15–4 COMMUNITY NOISE SOURCES AND CRITERIA

It is not our intent to provide a detailed discussion of the noise characteristics of all community noise sources. Likewise, we have not attempted to provide a comprehensive list of noise criteria. Rather, we have selected a few examples to provide you with a feeling for the magnitude and range of the numbers.

Transportation Noise

Aircraft Noise. The noise spectra of a wide body fan jet (e.g., the Boeing 747) reveal that sound pressure levels are higher on takeoff than during the approach to land. This is typical of all aircraft. With the notable exception of the turbo jets, smaller aircraft have lower sound pressure levels.

The annoyance criteria for aircraft operations are based on extensive field measurements and opinion surveys. The results of annoyance surveys at nine airports in the United States and Great Britain are summarized in Figure 15–24. L_{dn} is the L_{eq} for a 24-h period with a 10-dB penalty added to the sound levels that occur during the night which is defined as 10 P.M. to 7 A.M.

Highway Vehicle Noise. For most automobiles, exhaust noise constitutes the predominant source for normal operation below about 55 km $\cdot$ h^{-1} (Figure 15–25). Although tire noise is much less of a problem in automobiles than in trucks, it is the dominant noise source at speeds above 80 km $\cdot$ h^{-1}. Although not as noisy as trucks, the total contribution of automobiles to the noise environment is significant because of the very large number in operation.

Diesel trucks are 8–10 dB noisier than gasoline-powered ones. At speeds above 80 km $\cdot$ h^{-1}, tire noise often becomes the dominant noise source on the truck. The "crossbar" tread is the noisiest.

Motorcycle noise is highly dependent on the speed of the vehicle. The primary source of noise is the exhaust. The noise spectra of two-cycle and four-cycle engines are of somewhat different character. The two-cycle engines exhibit more high-frequency spectra energy content.

FIGURE 15–24

Relationship between exposure to aircraft noise and annoyance. (*Source:* K. D. Kryter, G. Jansen, D. Parker, et al., *Non-Auditory Effects of Noise.* Report of WG-63, National Academy of Science–National Research Council Committee on Hearing, Bioacoustics, and Biomechanics, Washington, DC: U.S. GPO, 1971.)

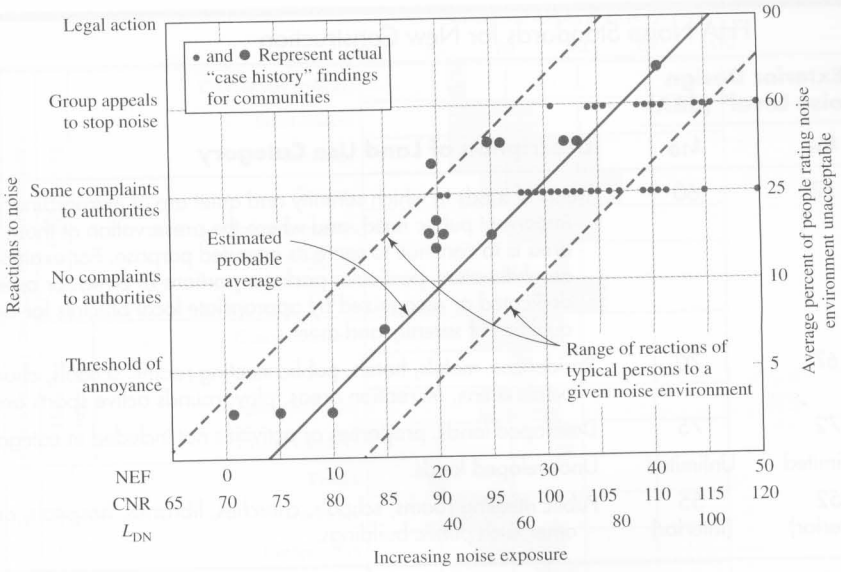
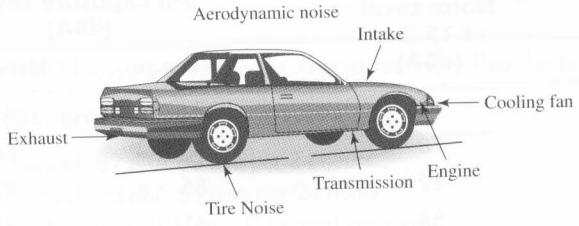
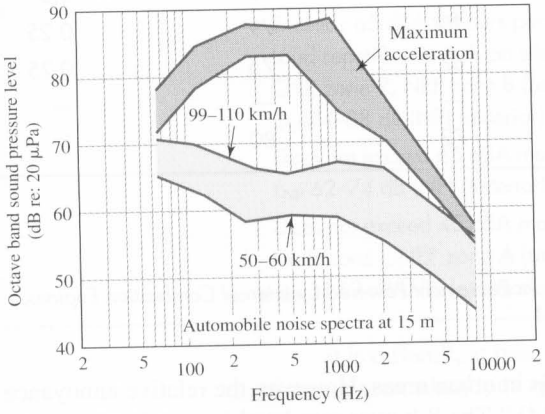
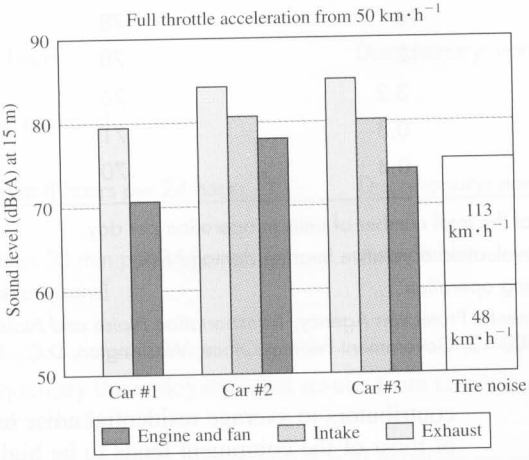


FIGURE 15–25

Typical noise spectra of automobiles. (*Source:* U.S. Environmental Protection Agency, *Transportation Noise*, Washington, DC: U.S. Government Printing Office, 1971.)







The U.S. Federal Highway Administration has developed the traffic noise standards shown in Table 15–3. The levels are above those that would be expected to yield no problems but are below those of many existing highways.

Other Internal Combustion Engines

Because of their ubiquitous nature and the general interest they stimulate, the combustion engines listed in Table 15–4 are included at this point. "In general, these devices are not significant

TABLE 15–3 FHA Noise Standards for New Construction

Land Use Category	Exterior Design Noise Level[a] (dBA)		Description of Land Use Category
	L_{eq}	L_{10}	
A	57	60	Tracts of lands in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. For example, such areas could include amphitheaters, particular parks or portions of parks, or open spaces, which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67	70	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds active sports areas, and parks.
C	72	75	Developed lands, properties or activities not included in categories A and B.
D	Unlimited	Unlimited	Undeveloped lands.
E	52 (interior)	55 (interior)	Public meeting rooms, schools, churches, libraries, hospitals, and other such public buildings.

[a]Either L_{eq} or L_{10} may be used, but not both. The levels are to be based on a 1-h sample.

TABLE 15–4 Summary of Noise Characteristics of Internal Combustion Engines

Source	A-Weighted Noise Energy[a] ($kW \cdot h \cdot day^{-1}$)	Typical A-Weighted Noise Level at 15.2 m (dBA)	8-h Exposure Level[b] (dBA)		Typical Exposure Time (h)
			Average	Maximum	
Lawn mowers	63	74	74	82	1.5
Garden tractors	63	78	N/A	N/A	N/A
Chain saws	40	82	85	95	1
Snow blowers	40	84	61	75	1
Lawn edgers	16	78	67	75	0.5
Model aircraft	12	78	70[c]	79[c]	0.25
Leaf blowers	3.2	76	67	75	0.25
Generators	0.8	71	—	—	—
Tillers	0.4	70	72	80	1

[a]Based on estimates of the total number of units in operation per day.

[b]Equivalent level for evaluation of relative hearing damage risk.

[c]During engine trimming operation.

Source: U.S. Environmental Protection Agency, *Transportation Noise and Noise from Equipment Powered by Internal Combustion Engines*, EPA Pub. No. NTID 300.13, Government Printing Office, Washington, D.C., 1971.

contributors to average residential noise levels in urban areas. However, the relative annoyance of most of the equipment tends to be high [14]." The 8-h exposure level is in reference to the equipment operator.

Construction Noise

The range of sound levels found for 19 common types of construction equipment is shown in Figure 15–26. Although the sample was limited, the data appear to be reasonably accurate. The noise produced by the interaction of the machine and the material on which it acts often contributes greatly to the sound level.

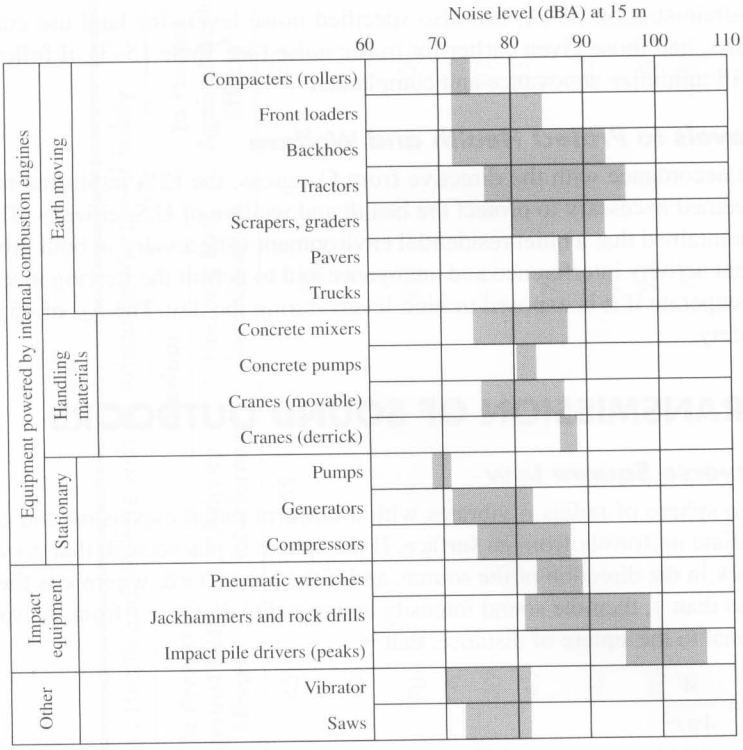


FIGURE 15–26

Range of sound levels from various types of construction equipment (based on limited available data samples). (*Source: Report to the President and Congress on Noise*, 1972.)

TABLE 15–5 HUD Noise Assessment Criteria for New Residential Construction

General External Exposures	Assessment
Exceeds 89 dBA 60 min per 24 hours Exceeds 75 dBA 8 hours per 24 hours CNR zone 3, NEF zone C (airport environs) $L_{NP} > 88$ dB (NP) (exterior)	Unacceptable
Exceeds 65 dBA 8 hours per 24 hours Loud repetitive sounds on site CNR zone 2, NEF zone B (airport environs) L_{NP} 74–88 dB (NP) (exterior)	Discretionary: normally unacceptable
Does not exceed 65 dBA more than 8 hours per 24 hours L_{NP} 62–74 dB (NP) (exterior)	Discretionary: normally acceptable
Does not exceed 45 dBA more than 30 min per 24 hours CNR zone I, NEF zone A (airport environs) $L_{NP} < 62$ dB (NP) (exterior)	Acceptable

It is difficult, at best, to quantify the annoyance that results from construction noise. The following generalizations appear to hold.

1. Single-house construction in suburban communities will generate sporadic complaints if the boundary line 8-h L_{eq} exceeds 70 dBA.
2. Major excavation and construction in a normal suburban community will generate threats of legal action if the boundary line 8-h L_{eq} exceeds 85 dBA.

Zoning and Siting Considerations

The U.S. Department of Housing and Urban Development (HUD) set out guideline criteria for noise exposure at residential sites for new construction (Table 15–5). The Federal Aviation

Administration (FAA) has also specified noise levels for land use compatibility. These guidelines, and those given earlier for traffic noise (see Table 15–3), if followed in zoning and siting, will minimize annoyance and complaints.

Levels to Protect Health and Welfare

In accordance with the directive from Congress, the EPA published noise criteria levels that it deemed necessary to protect the health and welfare of U.S. citizens (Table 15–6) [15]. The EPA maintained that a quiet residential environment is necessary in both urban and rural areas to prevent activity interference and annoyance and to permit the hearing mechanism an opportunity to recuperate if it is exposed to high levels during the day. The L_{dn} of 45 provides a fair margin of safety.