Prevention of Indoor and Outdoor noise pollution from building construction and operation

A. A Noise management plan must be submitted to HMDA along with the set of drawings for approval of all construction projects greater than 500 sq. m. in area.

B. Noise from all other construction activities shall be restricted by implementing the following measures onsite:
   1. Contractors should enclose noisy machineries in acoustic enclosures.
   2. Contractors should maintain and service equipment and machineries regularly.
   3. Acoustic screens and enclosures to be put to control noise from construction activity.
   4. All noisy construction work activities must be carried between 7 am to 7 pm (Table 3).
   5. Equipment used for construction work must be the quietest reasonably available.

C. Ensure that the outdoor noise level from Construction activities does not exceed the Central Pollution Control Board-Environmental Standards-Noise (ambient standards).

D. Ensure that the indoor noise levels conforms to the levels prescribed in the National Building Code, 2005, Part VIII-Building Services, Section 4-Acoustics, Sound Insulation and noise control as given in Table 1, through building design, building material selection.

Table 1: Acceptable indoor noise levels for various buildings

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Location</th>
<th>Noise level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auditoria and concert hall</td>
<td>20-25</td>
</tr>
<tr>
<td>2</td>
<td>Radio and TV studios</td>
<td>20-25</td>
</tr>
<tr>
<td>3</td>
<td>Music rooms</td>
<td>25-30</td>
</tr>
<tr>
<td>4</td>
<td>Hospitals and cinema theatres</td>
<td>35-40</td>
</tr>
<tr>
<td>5</td>
<td>Apartments, hotels and homes</td>
<td>35-40</td>
</tr>
<tr>
<td>6</td>
<td>Conference rooms, small offices and libraries</td>
<td>35-40</td>
</tr>
<tr>
<td>7</td>
<td>Court rooms and class rooms</td>
<td>40-45</td>
</tr>
<tr>
<td>8</td>
<td>Large public offices, banks and stores</td>
<td>45-50</td>
</tr>
<tr>
<td>9</td>
<td>Restaurants</td>
<td>50-55</td>
</tr>
</tbody>
</table>

Special points of interest:
1. Follow NBC guidelines while designing for services.
Phase 2 - Environmental Building Initiative for Greater Hyderabad—by TERI and TVPL

**Why is this required?**

Noise is often defined as unwanted sound. It has human and environmental health effects and is elaborated as follows:

**Human health effects**

Noise health effects are both health and behavioural in nature. Noise can damage physiological and psychological health. Noise pollution can cause annoyance and aggression, hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. Furthermore, stress and hypertension are the leading causes to health problems, whereas tinnitus can lead to forgetfulness, severe depression and at times panic attacks. Chronic exposure to noise may cause noise-induced hearing loss. Older males exposed to significant occupational noise demonstrate significantly reduced hearing sensitivity than their non-exposed peers, though differences in hearing sensitivity decrease with time and the two groups are indistinguishable by age 79. High noise levels can also contribute to cardiovascular problems and exposure to moderately high levels during a single eight hour period causes a statistical rise in blood pressure of five to ten points and an increase in stress and vasoconstriction leading to the increased blood pressure noted above as well as to increased incidence of coronary artery disease. Noise pollution is also a well known cause of annoyance.

**Environmental effects**

Noise can have a detrimental effect on animals by causing stress, increasing risk of mortality by changing the delicate balance in predator/prey detection and avoidance, and by interfering with their use of sounds in communication especially in relation to reproduction and in navigation. Acoustic overexposure can lead to temporary or permanent loss of hearing in animals as well. The noise levels in Hyderabad are above the mandated safe norms in most of the areas (Table 2). Noise effects are both health and behavioural in nature and can damage physiological and psychological health. This implies that there is an urgent need to take measures to protect the residents from unwanted sound and its impacts. This guideline therefore attempts to check noise pollution.

<table>
<thead>
<tr>
<th>Category of area</th>
<th>Standard 1993</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>Commercial</td>
<td>65</td>
<td>76</td>
</tr>
<tr>
<td>Residential</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>Silence zones</td>
<td>50</td>
<td>70</td>
</tr>
</tbody>
</table>

**How is it beneficial?**

Noise pollution causes hearing losses over time. It can also cause tinnitus, a ringing sound in the ears. Too much noise often makes one tired and nervous. It can raise blood pressure and add stress that eventually leads to heart disease. This guideline if implemented can ameliorate such conditions to a certain extent.
Benefits of controlling construction noise

Construction noise is one of the major environmental noise issues – not only from building works but also from demolition, remediation, renewal and maintenance. Construction can generate high noise levels that can adversely affect:

- Sleep
- Concentration, and thus learning performance
- Mental and physical health.

Construction can occur close to residences or silence zones and be variable in times of occurrence. These aspects of construction can exacerbate noise levels and their effects. However, Construction noise by its nature is temporary.

Taking adequate measures to control construction noise bring direct benefits to the lives of construction workers and indirectly to the people in close vicinity.

Benefits of indoor noise control

Controlling indoor noise pollution (operational use of a building) is helpful in many ways, depending on the function of the building. For example, productivity of workers in office increases with quieter indoors; school children show improved concentration levels; reduced irritability for people in general.

Some of these benefits in different kinds of buildings are enumerated as under:

**Factories**
Internal - enhances communication; improves transfer of instructions; improves efficiency; reduces errors; reduces sick leave; enhances safety; minimises hearing losses.

External - enhances the corporate image; communicates the company's image as a responsible corporate citizen.

**Offices**
Improves working environment & communication clarity. Speech privacy and confidentiality are thus ensured.

**Market Place**
Quiet, smooth running machines, or industrial processes, provides a commercial edge over competitors, and enables customers to fulfil stringent regulatory conditions.

**Schools**
Improved concentration levels of students
Better performance

**Residences**
Reduction in Stress, annoyance and fatigue

Submittals

1. For all construction projects greater than 500 sq.m, the Noise Management Plan consisting of the following components shall be submitted along with the building permission application
   i) The need for the Construction Work to be done out of hours;
   ii) The types of activity that may be noisy;
   iii) Noise level predictions;
iv) Proposed noise and vibration control measures;
v) Proposed methods of noise and vibration monitoring;

2. Install noise meters at 1 m from the affected building and submit the readings before applying for occupancy certificate. The readings need to be maintained and can be checked in case of any complaint by affected parties. Penalty charge on 2nd offense, warning on 1st offense.

3. Relevant sections of tender document showing that noise pollution prevention measures are mandatory to be adopted by contractors during construction.

4. For commercial buildings (offices, malls, schools, institutions, hotels, etc.), a Noise inspector (designated by the local government) can make surprise checks using a calibrated noise meter and check with the permissible limits.

5. Display of the measures undertaken and communication details of the grievance cell shall be displayed on the premises throughout the construction period until the building is granted the occupancy certificate. This shall be applicable for all retrofitting jobs being undertaken in existing buildings also. Relevant photographs showing the display board should be submitted.

Guidance Notes

Noise: sources and types

Noise is either generated by traffic or it arises from zones and buildings within built-up areas (industry, commerce, offices and public buildings). There are two types of noises, that is, air-borne and structure-borne noise. To reduce the intensity of air-borne noise, sound absorbent materials may be used. A sound absorbent material is one which reduces the intensity of sound reflected from its surface and may be applied to walls, floors, ceilings or used as furnishings to reduce the sound level by absorption. It should however, be kept in mind that the materials selected for sound absorption is consistent with fire safety requirements of the buildings. Sound absorbent materials block the passage of noise through them by virtue of their mass and physical properties. The extent of noise reduction provided by a single homogenous panel is proportional to the logarithm of mass per unit area. Heavy panel provide high values of sound insulation. Porous materials lack the mass required to provide any appreciable sound transmission loss, and readily allow sound at most frequencies to be transmitted through them. Special construction methods and elastic discontinuity in the structure may be used to reduce the transmission of structure-borne noise.

The Central Pollution Control Board-Environmental Standards-Noise (ambient standards) are as given below:

<table>
<thead>
<tr>
<th>Area code</th>
<th>Area category</th>
<th>Limit in dB(A)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daytime</td>
<td>Night time</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Industrial area</td>
<td>75</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Commercial area</td>
<td>65</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Residential area</td>
<td>55</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Silence zone</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Note:

i) Daytime is reckoned in between 6 a.m and 9 p.m.
ii) Night time is reckoned in between 9 p.m. and 6 a.m.
iii) Silence zone is defined as areas up to 100 metres around such premises as hospitals, educational institutions and courts. Such zones are declared by the development authority.
iv) Mixed categories of areas should be declared as ‘one of the four above mentioned categories by the competent authority and the corresponding standards shall apply.
**Noise regulations in India-existing scenario**

*Noise Pollution(Regulation and Control) Rules, 2000*

These rules are the governing rules to regulate noise pollution. There are established noise standards for various areas including silence zones. Though these Rules specified noise levels for industrial, commercial and residential zones, besides establishing “zones of silence”, there has been no systematic national-level monitoring and reporting network for noise pollution. Till now, the CPCB and the state boards have been carrying out sporadic and isolated noise monitoring. For better implementation of the Rules, the Ministry of Environment and Forests is setting up a network for national-level monitoring and reporting of noise pollution.

Based on the pattern of existing air and water networks, the setting up of the National Ambient Noise Monitoring Network and development of infrastructure for noise mapping in the country are expected to be in place within five years. The network will be managed by the Central Pollution Control Board (CPCB), involving the State Pollution Control Boards.

As part of this network, the use of construction machines, musical instruments, bursting of noise-emitting firecrackers and horns beyond permissible limits at nights in residential areas have been made punishable offences, attracting seven years of imprisonment or penalty of Rs 1 lakh. Moreover, Noise Pollution (Regulation and Control) Rules, 2000, have been amended as part of the government’s efforts to make cities less noisy and nights peaceful for residents, in keeping with the Supreme Court directives issued from time to time. According to amendments, new sources of noise, mainly musical instruments, use of construction machinery and fire crackers at nights — between 10 pm and 6 am — have been brought under the ambit of noise regulations.

*Noise Limit for Generator Sets run with Diesel*

1. Noise limit for diesel generator sets (upto 1000 KVA) manufactured on or after the 1st January, 2005.

   The maximum permissible sound pressure level for new diesel generator (DG) sets with rated capacity upto 1000 KVA, manufactured on or after the 1st January, 2005 shall be 75 dB(A) at 1 metre from the enclosure surface.

   The diesel generator sets should be provided with integral acoustic enclosure at the manufacturing stage itself.

   The implementation of noise limit for these diesel generator sets shall be regulated as given in paragraph 3 below.

2. Noise limit for DG sets not covered by paragraph 1.

   Noise limits for diesel generator sets not covered by paragraph 1, shall be as follows:-

   2.1 Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.

   2.2 The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of acoustic enclosure/ acoustic treatment. Under such circumstances the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5 m from the acoustic enclosure/ room, then averaged.

   2.3 The DGset shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).

   2.4 These limits shall be regulated by the State Pollution Control Boards and the State Pollution Control Committees.

For further details, refer [http://cpcb.nic.in/](http://cpcb.nic.in/). This website also gives list of manufacturers who have obtained Conformity of Production Verification for Noise Limits.
Measures to control outdoor and indoor noise

Noise Barriers
Noise barriers are used to control outdoor noise. The noise pollution can be controlled at the source of generation itself by employing techniques like Control in the transmission path, Installation of barriers etc. Barriers between noise source and receiver can minimize the noise levels. For a barrier to be effective, its lateral width should extend beyond the line-of-sight at least as much as the height (Figure 1).

![Figure 1: Noise barrier](Image)

Where, R is the distance between source and barrier. 
D, the lateral width, is the distance between the receiver and barrier.

The light horizontal line shows the line of sight. Barrier should be set in such a way that the height of barrier may break the visual contact of the receiver with the source and the audibility is reduced to standard level, i.e., the levels mentioned in codes given above.

Construction hour timings
Another mechanism to control noise generated due to construction activity is by limiting various construction related activities to designated hours. For instance, Hyderabad could have the following timings for construction related activities (Table 4).

<table>
<thead>
<tr>
<th>Type of works</th>
<th>7am-7pm</th>
<th>7pm-10 pm</th>
<th>10pm-7am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very noisy works, e.g., Piling, blasting, demolition, concreting works, borewell digging</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Moderately Noisy works, e.g., erection, dismantling of framework, tying, fixing of steel bars, operation of cranes, loading/unloading of construction materials, etc.</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Quiet works, e.g., Housekeeping, bricklaying, plastering, painting, etc.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Noise meter
Noise meters are instruments used to measure noise/sound level (dB) inside and outside (Figure 2). They are primarily of three types (Analog, digital and Calibrated) based on their range of measurement, precision, cost, etc.

Indoor noise control measures
Refer to guideline Com Bg. 4

![Figure 2: A Digital sound meter](Image)
**References**

2. CPCB, 2001, Noise Pollution Regulations in India. Central Pollution Control Board, Ministry of Environment and Forests, Govt. of India.