SIMPLIFIED TECHNIQUE FOR TRAFFIC NOISE LEVEL ESTIMATION

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

SIMPLIFIED TECHNIQUE FOR TRAFFIC NOISE LEVEL ESTIMATION

(Prepared for use in City and County situations characterized by low speed, low volume traffic operating at short distances from at-grade roadways)

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Research Laboratory Section
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ABSTRACT

Traffic noise is becoming increasingly detrimental to the quality of our urban and rural environments. Currently, it is the predominant and most widespread source of noise. Future design and routing of highways and upgrading of our present facilities must include traffic noise as a consideration.

In our city and county areas, there exists a need for predicting noise levels at sites very near to at-grade roadways carrying low speed, low volume traffic. This report is directed to that need.

It should be noted that noise levels based on the tables in this report are state-of-the-art prediction, as these levels are outputs from MDSHT's Research Report No. R-942, "Traffic Noise Level Predictor Computer Program," (1) which was based upon the NCHRP 117/144 method.

Research and validation studies have improved the precision of prediction techniques, leading to this update of the previous report (2). Several examples have also been added.

The common unit for measuring noise is the decibel, abbreviated simply "db." The logarithmic decibel scale for sound level was first introduced by communication engineers many years ago. They simply took the logarithm of the amount of power change that occurred in an amplifier or attenuator and named this unit the "Bell" in honor of Alexander Graham Bell. It was soon found that this unit was far too coarse, and it became common practice to use a unit one-tenth of a Bell, called the "decibel."

In sound measurement, decibel levels are related to a reference sound pressure level of 0.0002 dyne/cm^2. This particular level represents (approximately) the faintest sound that can be heard by the ear of a healthy young adult in an extremely quiet environment.

Therefore, if any given decibel level represents the logarithm of the difference between the reference level and some sound pressure level of interest, it can be seen for example, that a decibel level of 60 refers to a sound pressure one million (10^6) times the reference level. In a like manner, a decibel level of 120 (near the pain threshold) represents a pressure which is a million million (10^{12}) times the reference level.

Since the human ear detects sound in a nonlinear fashion over the audible frequency range of 16 to 16,000 Hz (cycles per second), the decibel unit must be weighted differently for each frequency. Of the various weightings available, it is accepted that so-called A-weighting, denoted as dbA, is the most practical measure of noise produced by today's highway vehicles. It correlates as well with human judgements of the acceptability of highway noise as do the more elaborate spectral analysis methods.

Knowledge of the average traffic noise level is not, in itself, necessarily sufficient if one is to define environmental acceptability. Some knowledge of the noise peaks and distribution is also required. Although several concepts have been proposed for characterizing these peaks and the distribution, it has been decided that the noisier aspects of the traffic environment can be adequately defined using the temporal unit, L_{10}. This is the noise level which is exceeded 10 percent of the sample time.

Two methods for determining the L_{10} level have been approved by the Federal Highway Administration in FHPM 7-7-3, "Noise Standards and Procedures," effective September 5, 1974. These approved methods are:

1) National Cooperative Highway Research Program Report 117, "Highway Noise: A Design Guide for Highway Engineers," 1971. Updated by NCHRP Report 144, "Highway Noise: A Field Evaluation of Traffic Noise Reduction Measures," 1973.

2) DOT Transportation Systems Center Report DOT-TSC-FHWA-72-1, "Manual for Highway Noise Prediction," March 1972.

Since these methods require access to a computer and may be more complex than necessary for the preliminary prediction purposes of most city and county groups, it was concluded that a set of tables covering the proper variables would be more appropriate and useful.

At the request of the Department's Local Government Division, and as the result of discussions with their personnel, certain parameters and ranges were established, for Research Report R-853R, as those which would best satisfy most of the noise prediction needs of city and county highway agencies. Based upon information from the Traffic Surveys and Analysis Division of the Bureau of Transportation Planning and the Highway Capacity Manual (3) the parameter ranges were modified.

The parameters and ranges established are:

1) DN - Distances between observer and center of near lane of 30 to 100 ft.
2) Q - Flow rates of 500 to 5,000 vehicles/hour.
3) S - Vehicle speeds of 25, 35, 45, and 55 mph.
4) P - Non-divided pavements of 2, 3, 4, and 5 lanes, and
5) T - Commercial[1] traffic volumes of 1 to 10 percent.

There are several rules-of-thumb for estimating changes in noise levels when only one parameter such as distance (DN) or flow rate (Q) varies. In the case of a modified line source traffic model (as opposed to an individual vehicle point source) we have:

1) The doubling of flow rate (Q) increases L_{10} by 3 db
2) The doubling of distance (DN) decreases L_{10}, on the average, by 4.5 db (3 dbA minimum to 6 dbA maximum).

If there are two noise sources and the noise power of each is known, decibel levels are not directly added to get the total sound level. Instead, one must convert from decibels to sound pressures, add the pressures, and then reconvert to decibels. For example, if an automobile which is radiating a level of 80 dbA (as measured from some fixed distance) is located next to an identical automobile also radiating 80 dbA, the resultant noise field will have twice the power. This will not produce 160 dbA, but only 83 dbA, as doubling the power adds only 3 dbA to the existing level. If the power is doubled again by adding two more such vehicles, the net result would be 86 dbA. Again doubling (for a total of eight such vehicles) would result in a total of 89 dbA, and further doubling (sixteen vehicles)

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[1] Commercial being defined as a motor vehicle having a gross vehicle weight greater than 10,000 lb and buses having a capacity exceeding 15 passengers.

would add another 3 dbA to the level for a total of 92 dbA. Therefore, in a hypothetical situation it would take 16 automobiles, each emitting 80 dbA to equal one truck which is emitting 92 dbA.

The tables presented in this report (Tables 1 through 14) for estimating L_{10} (dbA) noise levels were created by utilizing the method of MDSHT Research Report No. R-942, "Traffic Noise Level Predictor Computer Program." This computer program is based on the modified line source model of NCHRP Report Nos. 117 and 144. Use of these tables in predicting L_{10} (dbA) noise levels is demonstrated in the Appendix.

The previous graphical presentation (2) was eliminated in favor of the tabular presentation to provide increased accuracy.

Also, an interrupted flow adjustment of +3 dbA has been specified for observer points near a traffic signal or stop sign. Users of the prediction tables are directed to add 3 dbA to the L_{10} values found in the tables whenever the site in question is within 300 ft of a controlled intersection.

Levels at an observer point receiving noise from two or more different roadway sources, such as a divided city street or in a quadrant of an intersection, can be determined by "db addition" of the levels from each individual source as discussed in the Appendix.

TABLE 1

L_{10} dbA NOISE LEVELS FOR A TWO-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 500 vehicles per hour	30	69.2	72.4	75.0	77.1	73.0	73.6	75.5	77.3	76.2	75.4	76.2	77.6	81.5	79.4	78.6	78.9	30
	40	67.0	69.9	72.4	74.5	71.1	71.4	73.0	74.7	74.4	73.3	73.9	75.1	79.8	77.5	76.6	76.7	40
	50	65.2	68.0	70.4	72.5	69.6	69.7	71.0	72.7	73.0	71.8	72.1	73.2	78.4	76.1	75.0	74.9	50
	60	63.8	66.5	68.9	70.8	68.4	68.3	69.6	71.0	71.9	70.5	70.7	71.6	77.1	75.0	73.8	73.5	60
	70	62.6	65.2	67.6	69.4	67.3	67.1	68.3	69.7	70.9	69.4	69.5	70.3	76.0	73.9	72.7	72.3	70
	80	61.5	64.1	66.4	68.3	66.4	66.1	67.2	68.6	70.0	68.4	68.4	69.2	75.0	72.9	71.8	71.3	80
	90	60.6	63.1	65.4	67.2	65.6	65.2	66.2	67.6	69.3	67.6	67.6	68.2	74.2	72.0	70.9	70.5	90
	100	59.8	62.2	64.5	66.3	64.9	64.4	65.4	66.7	68.5	66.9	66.7	67.4	73.3	71.3	70.1	69.7	100
Total Traffic Volume, 1,000 vehicles per hour	30	71.7	73.9	76.4	78.5	77.7	76.8	77.6	79.0	81.6	79.6	79.2	79.9	86.7	84.6	83.1	82.5	30
	40	69.7	71.6	74.1	76.2	76.0	74.8	75.4	76.8	79.9	77.8	77.3	77.8	84.8	82.6	81.3	80.6	40
	50	68.1	69.9	72.2	74.3	74.6	73.3	73.7	75.0	78.4	76.4	75.7	76.1	83.1	81.1	79.7	79.1	50
	60	66.8	68.5	70.7	72.8	73.4	72.0	72.3	73.5	77.1	75.2	74.4	74.7	81.5	79.8	78.4	77.7	60
	70	65.7	67.3	69.5	71.5	72.4	71.0	71.2	72.3	76.0	74.1	73.3	73.5	80.2	78.6	77.3	76.6	70
	80	64.8	66.2	68.4	70.3	71.6	70.0	70.2	71.2	75.1	73.1	72.4	72.5	78.9	77.4	76.3	75.6	80
	90	64.0	65.3	67.4	69.4	70.7	69.2	69.3	70.2	74.2	72.3	71.5	71.6	77.8	76.4	75.4	74.7	90
	100	63.2	64.4	66.6	68.5	69.9	68.5	68.5	69.4	73.4	71.5	70.7	70.8	76.7	75.4	74.4	73.9	100

TABLE 2

L_{10} dbA NOISE LEVELS FOR A TWO-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 1,500 vehicles per hour	30	73.7	75.0	77.2	79.3	80.8	79.2	79.2	80.2	84.8	82.5	81.6	81.6	89.3	87.3	85.9	85.1	30
	40	71.8	72.9	74.9	77.0	79.1	77.3	77.2	78.0	82.8	80.8	79.7	79.6	87.0	85.4	83.9	83.1	40
	50	70.3	71.2	73.2	75.1	77.7	75.9	75.6	76.3	81.3	79.2	78.2	78.0	85.0	83.6	82.4	81.5	50
	60	69.2	69.9	71.8	73.7	76.5	74.7	74.3	75.0	80.0	77.9	76.9	76.7	83.3	82.0	81.0	80.2	60
	70	68.1	68.7	70.5	72.4	75.4	73.6	73.2	73.8	78.7	76.8	75.8	75.6	81.8	80.6	79.6	79.0	70
	80	67.2	67.8	69.5	71.4	74.4	72.7	72.2	72.8	77.6	75.9	74.8	74.6	80.5	79.3	78.5	77.9	80
	90	66.4	67.0	68.6	70.4	73.6	71.8	71.4	71.9	76.5	75.0	73.9	73.7	79.4	78.2	77.4	76.8	90
	100	65.7	66.2	67.8	69.5	72.8	71.1	70.6	71.1	75.6	74.1	73.1	72.8	78.4	77.2	76.4	75.9	100
Total Traffic Volume, 2,000 vehicles per hour	30	75.4	76.0	77.9	79.8	83.1	81.1	80.6	81.2	86.7	84.7	83.4	83.1	90.5	89.1	87.8	86.8	30
	40	73.6	74.0	75.7	77.6	81.3	79.3	78.7	79.1	84.8	82.7	81.6	81.1	88.0	86.8	85.8	84.8	40
	50	72.2	72.4	74.0	75.8	79.8	77.9	77.2	77.5	83.1	81.2	80.0	79.6	85.9	84.9	83.9	83.3	50
	60	71.0	71.2	72.6	74.4	78.5	76.6	75.9	76.2	81.6	79.9	78.7	78.2	84.2	83.2	82.4	81.7	60
	70	70.0	70.1	71.4	73.1	77.4	75.5	74.9	75.0	80.2	78.7	77.6	77.1	82.8	81.7	81.0	80.4	70
	80	69.2	69.2	70.5	72.1	76.4	74.6	73.9	74.0	79.0	77.6	76.6	76.1	81.6	80.4	79.7	79.2	80
	90	68.4	68.3	69.6	71.2	75.4	73.7	73.0	73.2	77.8	76.5	75.7	75.2	80.6	79.3	78.6	78.1	90
	100	67.7	67.6	68.9	70.4	74.5	73.0	72.3	72.4	76.8	75.6	74.8	74.4	79.7	78.3	77.6	77.1	100

TABLE 3

L_{10} dbA NOISE LEVELS FOR A THREE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 500 vehicles per hour	30	68.1	71.1	73.7	75.8	72.0	72.4	74.2	76.0	75.3	74.3	75.0	76.4	80.6	78.4	77.6	77.8	30
	40	66.1	68.9	71.4	73.5	70.3	70.5	72.0	73.7	73.7	72.5	72.9	74.1	79.1	76.8	75.8	75.8	40
	50	64.5	67.2	69.6	71.6	68.9	68.9	70.2	71.8	72.4	71.1	71.3	72.3	77.7	75.5	74.3	74.2	50
	60	63.1	65.8	68.2	70.0	67.8	67.7	68.9	70.3	71.3	69.9	70.0	70.9	76.5	74.4	73.2	72.8	60
	70	62.0	64.6	66.9	68.8	66.8	66.6	67.7	69.1	70.4	68.9	68.9	69.7	75.4	73.3	72.2	71.8	70
	80	61.0	63.5	65.8	67.7	66.0	65.6	66.7	68.0	69.6	68.0	68.0	68.7	74.5	72.4	71.3	70.8	80
	90	60.2	62.6	64.9	66.7	65.2	64.7	65.8	67.1	68.9	67.2	67.1	67.8	73.7	71.6	70.5	70.0	90
	100	59.4	61.8	64.0	65.8	64.5	64.0	64.9	66.2	68.1	66.5	66.3	67.0	72.8	70.9	69.7	69.3	100
Total Traffic Volume, 1,000 vehicles per hour	30	70.6	72.8	75.2	77.3	76.8	75.8	77.6	77.9	80.7	78.7	78.2	78.8	85.7	83.6	82.2	81.6	30
	40	68.8	70.7	73.1	75.2	75.2	74.0	75.4	75.8	79.2	77.0	76.4	76.9	84.0	81.8	80.5	79.8	40
	50	67.4	69.1	71.4	73.5	74.0	72.6	73.7	74.2	77.7	75.7	75.0	75.3	82.2	80.4	79.0	78.4	50
	60	66.2	67.8	70.0	72.1	72.9	71.4	72.3	72.8	76.5	74.6	73.8	74.0	80.8	79.2	77.8	77.1	60
	70	65.2	66.7	68.9	70.8	72.0	70.4	71.2	71.7	75.5	73.6	72.8	73.0	79.5	77.9	76.8	76.0	70
	80	64.3	65.7	67.8	69.8	71.1	69.6	70.2	70.7	74.6	72.7	71.9	72.0	78.3	76.8	75.8	75.1	80
	90	63.6	64.8	66.9	68.9	70.3	68.8	69.3	69.8	73.8	71.8	71.1	71.2	77.2	75.9	74.8	74.2	90
	100	62.9	64.1	66.1	68.0	69.5	68.1	68.5	69.0	72.9	71.1	70.3	70.4	76.2	74.9	74.0	73.5	100

TABLE 4

L_{10} dbA NOISE LEVELS FOR A THREE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 1,500 vehicles per hour	30	72.8	74.0	76.0	78.1	80.0	78.2	78.2	79.1	83.8	81.6	80.6	80.6	88.1	86.3	84.9	84.1	30
	40	71.0	72.0	74.0	76.0	78.4	76.6	76.3	77.2	82.0	80.0	78.9	78.8	86.0	84.4	83.1	82.3	40
	50	69.7	70.5	72.4	74.4	77.0	75.2	74.9	75.6	80.6	78.5	77.5	77.3	84.1	82.7	81.7	80.8	50
	60	68.6	69.2	71.1	73.0	75.9	74.1	73.7	74.3	79.3	77.3	76.3	76.1	82.5	81.3	80.2	79.6	60
	70	67.6	68.2	70.0	71.8	74.8	73.1	72.7	73.2	78.1	76.3	75.2	75.0	81.1	79.9	79.0	78.4	70
	80	66.8	67.3	68.9	70.8	73.9	72.2	71.8	72.3	77.0	75.4	74.3	74.1	79.9	78.7	77.9	77.3	80
	90	66.0	66.5	68.1	69.9	73.1	71.4	71.0	71.4	76.0	74.5	73.5	73.2	78.8	77.6	76.8	76.3	90
	100	65.4	65.8	67.4	69.1	72.4	70.7	70.3	70.6	75.0	73.6	72.8	72.4	77.9	76.7	75.9	75.4	100
Total Traffic Volume, 2,000 vehicles per hour	30	74.5	75.0	76.8	78.7	82.2	80.2	79.6	80.2	85.8	83.7	82.5	82.1	89.3	88.0	86.8	85.8	30
	40	72.9	73.2	74.8	76.7	80.5	78.6	77.9	78.3	84.0	81.9	80.8	80.3	86.9	85.8	84.8	84.0	40
	50	71.6	71.7	73.2	75.0	79.1	77.2	76.5	76.8	82.3	80.5	79.3	78.9	85.0	84.0	83.1	82.4	50
	60	70.5	70.6	72.0	73.7	77.9	76.0	75.3	75.6	80.9	79.3	78.1	77.6	83.4	82.4	81.6	81.0	60
	70	69.6	69.6	70.9	72.5	76.9	75.0	74.3	74.5	79.5	78.1	77.0	76.5	82.1	81.0	80.3	79.8	70
	80	68.7	68.7	70.0	71.6	75.8	74.1	73.4	73.6	78.3	77.0	76.1	75.6	81.0	79.8	79.1	78.6	80
	90	68.0	67.9	69.2	70.8	74.9	73.3	72.6	72.8	77.2	76.0	75.2	74.8	80.1	78.8	78.0	77.6	90
	100	67.4	67.2	68.5	70.0	74.0	72.6	71.9	72.0	76.3	75.1	74.3	74.0	79.2	77.8	77.1	76.6	100

TABLE 5

L_{10} dbA NOISE LEVELS FOR A THREE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 2,500 vehicles per hour	30	76.0	76.0	77.4	79.2	83.8	81.8	80.9	81.1	87.3	85.2	84.0	83.4	89.9	89.0	88.0	87.2	30
	40	74.4	74.2	75.5	77.2	82.1	80.1	79.2	79.3	85.1	83.4	82.2	81.6	87.5	86.7	85.9	85.2	40
	50	73.1	72.8	74.0	75.6	80.7	78.7	77.9	77.8	83.4	81.9	80.7	80.1	85.6	84.8	84.1	83.5	50
	60	72.1	71.7	72.8	74.3	79.4	77.5	76.7	76.6	81.8	80.5	79.5	78.9	84.2	83.2	82.5	82.0	60
	70	71.1	70.7	71.8	73.3	78.2	76.5	75.6	75.6	80.4	79.2	78.3	77.8	83.0	81.8	81.1	80.7	70
	80	70.3	69.9	70.9	72.4	77.1	75.6	74.7	74.7	79.2	78.1	77.3	76.9	81.9	80.7	79.9	79.5	80
	90	69.6	69.1	70.1	71.5	76.1	74.7	73.9	73.9	78.2	77.0	76.3	76.0	80.9	79.7	78.9	78.4	90
	100	68.9	68.4	69.4	70.8	75.1	73.8	73.2	73.2	77.2	76.1	75.4	75.1	80.0	78.8	77.9	77.5	100
Total Traffic Volume, 3,000 vehicles per hour	30	77.3	76.9	78.0	79.7	85.1	83.1	82.1	82.0	88.1	86.4	85.1	84.4	90.3	89.6	88.3	88.2	30
	40	75.7	75.2	76.2	77.7	83.3	81.4	80.4	80.2	86.0	84.5	83.3	82.6	87.9	87.2	86.6	86.0	40
	50	74.4	73.8	74.8	76.2	81.8	79.9	79.0	78.8	84.1	82.8	81.9	81.1	86.2	85.3	84.7	84.2	50
	60	73.4	72.7	73.6	75.0	80.4	78.8	77.8	77.6	82.5	81.4	80.5	80.0	84.8	83.8	83.1	82.7	60
	70	72.5	71.8	72.6	73.9	79.1	77.7	76.7	76.6	81.1	80.0	79.3	78.8	83.6	82.5	81.8	81.4	70
	80	71.6	70.9	71.7	73.0	78.0	76.6	75.8	75.7	79.9	78.8	78.2	77.8	82.5	81.4	80.6	80.2	80
	90	70.8	70.2	70.9	72.2	76.9	75.7	75.0	74.8	78.9	77.8	77.1	76.8	81.5	80.5	79.6	79.1	90
	100	70.1	69.5	70.2	71.4	75.9	74.8	74.2	74.1	78.0	76.8	76.2	76.0	80.6	79.6	78.8	78.2	100

TABLE 6

L_{10} dbA NOISE LEVELS FOR A FOUR-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 1,000 vehicles per hour	30	69.9	71.9	74.3	76.4	76.1	75.0	75.6	77.0	80.0	78.0	77.5	78.0	85.0	82.8	81.5	80.8	30
	40	68.2	70.0	72.3	74.4	74.6	73.3	73.8	75.1	78.5	76.4	75.8	76.2	83.2	81.1	79.8	79.2	40
	50	66.8	68.5	70.7	72.8	73.4	72.0	72.4	73.5	77.1	75.2	74.4	74.7	81.6	79.8	78.4	77.8	50
	60	65.7	67.3	69.4	71.5	72.4	70.9	71.2	72.2	76.0	74.1	73.3	73.5	80.2	78.5	77.3	76.6	60
	70	64.7	66.2	68.3	70.3	71.5	70.0	70.2	71.2	75.0	73.1	72.4	72.5	78.9	77.4	76.3	75.5	70
	80	63.9	65.2	67.4	69.3	70.6	69.2	69.3	70.2	74.2	72.2	71.5	71.6	77.7	76.3	75.3	74.6	80
	90	63.2	64.4	66.5	68.4	69.9	68.4	68.5	69.4	73.3	71.4	70.7	70.8	76.7	75.4	74.4	73.8	90
	100	62.5	63.7	65.7	67.6	69.2	67.8	67.7	68.6	72.5	70.7	69.9	70.0	75.7	74.4	73.5	73.0	100
Total Traffic Volume, 1,500 vehicles per hour	30	72.0	73.1	75.1	77.2	79.3	77.5	77.4	78.3	83.0	80.9	79.8	79.8	87.2	85.6	84.1	83.3	30
	40	70.4	71.3	73.3	75.2	77.8	75.9	75.7	76.4	81.4	79.3	78.3	78.1	85.1	83.6	82.4	81.6	40
	50	69.2	69.9	71.8	73.7	76.5	74.7	74.3	75.0	80.0	78.0	76.9	76.7	83.3	82.0	81.0	80.2	50
	60	68.1	68.7	70.5	72.4	75.4	73.6	73.2	73.8	78.7	76.8	75.8	75.6	81.8	80.6	79.6	79.0	60
	70	67.2	67.8	69.4	71.3	74.4	72.7	72.2	72.7	77.5	75.8	74.8	74.5	80.5	79.3	78.4	77.8	70
	80	66.4	66.9	68.5	70.3	73.5	71.8	71.4	71.8	76.5	74.9	73.9	73.6	79.3	78.1	77.3	76.8	80
	90	65.7	66.2	67.7	69.5	72.8	71.0	70.6	71.0	75.5	74.0	73.1	72.8	78.3	77.1	76.3	75.9	90
	100	65.1	65.5	67.0	68.7	72.0	70.3	69.9	70.3	74.6	73.2	72.4	72.1	77.5	76.2	75.4	75.0	100

TABLE 7

L_{10} dbA NOISE LEVELS FOR A FOUR-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 2,000 vehicles per hour	30	73.8	74.2	75.9	77.8	81.5	79.5	78.9	79.3	85.0	82.9	81.8	81.3	88.3	87.0	86.0	85.0	30
	40	72.3	72.5	74.1	75.9	79.8	77.9	77.2	77.6	83.2	81.2	80.1	79.7	86.0	85.0	84.0	83.3	40
	50	71.0	71.2	72.6	74.4	78.5	76.7	75.9	76.2	81.6	79.9	78.7	78.3	84.2	83.2	82.4	81.7	50
	60	70.0	70.1	71.4	73.1	77.4	75.5	74.8	75.0	80.2	78.7	77.5	77.1	82.7	81.7	80.9	80.4	60
	70	69.1	69.1	70.4	72.0	76.4	74.5	73.9	74.0	78.9	77.5	76.5	76.0	81.6	80.4	79.7	79.2	70
	80	68.4	68.3	69.6	71.2	75.3	73.7	73.0	73.1	77.8	76.5	75.6	75.2	80.5	79.3	78.5	78.1	80
	90	67.7	67.5	68.8	70.4	74.4	72.9	72.2	72.4	76.7	75.5	74.7	74.4	79.6	78.2	77.5	77.0	90
	100	67.0	66.9	68.1	69.7	73.6	72.2	71.5	71.7	75.8	74.6	73.9	73.6	78.8	77.4	76.6	76.2	100
Total Traffic Volume, 2,500 vehicles per hour	30	75.3	75.2	76.6	78.3	83.1	81.1	80.2	80.3	86.3	84.4	83.2	82.6	88.9	88.0	87.1	86.4	30
	40	73.8	73.6	74.8	76.5	81.4	79.5	78.6	78.6	84.3	82.8	81.5	80.9	86.6	85.8	85.1	84.4	40
	50	72.6	72.3	73.4	75.0	80.1	78.1	77.3	77.2	82.6	81.2	80.1	79.5	84.9	84.0	83.3	82.8	50
	60	71.6	71.2	72.3	73.8	78.8	77.0	76.2	76.1	81.1	79.8	78.9	78.4	83.6	82.5	81.8	81.3	60
	70	70.7	70.3	71.3	72.8	77.6	76.0	75.2	75.2	79.8	78.7	77.8	77.4	82.4	81.2	80.5	80.1	70
	80	70.0	69.5	70.5	71.9	76.6	75.1	74.3	74.3	78.7	77.5	76.8	76.4	81.4	80.2	79.4	79.0	80
	90	69.2	68.8	69.7	71.2	75.6	74.2	73.5	73.5	77.6	76.5	75.9	75.5	80.4	79.3	78.4	78.0	90
	100	68.5	68.1	69.0	70.4	74.6	73.4	72.8	72.8	76.7	75.6	75.0	74.7	79.6	78.4	77.5	77.0	100

TABLE 8

L_{10} dbA NOISE LEVELS FOR A FOUR-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 3,000 vehicles per hour	30	76.6	76.1	77.2	78.8	84.3	82.4	81.3	81.2	87.2	85.6	84.3	83.6	89.3	88.5	87.9	87.2	30
	40	75.1	74.6	75.5	76.9	82.7	80.7	79.7	79.6	85.1	83.7	82.6	81.9	87.1	86.3	85.7	85.3	40
	50	73.9	73.3	74.2	75.6	81.1	79.4	78.4	78.2	83.3	82.1	81.2	80.6	85.5	84.6	83.9	83.5	50
	60	72.9	72.2	73.1	74.4	79.7	78.2	77.3	77.1	81.8	80.7	79.9	79.4	84.2	83.1	82.4	82.0	60
	70	72.0	71.3	72.1	73.4	78.5	77.1	76.3	76.1	80.5	79.4	78.7	78.3	83.0	82.0	81.2	80.8	70
	80	71.2	70.5	71.3	72.6	77.4	76.1	75.4	75.2	79.4	78.3	77.6	77.3	82.0	80.9	80.1	79.6	80
	90	70.4	69.8	70.5	71.8	76.4	75.2	74.6	74.4	78.4	77.3	76.6	76.4	81.0	80.0	79.2	78.6	90
	100	69.7	69.2	69.9	71.1	75.4	74.4	73.8	73.8	77.6	76.4	75.8	75.5	80.2	79.2	78.4	77.8	100
Total Traffic Volume 3,500 vehicles per hour	30	77.7	77.0	77.8	79.2	85.4	83.4	82.3	82.0	87.9	86.5	85.3	84.5	89.6	89.0	88.4	87.9	30
	40	76.3	75.4	76.2	77.5	83.5	81.7	80.7	80.4	85.7	84.5	83.6	82.9	87.6	86.7	86.2	85.8	40
	50	75.1	74.2	74.8	76.1	81.9	80.4	79.3	79.1	83.9	82.8	82.0	81.5	86.0	85.0	84.4	84.0	50
	60	74.0	73.1	73.7	75.0	80.5	79.1	78.2	77.9	82.4	81.3	80.6	80.2	84.6	83.7	83.0	82.6	60
	70	73.1	72.2	72.8	74.0	79.2	78.0	77.2	76.9	81.1	80.0	79.4	79.0	83.4	82.5	81.8	81.3	70
	80	72.2	71.5	72.0	73.2	78.0	76.9	76.2	76.1	80.0	78.9	78.3	78.0	82.4	81.5	80.7	80.2	80
	90	71.4	70.7	71.3	72.4	77.0	76.0	75.4	75.3	79.1	77.9	77.3	77.0	81.5	80.6	79.8	79.3	90
	100	70.8	70.0	70.6	71.8	76.1	75.1	74.6	74.5	78.3	77.0	76.4	76.2	80.7	79.7	79.0	78.5	100

TABLE 9

L_{10} dbA NOISE LEVELS FOR A FOUR-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 4,000 vehicles per hour	30	78.7	77.8	78.4	79.6	86.2	84.3	83.2	82.8	88.3	87.1	86.2	85.3	89.9	89.2	88.8	88.4	30
	40	77.3	76.2	76.8	78.0	84.2	82.6	81.5	81.1	86.1	85.1	84.2	83.7	87.9	87.1	86.6	86.2	40
	50	76.0	75.0	75.5	76.6	82.5	81.1	80.2	79.8	84.3	83.3	82.6	82.1	86.3	85.5	84.8	84.5	50
	60	74.9	74.0	74.4	75.5	81.0	79.8	79.0	78.7	82.8	81.8	81.2	80.8	84.9	84.1	83.5	83.0	60
	70	74.0	73.1	73.5	74.5	79.7	78.6	77.9	77.7	81.6	80.6	79.9	79.6	83.8	83.0	82.3	81.8	70
	80	73.1	72.2	72.7	73.7	78.6	77.5	76.9	76.8	80.6	79.4	78.8	78.6	82.7	81.9	81.3	80.8	80
	90	72.4	71.5	71.9	73.0	77.6	76.5	76.0	75.9	79.7	78.4	77.8	77.6	81.8	81.0	80.4	79.9	90
	100	71.7	70.8	71.3	72.3	76.3	75.6	75.2	75.1	78.8	77.6	76.9	76.7	81.0	80.2	79.5	79.0	100
Total Traffic Volume, 4,500 vehicles per hour	30	79.6	78.5	78.9	80.1	86.8	85.1	83.9	83.5	88.6	87.7	86.7	86.0	90.2	89.5	89.1	88.8	30
	40	78.2	77.0	77.3	78.4	84.8	83.3	82.2	81.8	86.4	85.5	84.8	84.2	88.2	87.4	86.9	86.6	40
	50	76.8	75.7	76.0	77.1	83.0	81.7	80.9	80.4	84.6	83.8	83.1	82.7	86.6	85.8	85.2	84.8	50
	60	75.7	74.7	75.0	76.0	81.5	80.4	79.6	79.3	83.2	82.3	81.6	81.3	85.2	84.5	83.9	83.4	60
	70	74.8	73.8	74.1	75.0	80.2	79.2	78.5	78.3	82.1	81.0	80.4	80.1	84.0	83.3	82.7	82.3	70
	80	73.9	72.9	73.3	74.2	79.0	78.0	77.5	77.3	81.0	79.9	79.3	79.0	83.0	82.3	81.7	81.2	80
	90	73.2	72.2	72.5	73.5	78.0	77.0	76.6	76.5	80.1	79.0	78.3	78.1	82.2	81.4	80.8	80.3	90
	100	72.4	71.5	71.8	72.8	77.1	76.1	75.7	75.7	79.3	78.1	77.4	77.2	81.4	80.5	80.0	79.5	100

TABLE 10

L_{10} dbA NOISE LEVELS FOR A FIVE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 1,000 vehicles per hour	30	69.2	71.1	73.5	75.6	75.5	74.4	74.9	76.2	79.5	77.4	76.8	77.3	84.3	82.2	80.8	80.2	30
	40	67.6	69.4	71.6	73.7	74.1	72.8	73.2	74.4	77.9	75.9	75.2	75.5	82.5	80.6	79.2	78.6	40
	50	66.3	68.0	70.2	72.2	73.0	71.6	71.8	73.0	76.6	74.7	73.9	74.2	80.9	79.3	77.9	77.2	50
	60	65.2	66.8	68.9	70.9	72.0	70.5	70.7	71.7	75.6	73.6	72.9	73.0	79.6	78.0	76.8	76.1	60
	70	64.4	65.7	67.9	69.8	71.1	69.6	69.7	70.7	74.6	72.7	72.0	72.0	78.3	76.9	75.8	75.1	70
	80	63.6	64.8	66.9	68.9	70.3	68.8	68.9	69.8	73.8	71.8	71.1	71.2	77.2	75.9	74.8	74.2	80
	90	62.9	64.0	66.1	68.0	69.5	68.1	68.1	69.0	72.9	71.1	70.3	70.4	76.2	74.9	74.0	73.5	90
	100	62.2	63.4	65.3	67.3	68.9	67.4	67.4	68.3	72.1	70.4	69.6	69.7	75.3	74.0	73.2	72.6	100
Total Traffic Volume, 1,500 vehicles per hour	30	71.4	72.4	74.4	76.4	78.7	76.9	76.7	77.5	82.4	80.3	79.2	79.1	86.4	84.9	83.5	82.6	30
	40	69.9	70.7	72.6	74.6	77.2	75.4	75.1	75.8	80.8	78.7	77.7	77.5	84.3	83.0	81.9	81.0	40
	50	68.7	69.3	71.2	73.1	76.0	74.2	73.8	74.4	79.4	77.4	76.4	76.2	82.6	81.4	80.4	79.7	50
	60	67.7	68.3	70.0	71.9	74.9	73.2	72.7	73.3	78.2	76.4	75.3	75.1	81.2	80.0	79.1	78.4	60
	70	66.8	67.4	69.0	70.8	74.0	72.3	71.8	72.3	77.0	75.4	74.3	74.1	79.9	78.7	77.9	77.3	70
	80	66.0	66.5	68.1	69.9	73.1	71.4	71.0	71.4	76.0	74.5	73.5	73.2	78.8	77.6	76.8	76.3	80
	90	65.4	65.8	67.4	69.1	72.4	70.7	70.2	70.6	75.0	73.6	72.7	72.4	77.9	76.6	75.9	75.4	90
	100	64.8	65.1	66.7	68.4	71.6	70.0	69.6	70.0	74.1	72.8	72.0	71.7	77.1	75.8	75.0	74.6	100

TABLE 11

L_{10} dbA NOISE LEVELS FOR A FIVE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 2,000 vehicles per hour	30	73.2	73.5	75.2	77.0	80.8	78.9	78.2	78.6	84.4	82.3	81.1	80.7	87.4	86.3	85.2	84.4	30
	40	71.8	71.9	73.4	75.3	79.3	77.4	76.7	77.0	82.5	80.7	79.5	79.1	85.3	84.2	83.3	82.7	40
	50	70.6	70.7	72.1	73.8	78.0	76.2	75.4	75.7	81.0	79.4	78.2	77.7	83.6	82.5	81.8	81.1	50
	60	69.6	69.6	71.0	72.6	76.9	75.1	74.4	74.6	79.6	78.1	77.1	76.6	82.2	81.1	80.4	79.8	60
	70	68.8	68.7	70.0	71.6	75.9	74.1	73.4	73.6	78.4	77.0	76.2	75.6	81.1	79.9	79.1	78.6	70
	80	68.0	67.9	69.2	70.8	74.9	73.3	72.6	72.8	77.3	76.0	75.2	74.8	80.1	78.8	78.0	77.6	80
	90	67.4	67.2	68.5	70.0	74.0	72.6	71.9	72.0	76.3	75.1	74.3	74.0	79.2	77.8	77.0	76.6	90
	100	66.8	66.6	67.8	69.3	73.2	71.8	71.2	71.3	75.4	74.2	73.5	73.3	78.4	77.0	76.2	75.8	100
Total Traffic Volume, 2,500 vehicles per hour	30	74.7	74.6	75.9	77.6	82.4	80.5	79.6	79.6	85.6	83.8	82.5	82.0	88.0	87.1	86.3	85.6	30
	40	73.3	73.0	74.2	75.8	80.8	78.9	78.1	78.0	83.7	82.1	80.9	80.3	85.9	85.0	84.3	83.7	40
	50	72.2	71.8	72.9	74.4	79.5	77.6	76.8	76.8	82.0	80.6	79.6	79.0	84.3	83.3	82.6	82.2	50
	60	71.2	70.8	71.9	73.3	78.2	76.6	75.7	75.7	80.5	79.3	78.4	77.9	83.0	81.9	81.2	80.8	60
	70	70.4	69.9	70.9	72.4	77.1	75.6	74.8	74.7	79.3	78.1	77.3	76.9	81.9	80.7	80.0	79.5	70
	80	69.6	69.1	70.1	71.6	76.1	74.7	73.9	73.9	78.2	77.0	76.3	76.0	80.9	79.7	78.9	78.5	80
	90	68.9	68.4	69.4	70.8	75.1	73.8	73.2	73.1	77.2	76.0	75.4	75.1	80.0	78.8	77.9	77.5	90
	100	68.2	67.8	68.7	70.1	74.2	73.0	72.5	72.5	76.3	75.2	74.6	74.3	79.2	78.0	77.1	76.6	100

TABLE 12

L_{10} dbA NOISE LEVELS FOR A FIVE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 3,000 vehicles per hour	30	76.0	75.5	76.5	78.1	83.7	81.7	80.7	80.6	86.4	84.9	83.7	83.0	88.4	87.7	87.0	86.5	30
	40	74.6	74.0	75.0	76.4	82.0	80.1	79.2	79.0	84.4	83.1	82.1	81.4	86.5	85.6	85.0	84.5	40
	50	73.5	72.8	73.7	75.1	80.5	78.9	77.9	77.7	82.7	81.5	80.6	80.1	84.9	83.9	83.3	82.8	50
	60	72.5	71.8	72.6	74.0	79.2	77.7	76.8	76.6	81.2	80.1	79.3	78.9	83.6	82.6	81.8	81.4	60
	70	71.6	70.9	71.7	73.0	78.0	76.6	75.9	75.7	80.0	78.9	78.2	77.8	82.5	81.5	80.6	80.2	70
	80	70.8	70.2	70.9	72.2	76.9	75.7	75.0	74.8	78.9	77.8	77.2	76.8	81.5	80.5	79.6	79.2	80
	90	70.1	69.5	70.2	71.4	75.9	74.8	74.2	74.1	78.0	76.8	76.2	76.0	80.6	79.6	78.8	78.2	90
	100	69.4	68.9	69.6	70.8	75.0	74.0	73.4	73.4	77.2	75.9	75.3	75.1	79.8	78.8	78.0	77.4	100
Total Traffic Volume, 3,500 vehicles per hour	30	77.2	76.4	77.2	78.5	84.7	82.7	81.7	81.4	87.0	85.7	84.7	83.9	88.8	88.1	87.6	87.1	30
	40	75.8	74.9	75.6	76.9	82.8	81.2	80.1	79.8	84.9	83.8	82.9	82.3	86.9	86.0	85.5	85.1	40
	50	74.6	73.7	74.4	75.6	81.3	79.8	78.8	78.6	83.2	82.2	81.4	80.9	85.4	84.4	83.8	83.4	50
	60	73.6	72.7	73.3	74.5	79.9	78.6	77.8	77.5	81.8	80.7	80.1	79.6	84.1	83.2	82.4	82.0	60
	70	72.7	71.9	72.4	73.6	78.6	77.5	76.8	76.5	80.6	79.5	78.8	78.5	82.9	82.0	81.3	80.8	70
	80	71.8	71.1	71.6	72.8	77.5	76.5	75.8	75.7	79.6	78.4	77.8	77.5	81.9	81.0	80.3	79.8	80
	90	71.1	70.4	71.0	72.1	76.6	75.5	75.0	74.9	78.7	77.4	76.8	76.6	81.1	80.2	79.4	78.9	90
	100	70.4	69.7	70.3	71.4	75.7	74.6	74.2	74.2	77.9	76.6	76.0	75.8	80.3	79.3	78.6	78.1	100

TABLE 13

L_{10} dbA NOISE LEVELS FOR A FIVE-LANE AT-GRADE ROADWAY

	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
Total Traffic Volume, 4,000 vehicles per hour	30	78.2	77.2	77.8	79.0	85.4	83.6	82.5	82.2	87.4	86.4	85.4	84.7	89.1	88.4	87.9	87.6	30
	40	76.8	75.7	76.2	77.4	83.5	82.0	81.0	80.6	85.3	84.4	83.5	83.0	87.2	86.4	85.9	85.5	40
	50	75.6	74.5	75.0	76.1	81.9	80.5	79.7	79.3	83.6	82.7	82.0	81.5	85.7	84.9	84.2	83.8	50
	60	74.5	73.6	74.0	75.0	80.4	79.3	78.5	78.2	82.2	81.2	80.6	80.3	84.4	83.6	82.9	82.4	60
	70	73.6	72.7	73.1	74.1	79.2	78.1	77.4	77.3	81.1	80.0	79.4	79.1	83.3	82.5	81.8	81.3	70
	80	72.7	71.9	72.3	73.4	78.1	77.0	76.5	76.4	80.1	78.9	78.3	78.1	82.3	81.5	80.8	80.3	80
	90	72.0	71.1	71.6	72.6	77.1	76.1	75.6	75.5	79.2	78.0	77.4	77.2	81.4	80.6	79.9	79.5	90
	100	71.3	70.5	71.0	72.0	76.2	75.2	74.8	74.8	78.4	77.2	76.5	76.3	80.7	79.8	79.1	78.7	100
Total Traffic Volume, 4,500 vehicles per hour	30	79.1	77.9	78.3	79.4	86.0	84.4	83.3	82.8	87.8	86.9	86.0	85.4	89.4	88.6	88.2	87.9	30
	40	77.6	76.4	76.8	77.9	84.0	82.6	81.7	81.2	85.7	84.8	84.1	83.6	87.5	86.8	86.2	85.9	40
	50	76.4	75.3	75.6	76.6	82.3	81.2	80.4	80.0	84.0	83.1	82.5	82.1	85.9	85.2	84.6	84.2	50
	60	75.3	74.3	74.6	75.5	80.9	79.8	79.1	78.9	82.7	81.7	81.1	80.8	84.6	83.9	83.3	82.9	60
	70	74.4	73.4	73.7	74.6	79.6	78.6	78.0	77.8	81.6	80.4	79.9	79.6	83.6	82.8	82.2	81.8	70
	80	73.6	72.5	72.9	73.9	78.5	77.5	77.1	76.9	80.6	79.4	78.8	78.6	82.6	81.8	81.2	80.8	80
	90	72.8	71.8	72.2	73.2	77.6	76.6	76.1	76.1	79.7	78.5	77.8	77.6	81.8	80.9	80.4	79.9	90
	100	72.0	71.2	71.5	72.5	76.8	75.7	75.3	75.3	78.9	77.7	77.0	76.8	81.0	80.2	79.6	79.1	100

TABLE 14

L_{10} dbA NOISE LEVELS FOR A FIVE-LANE AT-GRADE ROADWAY

Total Traffic Volume, 5,000 vehicles per hour	DN, ft	1 Percent Commercial				3 Percent Commercial				5 Percent Commercial				10 Percent Commercial				DN, ft
		25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	25 mph	35 mph	45 mph	55 mph	
	30	79.9	78.5	78.8	79.8	86.5	85.1	83.9	83.4	88.0	87.2	86.5	85.9	89.6	88.9	88.5	88.2	30
	40	78.3	77.1	77.3	78.3	84.4	83.2	82.4	81.8	85.9	85.1	84.5	84.1	87.7	87.0	86.5	86.2	40
	50	77.1	76.0	76.1	77.0	82.7	81.7	80.9	80.6	84.4	83.4	82.9	82.5	86.2	85.5	85.0	84.5	50
	60	76.0	74.9	75.1	76.0	81.3	80.3	79.6	79.4	83.1	82.0	81.5	81.2	84.9	84.2	83.7	83.3	60
	70	75.1	74.0	74.2	75.1	80.0	79.0	78.6	78.3	82.0	80.9	80.3	80.0	83.8	83.1	82.6	82.2	70
	80	74.2	73.2	73.4	74.3	79.0	78.0	77.5	77.4	81.0	79.9	79.2	79.0	82.9	82.1	81.6	81.2	80
	90	73.4	72.4	72.7	73.6	78.1	77.0	76.6	76.6	80.1	79.0	78.3	78.0	82.0	81.2	80.7	80.3	90
	100	72.6	71.8	72.0	73.0	77.2	76.1	75.7	75.8	79.3	78.2	77.5	77.2	81.2	80.5	79.9	79.5	100

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1. Grove, G. H., "Traffic Noise Level Predictor Computer Program," Michigan Department of State Highways and Transportation, Research Laboratory Report R-942, October 1974.

2. Grove, G. H., "Simplified Technique For Traffic Noise Level Estimation," Michigan Department of State Highways and Transportation, Research Laboratory Report R-853R, April 1973.

3. "Highway Capacity Manual, 1965," Highway Research Board, Special Report 87.

APPENDIX

1. Examples for predicting noise levels.
2. Addition of decibel levels.

USING THE TABLES TO PREDICT L_{10} dbA NOISE LEVELS

EXAMPLE 1

Given a two-lane at-grade roadway with a total traffic volume of 1,200 vehicles per hour traveling at 55 mph with 5 percent of the volume being commercial vehicles. The receiver is 50 ft from the center of the near lane. The site is located 175 ft from a controlled intersection.

From Table 1: Q=1000, S=55, T=5 percent, DN=50; L_{10}=76.1 dbA

Table 2: Q=1500, S=55, T=5 percent, DN=50; L_{10}=78.0 dbA

Interpolating for Q1200 gives a factor of 2/5 of the difference between Q1000 and Q1500.

Therefore L_{10} for Q1200=76.1 + 2/5(78.0-76.1)=76.9 dbA

Since the site is located within 300 ft of a controlled intersection, 3 db is added.

$$L_{10} = 80 \text{ dbA}^*$$

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* Due to the method of approximation L_{10} values should be rounded to the nearest decibel.

EXAMPLE 2

Given a four-lane at-grade roadway with a total traffic volume of 3,750 vehicles per hour traveling at 55 mph with 7 percent of the volume being commercial vehicles. The receiver is 90 ft from the center of the near lane.

From Table 8: Q=3500, S=55, T=5 percent, DN=90; L_{10}=77.0 dbA

Table 9: Q=4000, S=55, T=5 percent, DN=90; L_{10}=77.6 dbA

Interpolating for Q3750 gives a factor of 1/2 of the difference between Q3500 and Q4000.

Therefore L_{10} for Q3750 and T=5 percent=77.0+1/2(77.6-77.0)=77.3 dbA.

Table 8: Q=3500, S=55, T=10 percent, DN=90; L_{10}=79.3 dbA

Table 9: Q=4000, S=55, T=10 percent, DN=90; L_{10}=79.9 dbA

Using the interpolation factor for Q3750 as above.
Therefore L_{10} for Q3750 and T=10 percent=79.3+1/2(79.9-79.3)=79.6 dbA.

Interpolation factor for T=7 percent is 2/5.

Therefore L_{10} for Q=3750 and T=7 percent=77.3+2/5(79.6-77.3)=78.2 dbA.

$$L_{10} = 78 \text{ dbA}^*$$

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* Due to the method of approximation L_{10} values should be rounded to the nearest decibel.

ADDITION OF DECIBEL LEVELS

The addition of decibel levels is accomplished by use of the graph as follows:

1. Call the larger level A, the smaller B.
2. Find the numerical difference between A and B, i.e., A - B.
3. Enter the graph on the absicissa (x) at A - B. On the ordinate (y) read C.
4. Add the numerical sum of A plus C to obtain the true combined decibel level, D.

EXAMPLE:

1. A = 83 dbA, B = 77 dbA
2. A - B = 6 dbA
3. C = 1 dbA
4. D = A + C = 83 + 1 = 84 dbA