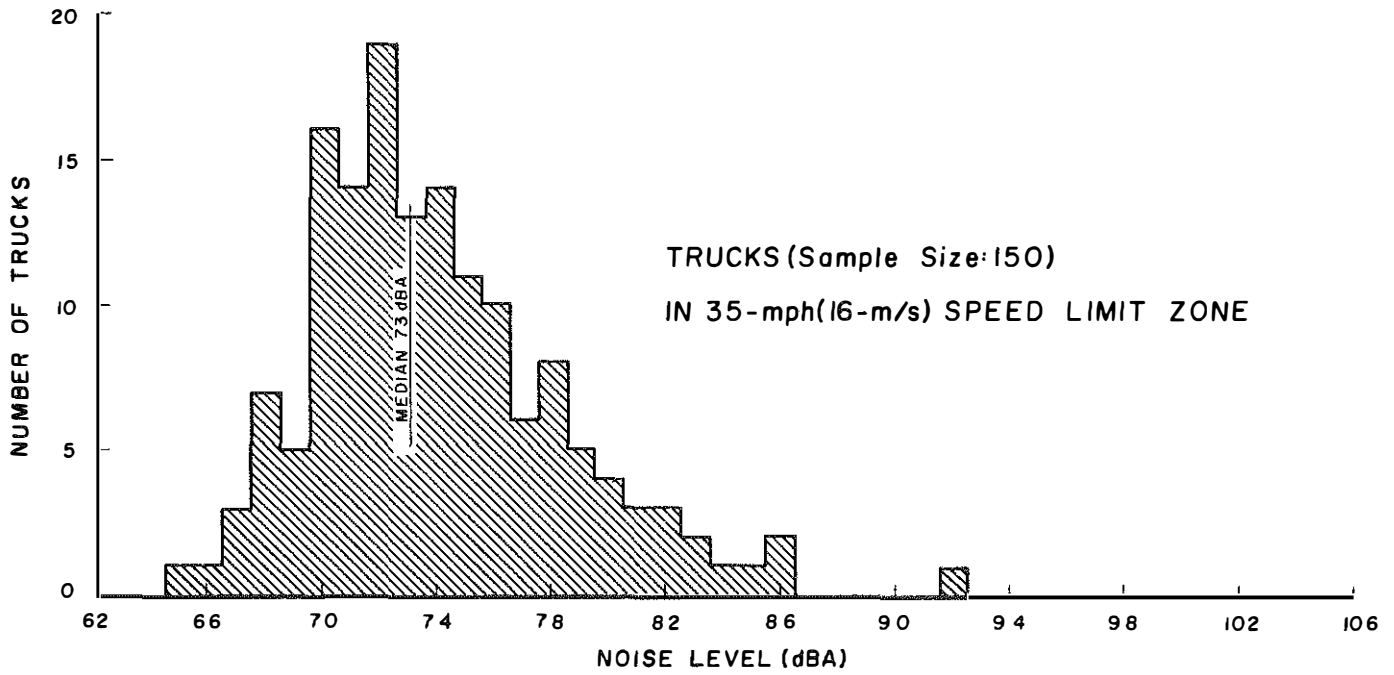
**APPENDIX B**  
**NOISE LEVEL DISTRIBUTIONS FOR**  
**AUTOMOBILES AND TRUCKS**



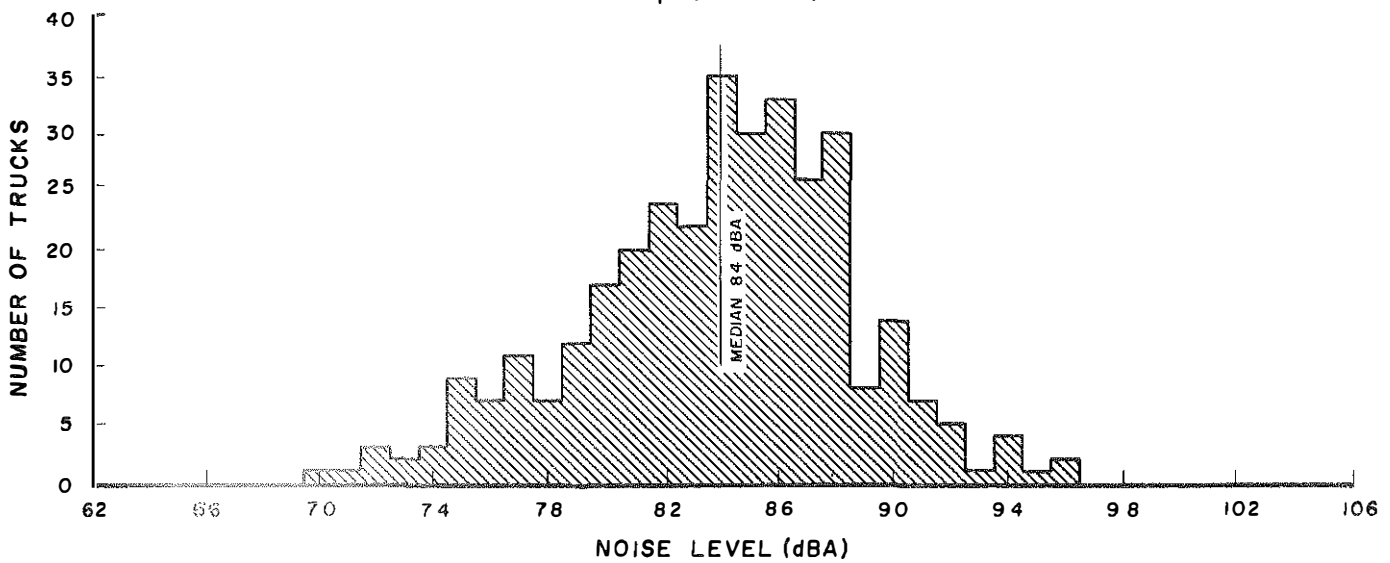




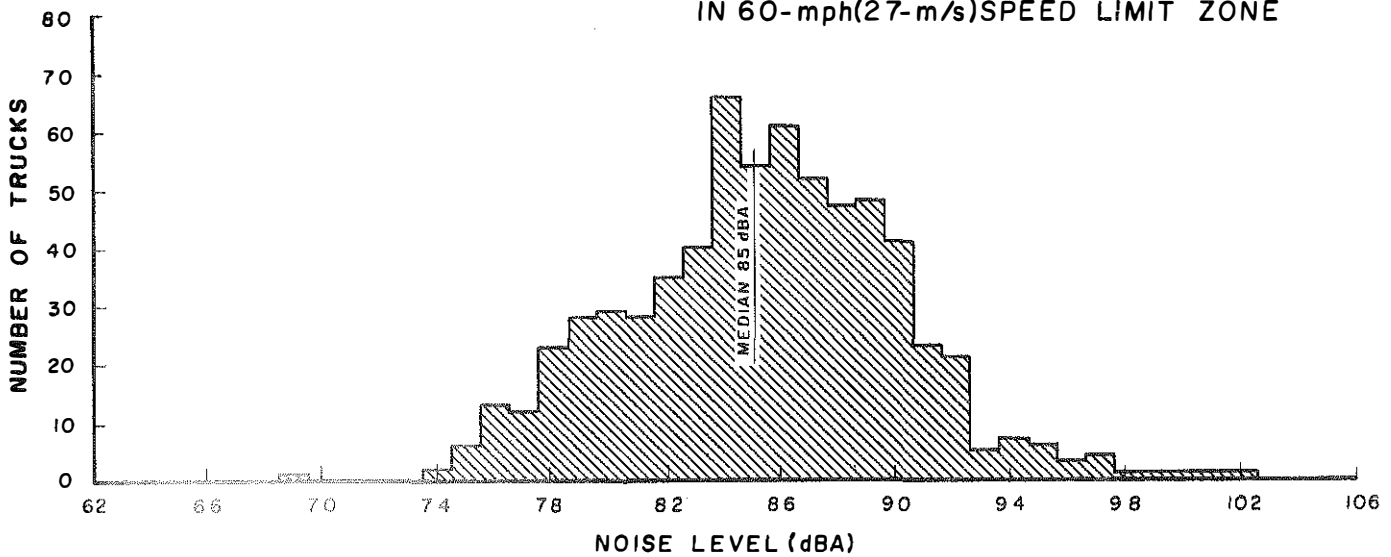


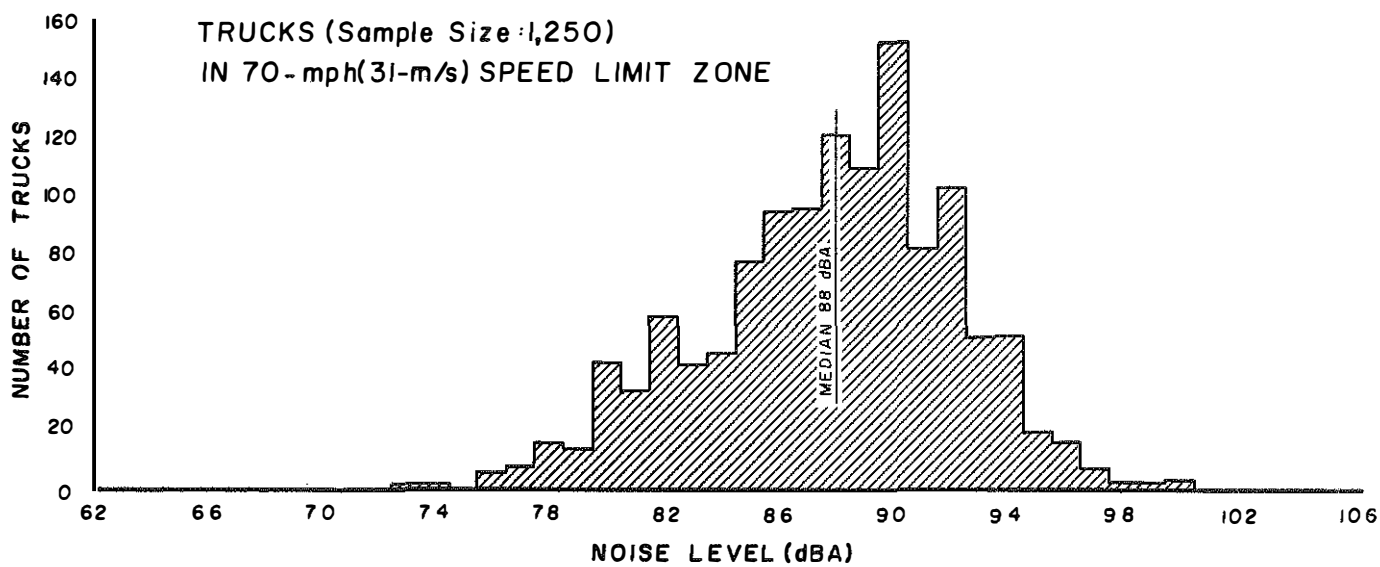


TRUCKS (Sample Size:335)  
 IN 50-mph(22-m/s) SPEED LIMIT ZONE



TRUCKS (Sample Size:665)  
 IN 60-mph(27-m/s) SPEED LIMIT ZONE





**APPENDIX C**  
**SUMMARY OF NOISE CONTROL LAWS**

## NOISE CONTROL LAWS IN OTHER STATES

The State of Washington conducted a survey of 48 states and six Canadian provinces concerning their legislation on highway vehicle noise (2). As of December 1971, six states had set limits on the noise emitted by motor vehicles. Table C-1 is a summary of these limits.

Applicable noise control laws for the six states are as follows:

### California

(Excerpts from Amended (11/71) California Vehicle Code)

23130. (a) No person shall operate either a motor vehicle or combination of vehicles of a type subject to registration at any time or under any condition of grade, load, acceleration or deceleration in such a manner as to exceed the following noise limit for the category of motor vehicle within the speed limits specified in this section:

		Speed Limit of 35 mph or less	Speed Limit of more than 35 mph
(1)	Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 pounds or more and any combination of vehicles towed by such motor vehicle:		
	(A) Before January 1, 1973	88 dB(A)	90 dB(A)
	(B) On and after January 1, 1973	86 dB(A)	90 dB(A)
(2)	Any motorcycle other than a motor-driven cycle	82 dB(A)	86 dB(A)
(3)	Any other motor vehicle and any combination of vehicles towed by such motor vehicle	76 dB(A)	82 dB(A)

23130.5 (a) Notwithstanding the provisions of subdivision (a) of Section 23130, the noise limits, within a speed zone of 35 miles per hour or less on level streets or streets with a grade not exceeding plus or minus 1 percent for the following categories of motor vehicles, or combinations of vehicles, which are subject to registration, shall be:

(1)	Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 pounds or more and any combination of vehicles towed by such motor vehicle	82 dB(A)
(2)	Any motorcycle other than a motor-driven cycle	77 dB(A)
(3)	Any other motor vehicle and any combination of vehicles towed by such motor vehicle	74 dB(A)

27100. (a) No person shall sell or offer for sale, a new motor vehicle which produces a maximum noise exceeding the following noise limit at a distance of 50 feet from the centerline of travel under test procedures established by the department:

(1)	Any motorcycle manufactured before 1970.	92 dB(A)
(2)	Any motorcycle, other than a motor-driven cycle, manufactured after 1969, and before 1973	88 dB(A)
(3)	Any motorcycle, other than a motor-driven cycle, manufactured after 1972 and before 1975	86 dB(A)
(4)	Any motorcycle, other than a motor-driven cycle, manufactured after 1974 and before 1978	80 dB(A)
(5)	Any motorcycle, other than a motor-driven cycle, manufactured after 1977 and before 1988	75 dB(A)
(6)	Any motorcycle, other than a motor-driven cycle, manufactured after 1987	70 dB(A)
(7)	Any snowmobile manufactured after 1972.	82 dB(A)
(8)	Any motor vehicle with a gross vehicle rating of 6,000 pounds or more manufactured after 1967 and before 1973.	88 dB(A)
(9)	Any motor vehicle with a gross vehicle weight of 6,000 pounds or more manufactured after 1972 and before 1975.	86 dB(A)
(10)	Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1974 and before 1978	83 dB(A)
(11)	Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1977 and before 1988.	80 dB(A)
(12)	Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1987	70 dB(A)
(13)	Any other motor vehicle manufactured after 1967 and before 1973.	86 dB(A)
(14)	Any other motor vehicle manufactured after 1972 and before 1975.	84 dB(A)
(15)	Any other motor vehicle manufactured after 1974 and before 1978.	80 dB(A)

(16) Any other motor vehicle manufactured after 1977 and before 1988 75 dB(A)

(17) Any other motor vehicle manufactured after 1987. 70 dB(A)

**Idaho**

(1) Every motor vehicle must be equipped with a muffler to prevent the emission of excessive or unusual noise.

(2) Excessive or unusual noise includes any sound made by a motor vehicle at any time under any condition of grade, speed, acceleration or deceleration which exceeds 92 dB (A) measured at a distance of not less than 20 feet to the side of the vehicle.

**Minnesota**

(169.691) No person shall operate a motor vehicle or combination of vehicles at any time or under any condition of grade, road, acceleration or deceleration which exceeds the noise limit specified below at a distance of 50 ft from the center of the lane of travel within the speed limits specified:

	35 mph or less	more than 35 mph
(1) Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 lb or more, any combination of vehicles towed by such motor vehicle, and any motorcycle:		
(a) Before Jan. 1, 1975	88 dB(A)	90 dB(A)
(b) On and after Jan 1, 1975	86 dB(A)	90 dB(A)
(2) Any other motor vehicle and any combination of vehicles towed by such motor vehicle	82 dB(A)	86 dB(A)

(160.692) No person shall sell or offer for sale a new motor vehicle which produces a maximum noise exceeding the following noise limit of a distance of 50 ft from the centerline of travel:

Any motorcycle manufactured

- (1) Before Jan. 1, 1972 92 dB(A)
- (2) On or after Jan. 1, 1972 and before Jan 1, 1973 88 dB(A)
- (3) On or after Jan. 1, 1973 86 dB(A)

Any motor vehicle with a gross vehicle weight rating of 6,000 lb or more manufactured

- (4) On or after Jan 1, 1972 and before Jan 1, 1975 88 dB(A)
- (5) On or after Jan. 1, 1975 86 dB(A)

Any other motor vehicle manufactured

- |   |          |
|---|----------|
| (6) On or after Jan. 1, 1972 and before Jan 1, 1975 | 86 dB(A) |
| (7) After Jan. 1, 1975                              | 84 dB(A) |

**Nevada**

Law patterned after that of California (pre-amended).

**New York**

Sec. 386 of the Vehicle and Traffic Law - Motor vehicle noise limit:

- (1) No motor vehicle, other than an authorized emergency vehicle or a vehicle moving under special permit, which makes or creates excessive or unusual noise, shall operate upon a public highway.
- (2) A motor vehicle which produces a sound level of 88 dB or more on the "A" scale shall be deemed to make or create excessive or unusual noise.

(Excessive or unusual noise is defined as a sound pressure level (SPL) of dBA or more measured on a standard sound level meter. The measurements of SPL shall be made at speeds of less than 35 mph with the microphone positioned 50 ft, ± 2 ft, from the center of the lane in which the vehicle is traveling. SPL measurements shall be made according to the practices outlined in the Society of Automotive Engineers Standard J672, "Measurement of Truck and Bus Noise" as approved Jan. 1957.)

- (3) No arrest shall be made in cases where the noise limit is exceeded by less than a 2 dB tolerance.
- (4) Every motor vehicle shall be equipped with an adequate muffler to prevent the emission of excessive or unusual noise.

**Pennsylvania**

- (1) No motor vehicle, except for emergency vehicles, at any time or under any condition of grade, load, acceleration or deceleration, may exceed the following noise limit for the category of motor vehicle measured 50 ft from the center of the lane of travel within the speed limits specified:

	35 mph or less	more than 35 mph
(a) Any motor vehicle with manufacturer's gross vehicle weight rating of 7,000 lb or more, any combination of vehicles towed by such motor vehicle, and any motorcycle.	90 dB	92 dB
(b) Any other motor vehicle and any combination of vehicles towed by such motor vehicle.	82 dB	86 dB
(2) No new motor vehicle, except for emergency vehicles, may be sold which produces a maximum noise exceeding the following noise limit measured 50 ft from the center of the lane of travel.		
(a) Same as (a) above with the addition of manufactured after Jan. 1, 1973	90 dB	
(b) Same as (b) above with the addition of manufactured after Jan. 1, 1973	84 dB	



**TABLE C-1**  
**NOISE LIMITS IN SIX STATES**  
**(Current Legislation)**

STATE	SPEED LIMIT 35 mph (16 m/s) OR LOWER		SPEED LIMIT HIGHER THAN 35 mph (16 m/s)	
	AUTOMOBILES	TRUCKS	AUTOMOBILES	TRUCKS
California	76 dBA at 50 ft (15 m)	86 dBA at 50 ft (15 m)	82 dBA at 50 ft (15 m)	90 dBA at 50 ft (15 m)
Idaho	92 dBA at 20 ft (6 m)	(for any vehicle at any speed)		
Minnesota	82 dBA at 50 ft (15 m)	88 dBA at 50 ft (15 m)	86 dBA at 50 ft (15 m)	90 dBA at 50 ft (15 m)
Nevada	76 dBA at 50 ft (15 m)	86 dBA at 50 ft (15 m)	82 dBA at 50 ft (15 m)	90 dBA at 50 ft (15 m)
New York	88 dBA (2 dB tolerance) at 50 ft (15 m)	(measured while vehicle moving less than 35 mph (16 m/s))		
Pennsylvania	82 dBA at 50 ft (15 m)	90 dBA at 50 ft (15 m)	86 dBA at 50 ft (15 m)	92 dBA at 50 ft (15 m)

**APPENDIX D**

**NOISE CONTROL ACT OF 1972 – PUBLIC LAW 92-574  
Section 18 on Motor Carrier Noise Emission Standards  
U.S. Congress**

**(From Congressional Record -- Senate, October 18, 1972)**

## MOTOR CARRIER NOISE EMISSION STANDARDS

Sec. 18. (a) (1) Within nine months after the date of enactment of this Act, the Administrator shall publish proposed noise emission regulations for motor carriers engaged in interstate commerce. Such proposed regulations shall include noise emission standards setting such limits on noise emissions resulting from operation of motor carriers engaged in interstate commerce which reflect the degree of noise reduction achievable through the application of the best available technology, taking into account the cost of compliance. These regulations shall be in addition to any regulations that may be proposed under section 6 of this Act.

(2) Within ninety days after the publication of such regulations as may be proposed under paragraph (1) of this subsection, and subject to the provisions of section 16 of this Act, the Administrator shall promulgate final regulations. Such regulations may be revised from time to time, in accordance with this subsection.

(3) Any standard or regulation, or revision thereof, proposed under this subsection shall be promulgated only after consultation with the Secretary of Transportation in order to assure appropriate consideration for safety and technological availability.

(4) Any regulation or revision thereof promulgated under this subsection shall take effect after such period as the Administrator finds necessary, after consultation with the Secretary of Transportation, to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period.

(b) The Secretary of Transportation, after consultation with the Administrator shall promulgate regulations to insure compliance with all standards promulgated by the Administrator under this section. The Secretary of Transportation shall carry out such regulations through the use of his powers and duties of enforcement and inspection authorized by the Interstate Commerce Act and the Department of Transportation Act. Regulations promulgated under this section shall be subject to the provisions of sections 10, 11, 12, and 16 of this Act.

(c) (1) Subject to paragraph (2) of this subsection but notwithstanding any other provision of this Act, after the effective date of a regulation under this section applicable to noise emissions resulting from the operation of any motor carrier engaged in interstate commerce, no State of political subdivision thereof may adopt or enforce any standard applicable to the same operation of such motor carrier, unless such standard is identical to a standard applicable to noise emissions resulting from such operation prescribed by any regulation under this section.

(2) Nothing in this section shall diminish or enhance the right of any State or political subdivision thereof to establish and enforce standards or controls on levels of environmental noise, or to control, license, regulate, or restrict the use, operation, or movement of any produce if the Administrator, after consultation with the Secretary of Transportation, determines that such standard, control, license, regulation, or restriction is necessitated by special local conditions and is not in conflict with regulations promulgated under this section.

(d) For purposes of this section, the term "motor carrier" includes a common carrier by motor vehicle, a contract carrier by motor vehicle, and a private carrier of property by motor vehicle as those terms are defined in paragraphs (14), (15), and (17), of section 203(a) of the Interstate Commerce Act (49 U.S.C. 303 (a)).