Day–Night and Day–Evening–Night Noise Levels (Ldn, Lden)

Day–night average sound level Ldn from day and night equivalent levels with the 10 dB night penalty, and Lden with an evening period and 5 dB penalty.

Method: Day–night level (US EPA, 1974) and Lden (EU Directive 2002/49/EC) definitions

Input parameters

Unit system: SI

Parameter	Value	Unit
Day Leq (dBA)	65.000	
Evening Leq (dBA)	60.000	
Night Leq (dBA)	55.000	
Day hours (Ldn)	15.000	
Day hours (Lden)	12.000	
Evening hours (Lden)	4.0000	

Calculated results

Parameter	Value	Unit
Day–night level (dBA)	65.000	
Day–evening–night level (dBA)	65.000	
24-hour Leq without penalties, from the day–evening–night periods (dBA)	62.679	

Notes for this case

- Ldn: day 07–22 (15 h), night 22–07 with +10 dB. Lden (EU): day 12 h, evening 4 h with +5 dB, night 8 h with +10 dB. Indian ambient limits are set separately for day and night Leq.

Formula and method

$$L_{dn} = 10\log_{10}\frac{h_d 10^{L_d/10} + (24-h_d)10^{(L_n+10)/10}}{24}$$

$$L_{den} = 10\log_{10}\frac{h'_d 10^{L_d/10} + h_e 10^{(L_e+5)/10} + (24-h'_d-h_e)10^{(L_n+10)/10}}{24}$$

$$L_{eq,24h} = 10\log_{10}\frac{h'_d 10^{L_d/10} + h_e 10^{L_e/10} + (24-h'_d-h_e)10^{L_n/10}}{24}$$

Variables

L_d	Day Leq (dBA)	-
L_e	Evening Leq (dBA)	-
L_n	Night Leq (dBA)	-
h_d	Day hours (Ldn)	-
h_d'	Day hours (Lden)	-
h_e	Evening hours (Lden)	-
L_{dn}	Day–night level (dBA)	-
L_{den}	Day–evening–night level (dBA)	-
$L_{eq,24h}$	24-hour Leq without penalties, from the day–evening–night periods (dBA)	-

Method and standards

Energy average with penalties.

Assumptions and limits

- Period Leq values measured or predicted. The unpenalised 24-hour Leq uses the three Lden periods, so the evening level counts.

References

- Day–night level (US EPA, 1974) and Lden (EU Directive 2002/49/EC) definitions

Report details

Report reference	FCC-0KPR-PBA3 (the same inputs always give the same reference)
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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/vibration-noise/ldn-day-night-level

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.