

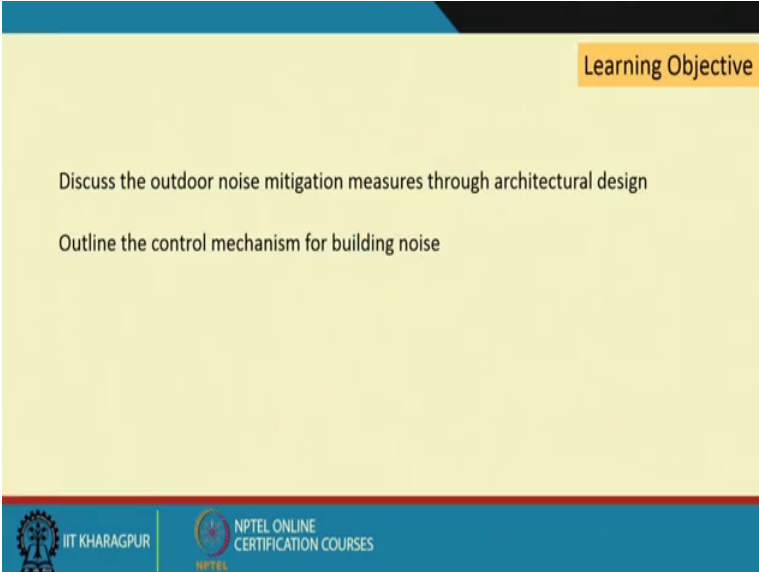
**Architectural Acoustics**  
**Prof. Shankha Pratim Bhattacharya**  
**Department of Architecture and Regional Planning**  
**Indian Institute of Technology, Kharagpur**

**Lecture – 40**  
**Urban Noise Control: Architectural Consideration**

Good morning students, this is the course on Architectural Acoustics in the NPTEL platform and this is the eighth week lecture on the last lecture of the last week. So, the lecture number 40, it is on the Urban Noise Control and the Architectural Consideration. So, if you remember the last 2 lectures, we have given we have discussed the control of urban noise based on the urban planning consideration.

So, in the architectural consideration and in this lecture the objective of the lecture will be through discuss the outdoor noise mitigation through some kind of design strategies by architectural design strategies and also not only the urban noise or maybe the outdoor noise also will do some thought. We will discuss some thoughts on the mechanism of reduction or control of the building noise. There are some part of the building may also create some kind of a noise and that sometimes very bad and we have to actually mitigate from that.

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The slide features a yellow background with a blue header and footer. The header contains the text 'Learning Objective' in a yellow box. The main content area lists two objectives: 'Discuss the outdoor noise mitigation measures through architectural design' and 'Outline the control mechanism for building noise'. The footer includes the logos of IIT Kharagpur and NPTEL Online Certification Courses.

Learning Objective

Discuss the outdoor noise mitigation measures through architectural design

Outline the control mechanism for building noise

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Noise Control at Receiver

Control at the reception point can be achieved by

- Site Planning and Building Placement and Orientation
- Layout Planning and Space Segregation
- Applying Architectural Acoustic Treatments

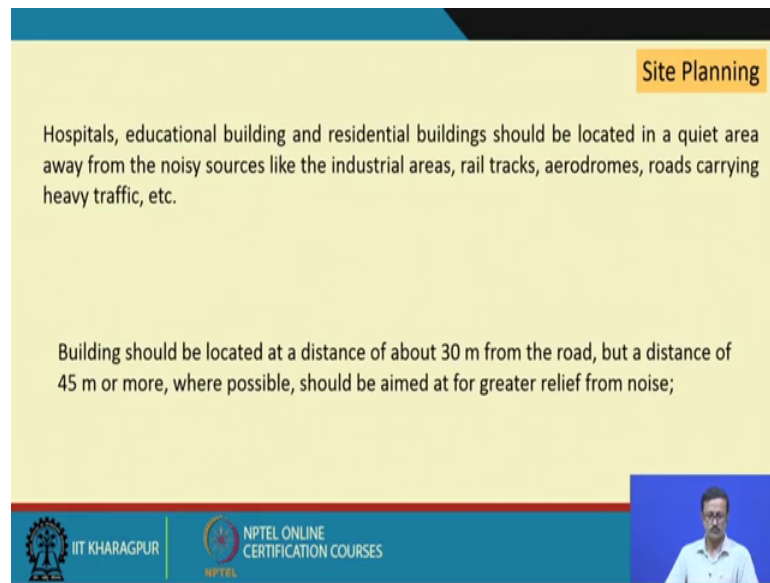
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So, again if you just go to the last 2, 3 lecture back that we are actually prying to mitigate can the noise the urban noise and we thought or we have proposed 3 type of strategies, one cut down from the source. So, noise is actually taken very seriously and from the source point of view people are going to cut it off. We have discussed in the very I think 38th lecture on that. Second one 39 lecture what we have discussed is that, the path between the source and the receiver do some changes and landscaping and barrier and the formation change and try to make the receiver in a sound shadow zone and the you get the benefit and the third one is this. Now we road noise source is taken care of, then it is taken care of by the path and third. Now you taken care of the receiver. You see the how the receiver can be placed receiver can be designed and that can be reduce your noise and all.

So, there are many strategies, but it can be clubbed into 3 strategies, one is site planning and building placement and orientation, this is one of the way the architect actually start thinking thought of the landscaping and the site planning all together and then the building orientations and all and go for the next step; next stage of the development of the building plans and all. Also it is also covers the I mean the some layout planning and the space programming and the space segregation arrangement of the space also take care in the next level after this planning, site planning is done. And finally, people me apply some kind of the acoustical the treatment architectural acoustical treatment that already you have discussed in the lectures transmission loss and all those kind of a think and those treatment can be done inside the building or maybe the wall between the outdoor and the indoor those particular wall which segregate the noise also.

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The slide is titled "Site Planning" in an orange box at the top right. The main text is on a yellow background and reads: "Hospitals, educational building and residential buildings should be located in a quiet area away from the noisy sources like the industrial areas, rail tracks, aerodromes, roads carrying heavy traffic, etc." Below this, it states: "Building should be located at a distance of about 30 m from the road, but a distance of 45 m or more, where possible, should be aimed at for greater relief from noise;". At the bottom left, there are logos for IIT KHARAGPUR and NPTEL ONLINE CERTIFICATION COURSES. At the bottom right, there is a small video inset of a man in a light blue shirt.

In the site planning criteria, the hospitals education buildings and residential buildings are treated under the noise sensitive building and that should be located in the quiet area. So, as an when I got a site, I will try to locate the which areas or the quiet area and I will put those kind of a buildings in that area see the it is better to have a high setback and it is always preferably if there is a very heavy noise source as a railway track or maybe a highway a 45 meter setback is preferred for a noise sensitive zone. I see I am not talking about the 45 meter pushing back all the building, but the noise sensitive buildings which may be a school or which may be a inpatient department of a hospital, sometimes it may be a old age home or those kind of the areas those kind of the areas or maybe a temple which required a kind of a the silent zone area can be thought of at a distance 45 meter from that noise source. Or so, but 30 meter is sometimes it is good enough to have that particular zone as a 30 meter away from that particular road.

So, the first consideration in the site planning is how much setback I may get for those zone, of course in between this 30 meter or 45 meter I may have some other the buildings al also all other part of the habitat also which may not that much noise sensitive.


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**Site Planning**

Rooms should be planned in a manner so that the minimum amount of glazing is placed on the side facing the external noise.

In case of hospitals sensitive areas like wards, consulting and treatment rooms, operating theatres and staff bedrooms need to be placed away from outdoor sources of noise, if possible, with their windows overlooking areas of acoustic shadow.

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Next is the, it has to be planned such a way that the minimum amount of glazing, minimum amount of the meaning of the hazard which is exposed to the noise should be exposed to the noise. In case of the hospital the sensitive area like the treatment room this consulting rooms, then the operation theatre and all those has to be move away from the outdoor noise it is as far as possible has to be overlooked and has to be pushed back and this windows should not be overlooked to that particular, should be overlook to the pa acoustical shadow area, should not be overlook to the bright zone and all those kind of a zone.

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**Site Planning**

To minimize ground reflection, the dwellings should be surrounded by the maximum amount of planting and grassed areas and the minimum amount of hard surfacing.

Where for maintenance reasons a large amount of hard paving is necessary, it should be broken up by areas of planting and grassing. Narrow hard paved courts should be avoided between adjacent tall buildings.

Play areas for older children should be sited as far away from dwellings as possible. Special care should be taken with old peoples' dwellings.

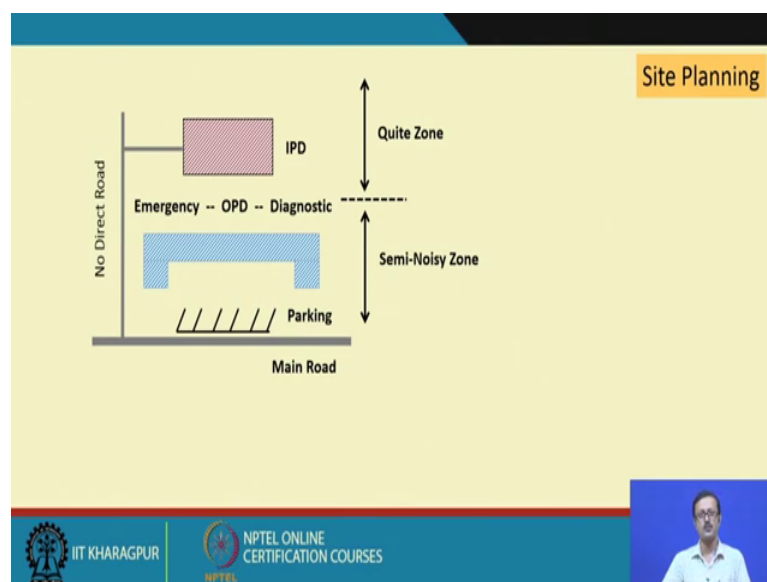
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We also try to minimize the ground reflection effect which I have talked about adduct in the last lecture and it should not be dwellings and all those things which are noise sensitive should not be surrounded by the hard pavement. Because it will give you reflection rather it should be the surrounded by some soft pavement like the planting. And all those and also the narrow pave road between the adjacent tall building has to be also going to be avoided which as the second point of this slide because this tall building adjacent building may create the noise or may not create the noise. And it will between if there is a kind of a motion or maybe a traffic and that will create some kind of the mutual reflection and that can be act as a multistoried known as a multistoried effect also.

Again this is a another important criteria, if you are thought of some old age home or may be some relaxation area for a old age people or maybe a sleeping area for some residential zone which is having a old age people or maybe people sleeping zone sleep not a sleeping zone. But the bedroom facing zone or whatever sides that should be or not to be faced in the play areas of the playground for the older children that is a communication noise can be created in the in the field where there are older people are playing cricket football or whatever and they shout and that particular noise may disturb the old age bedroom areas or the old age areas where there are going to relax.

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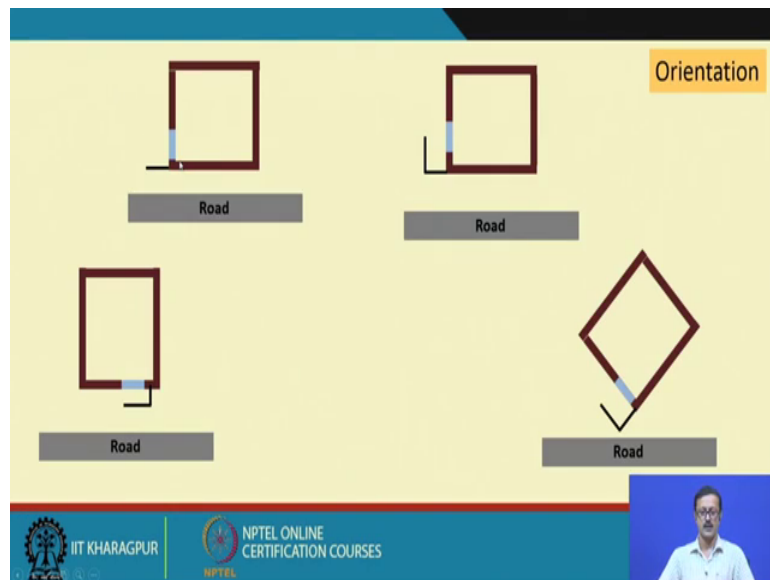


So, this is a small sketch that is going to give you a kind of a understanding that how this 45 meter or 30 meter whatever I talked about can be implemented. So, a main road

which is a noise source can we first shield by maybe a boundary wall and then the rows of trees and then maybe there is a parking which gives you a kind of a first set back and the barrier, then I can provide some semi noisy zone which is emergency then the OPD outpatient department; then the diagnostics this 3 and the IPD this 4 are the 4 coordinate of a hospital and hospital though out of this 4 coordinate this emergency OPD diagnostics or the relatively noisy zone where people actually go talk wait, then listen to somebody are talking with waiting for something.

So, this is a kind and IPD the inpatient department is the patient which is under treatment and there in the ward and operation theatre and all these areas and the ICU where all are actually very close to this all the sub areas of this IPD and that can be directed to the lower or the other part or the deeper part of the site and the quiet zone can be thought of and this quiet why it is quite zone because it is directly shield by this building and it is no direct entry, if there is a entry direct entry like from this particular main then this particular with the building can be exposed. So, there is no direct road there is a road and there is a sub road or the link road so that also helps.

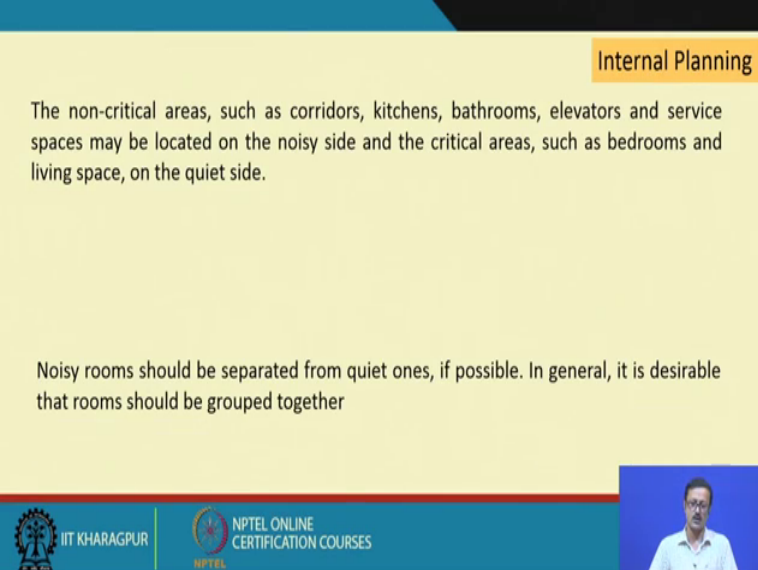
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Next is some orientation issues are there, suppose there are some road and there is open window sorry window is there exposed window so and this window actually create some kind of a lick sound lick. So, they are maybe this particular protection can be made a kind of a protection can be made. So, I have drawn 4 type of orientation with respect to

the road and with respect to the road and the window. So, wall this black colour protection wall can be thought of, can be or can be placed to provide the full noise barrier create a full noise barrier, but of course, it is will spoil your elevation sometimes and it mean give you a kind of a, so some kind of the some kind of additive things in your elevations or which may not you may not like or your client may not like. But kind of shielding can be thought of maybe this to are very much not possible, but sometime this can be extension type of a things can be possible and it can be one of the way to handle the bad orientation windows and creating the shielding of this sound.

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**Internal Planning**

The non-critical areas, such as corridors, kitchens, bathrooms, elevators and service spaces may be located on the noisy side and the critical areas, such as bedrooms and living space, on the quiet side.

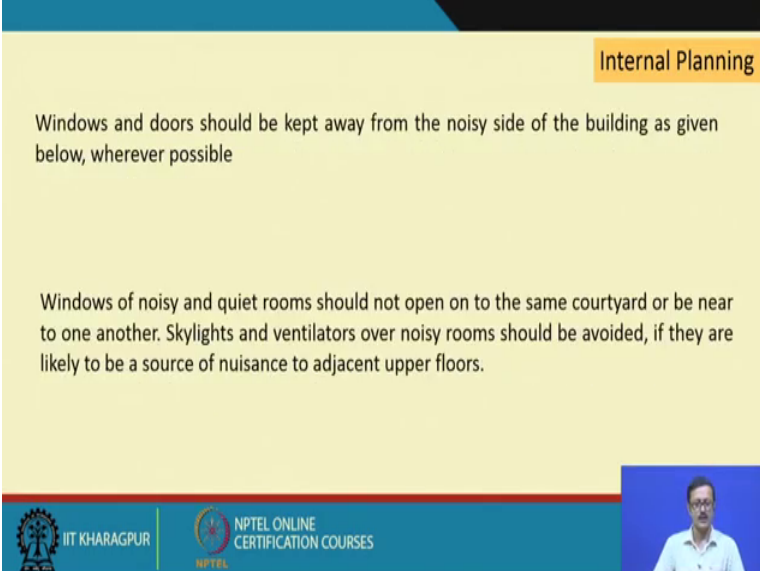
Noisy rooms should be separated from quiet ones, if possible. In general, it is desirable that rooms should be grouped together

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Next is a internal planning in internal planning the critical areas should be segregated from the non critical areas, non critical areas like corridor kitchen, bathroom, which actual are elevator, the lift shape or the staircase block can have the very close to the noise zone or the noise source. And that will create a barrier to the critical zone critical areas of the bedroom and the living space. The noisy rooms should be separated from the quite areas as far as possible. In general, it is desirable to group together.

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Internal Planning

Windows and doors should be kept away from the noisy side of the building as given below, wherever possible

Windows of noisy and quiet rooms should not open on to the same courtyard or be near to one another. Skylights and ventilators over noisy rooms should be avoided, if they are likely to be a source of nuisance to adjacent upper floors.

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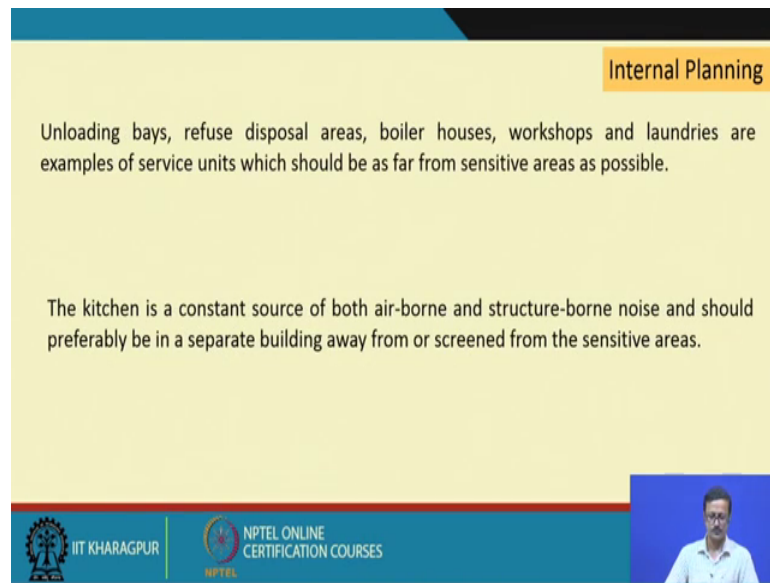
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So, have I think I have a sketch on that in the next slide. The window door should be kept away from the noisy zone side of the building and whatever it possible it should be kept away from that noisy zone, even the noisy courtyard or the noisy areas has to be designed such a way that it should be not directly facing towards the any skylight or any kind of the punchers the wall punctures.

So, sometimes we create some kind of a noisy area maybe some kind of a the play areas or maybe some kind of a traffic area as were people actually go talk with each other or some time some small area where there is a amphitheater or some kind of a informal amphitheater gathering areas also with some time is very maybe very noisy and there is office building which is part of the office building which required some kind of a the sound insulations kind of a thing. So, we have to see the there should not be any skylight or those kind of a things are the window should not be faced to each other.



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Internal Planning

Unloading bays, refuse disposal areas, boiler houses, workshops and laundries are examples of service units which should be as far from sensitive areas as possible.

The kitchen is a constant source of both air-borne and structure-borne noise and should preferably be in a separate building away from or screened from the sensitive areas.

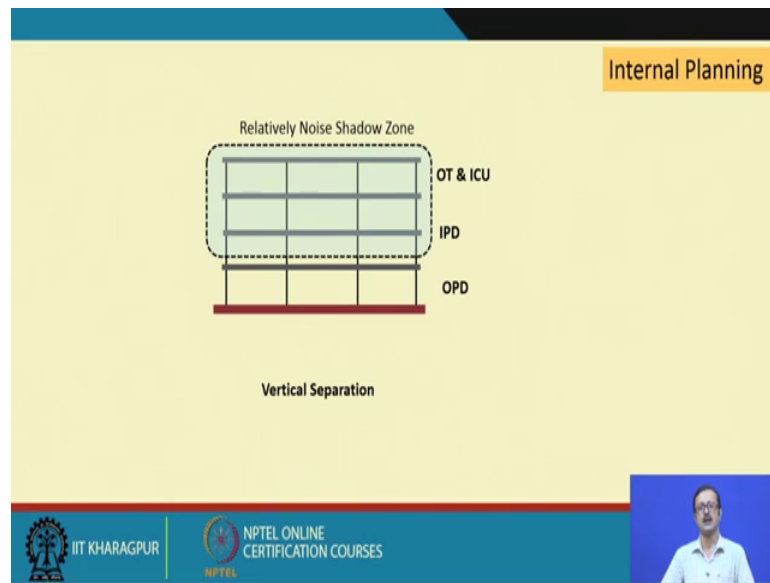
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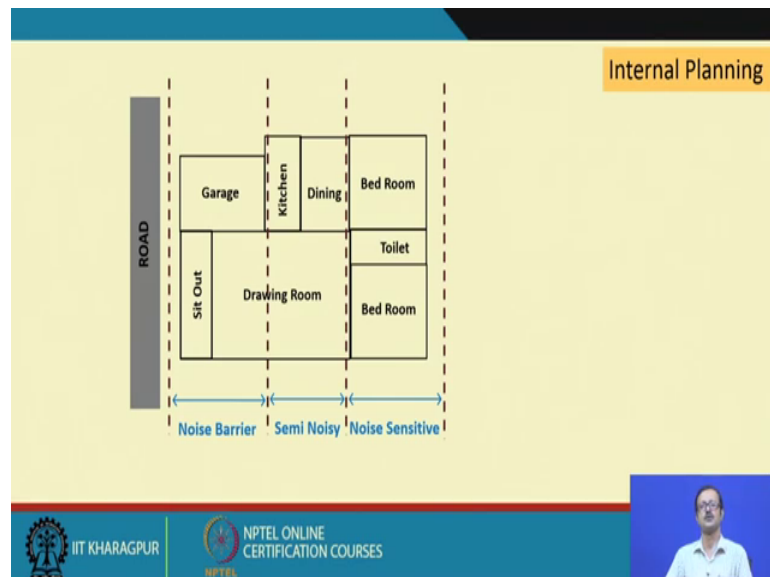
The unloading bays refuse disposal boiler houses workshops etcetera laundries are actually the new sense area where actually there are lot of mechanical and the lot of other equipment will be run throughout the day or a part of the day. And it should be isolated from that from the noise sensitive zone as far as possible. The kitchen is another area where you can have lot of airborne sound and also from the structure borne sound. Because of the vibrations and all which again has to be take in separated away and the very seriously you have to design that particular separation from the sensitive zone to this kitchen at area.

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So, there are some kind of a internal planning can be done in the vertical line also. So, in multistoried hospitals also we can have the OPD up and ICU and this things furthermore up which is very very noise sensitive area and it put the ground floor areas and all under OPD and the emergencies and all.

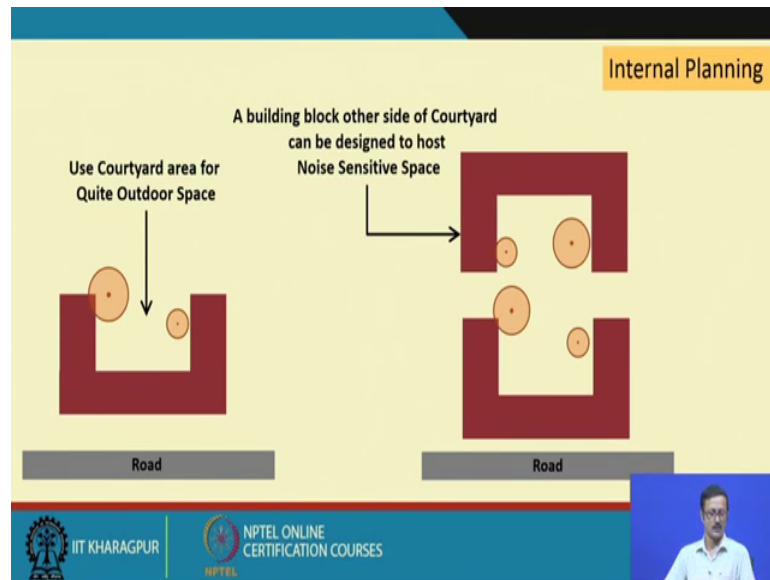
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This is another way I have just discussed you make the noisy zone shielded by the some noisy shielded by some kind of a grouping of some kind of building which is bara garage and the sit out for a bungalows. And then next is the kitchen dining which is in semi

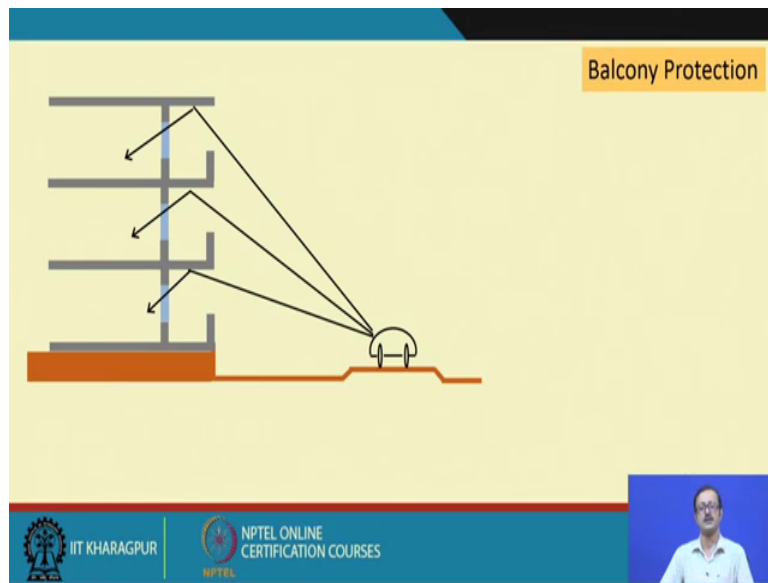
noisy zone and your the study and the bathrooms and sorry study and the bed rooms and all can be put in the further more further deep deeper part of the site on the noise sensitive zone can be created.

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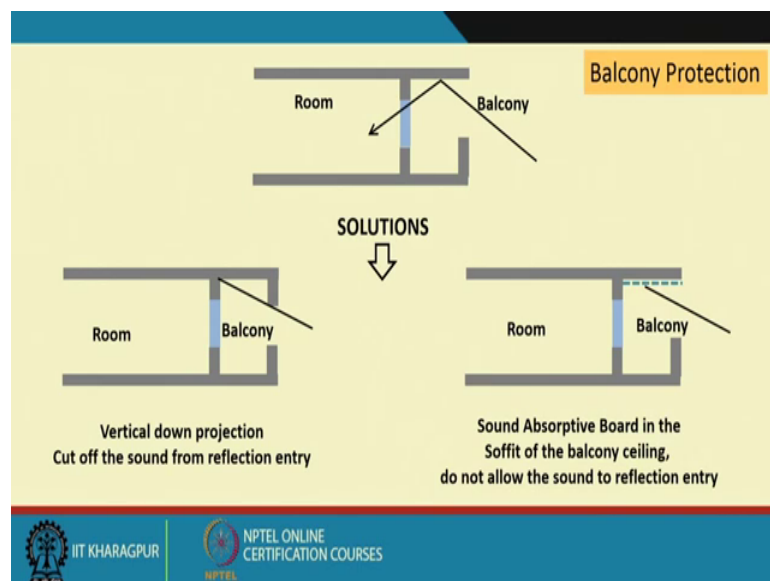
Similarly, if you go for a planning for a courtyard, the this particular u shape inverted u shape courtyard can be used for the any outdoor space which is required some kind of a noise sensitive outdoor space also or we make go for a kind of the both the u shape and create a interesting space in between and courtyard space of course. And that courtyard space and the second block which is actually creating that kind of the interesting courtyard can be a noise sensitive block I have already told you about that hospital the site plan. So, you pushed back and create a noise sensitive zone over there.

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The balcony protections, so I have a told in the last lectures also the diffraction of the sound and all and this particular the balcony which is exposed to the roadside is dangerous, sometimes it actually that will going to allow the noise how suppose there is a the I mean the noise source from the street vehicles. And because of the reflection direct reflection of this hard surface above balcony ceiling it will direct the noise to your bed rooms or maybe your living areas which is actually triggered the noise level inside in your building.

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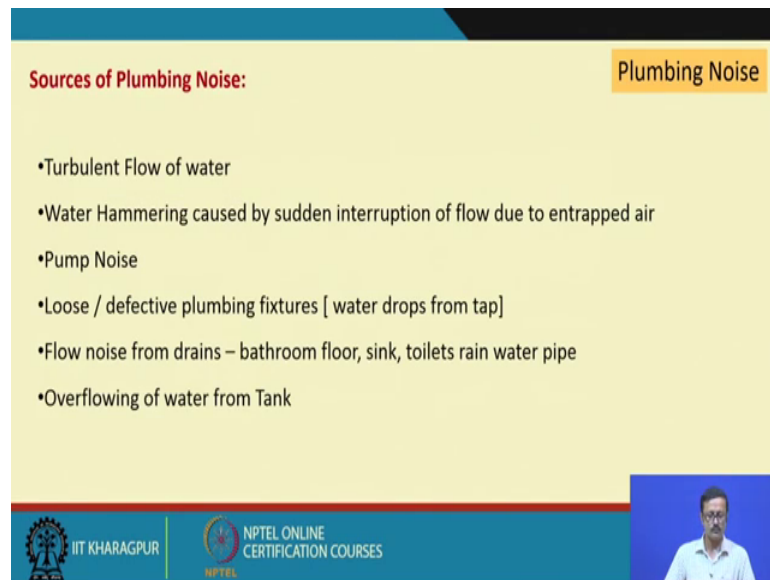
So, we need some kind of a solution, this is the problem the noise comes from the road straight in the balcony goes down to the room the solutions are possibly one is you put the this balcony overhang and make a kind of a projections like the vertical projections and that will cut off that will cut off. So, there will be any sound comes like this side will cut of reflected back and there will be no reflection towards the room that is one and another one is you can put some kind of a absorptive board the in su sound insulation or sound absorptive board that will going to reduce domain kind of reflection.

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Acceptable Indoor Noise levels for Various Buildings as per NBC-2016		Noise Level
Location	Noise Level dB(A)	
Auditoria and concert halls, Radio and TV studios	20-25	
Cinemas, Music rooms	25-30	
Apartments, hotels and homes Hospitals, Conference rooms, small offices and libraries	35-40	
Court rooms and class rooms	40-45	
Large public offices, banks and stores	45-50	
Restaurants	50-55	

So, some of the noise level I have listed down from the NBC 2016, which is desirable or not desirable, but which is the maximum amount of noise level is desirable for a particular area. So, the auditoria, concert hall, radio, TV studios are very noise sensitive me may allow only 20 to 25 dB. So, those are the some list I have given over here. Restaurants are with 50 to 55 because people will talk with each other so that is an end of area where noise is not that much sensitive.

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**Sources of Plumbing Noise:**

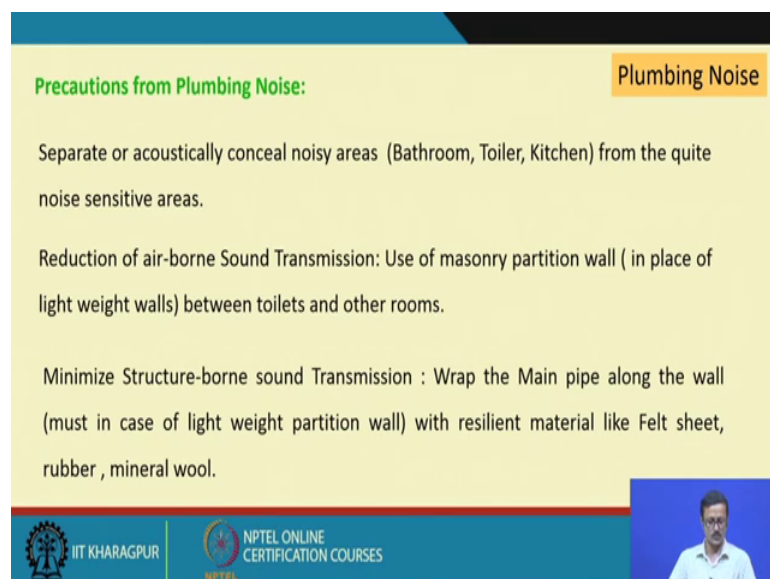
- Turbulent Flow of water
- Water Hammering caused by sudden interruption of flow due to entrapped air
- Pump Noise
- Loose / defective plumbing fixtures [ water drops from tap]
- Flow noise from drains – bathroom floor, sink, toilets rain water pipe
- Overflowing of water from Tank

**Plumbing Noise**

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Then there are some source of noise in the building some plumbing noise because of the plumbing or the flow of water, the water hammer which is sudden interruption of the water by virtue of the air interrupt air in it, pump noise, loose and defective plumbing water dropping from the tap overflowing of the water at the source of the plumbing noise and the precautions of the plumbing noise has to be taken you have to separate out the acoustical noise areas from that and from the noise sensitive zone.

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**Precautions from Plumbing Noise:**

Separate or acoustically conceal noisy areas (Bathroom, Toiler, Kitchen) from the quite noise sensitive areas.

Reduction of air-borne Sound Transmission: Use of masonry partition wall ( in place of light weight walls) between toilets and other rooms.

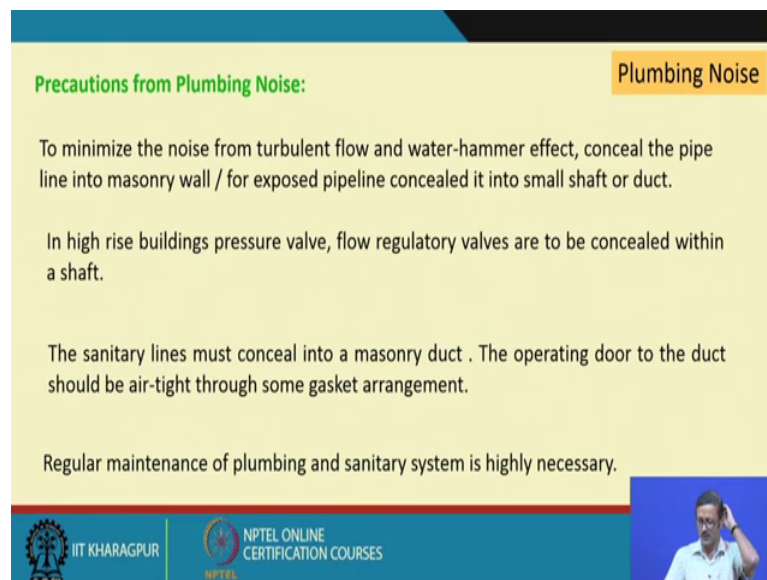
Minimize Structure-borne sound Transmission : Wrap the Main pipe along the wall (must in case of light weight partition wall) with resilient material like Felt sheet, rubber , mineral wool.

**Plumbing Noise**

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The reduction of the airborne sound transmission; yes we have to do for the partition wall, but not the light weight partition wall the heavy partition wall which will reduce the noise. We can maximize the or minimize the structure borne sound transmission also because there are some pump noise and all which is vibrating. We can also again this the high amount of mass surface of the wall mass will create a resilient kind of a thing first resilience because of the transmission point of view and sometimes may put the felt or those kind of a resilient layer mineral wool and all to resilient that particular structure borne sound. And also we can minimize the water hammer pressure by virtue of some kind of concealing the pipes in the in the wall that always we do that will reduce down the noise from the water hammer.

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**Precautions from Plumbing Noise:**

**Plumbing Noise**

To minimize the noise from turbulent flow and water-hammer effect, conceal the pipe line into masonry wall / for exposed pipeline concealed it into small shaft or duct.

In high rise buildings pressure valve, flow regulatory valves are to be concealed within a shaft.

The sanitary lines must conceal into a masonry duct . The operating door to the duct should be air-tight through some gasket arrangement.

Regular maintenance of plumbing and sanitary system is highly necessary.

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We can regulate valve regulatory valve and all has to be also may be concealed in a shaft which actually triggered some kind of a the turbulency and that can create some kind of vibration and noise.

The sanitary lines should be conceal in a duct because sanitary lines because of the flushing of the water in the sanitary that sudden fall of the water from that pipe will create noise and that can be enclosed in a shaft which is a air tight shaft and gasket and all with if there is a door also that can be a gasket and all and regular maintenance is also very necessary.

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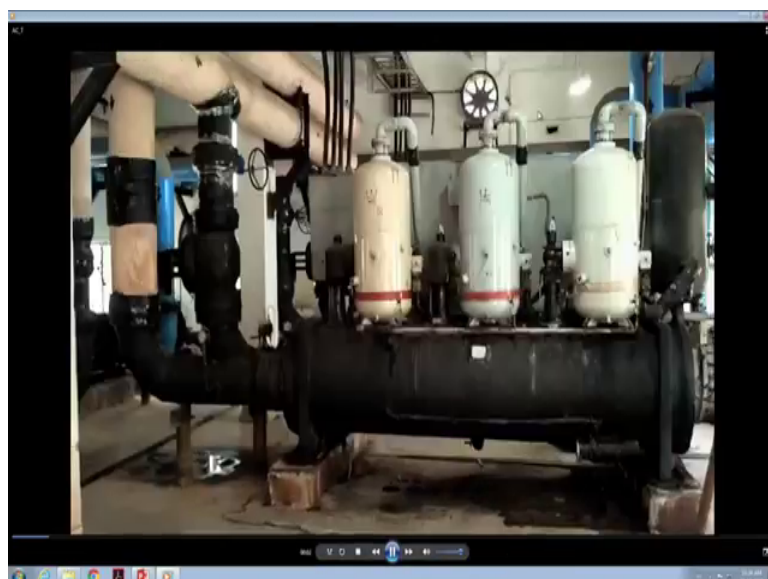
The slide is titled "Sources of Air Conditioning System Noise:" and "Air Conditioning Unit Noise". It lists five sources of noise:

- Noise from Mechanical equipment in Central Unit
- Air flow generate noise in duct
- Fan noise in duct
- Noise from grilles and diffusers
- Air-borne sound transmission from source to receiving room through duct

The slide also features the IIT Kharagpur logo and NPTEL Online Certification Courses logo. A small video inset shows a man speaking.

So, other areas where there is an air conditioning plant that can also create some kind of a noise. The noise from the mechanical equipment and those kind of a thing also generate those kind of a noise, air flow noise can be is comes from the duct. So, those noise if I want to see I have one small video for you and that I will run that is from our one of our plant AC plant in our campus. So, this is the video in that you can see the there are some equipment in the duct this particular machines create vibrations. They are on bench and they are some insulations also and this particular AC plant is a made of by double wall the double wall cavity wall which also reduced noise.

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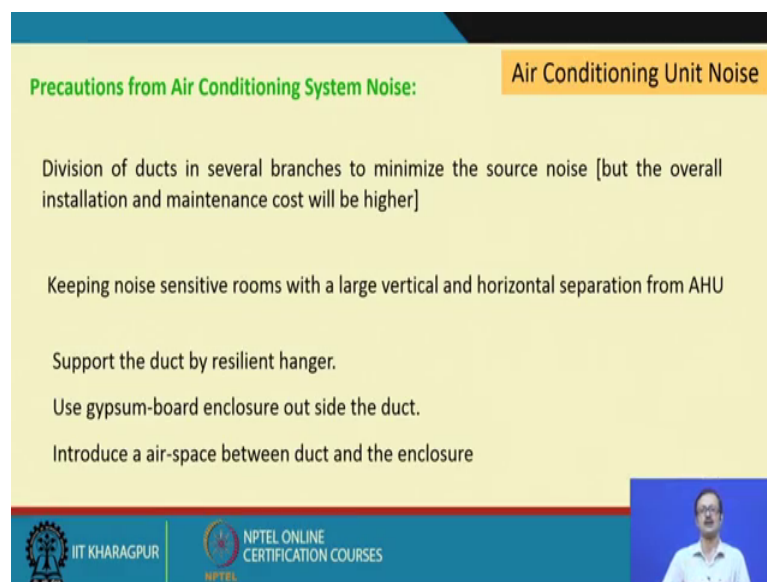




So, this is one of the video old one, the new one is in our Nalanda which is a new one and the it gives you relatively less amount of noise because of it is a new because it is properly maintained its only 1 year old this particular building. So, the amount of noise all the instruments are also very new. So, the amount of noise is little low, but as even its gets older there are some leakages more leakage some maintenance slaps may propagate the more amount of noise or more amount of sound.

So, that is some of the example of this particular air conditioning noise which comes from lot of equipment and the flow from the fan, then duct and the air handling units and all.

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The slide is titled "Air Conditioning Unit Noise" and lists several precautions for minimizing noise from air conditioning systems. The text on the slide is as follows:

- Precautions from Air Conditioning System Noise:
- Division of ducts in several branches to minimize the source noise [but the overall installation and maintenance cost will be higher]
- Keeping noise sensitive rooms with a large vertical and horizontal separation from AHU
- Support the duct by resilient hanger.
- Use gypsum-board enclosure out side the duct.
- Introduce a air-space between duct and the enclosure

The slide also features logos for IIT KHARAGPUR and NPTEL ONLINE CERTIFICATION COURSES, and a small video inset of a speaker in the bottom right corner.

So, how to the take the precautions from those we can have several branch of the pipes or the ducts which take care of the different I mean the complete below amount of flow the air flow of course, that may be a high having maybe high installation or maintenance cost, but that will minimize the noise because if it is handle less amount of air.

Noise sensitive rooms are also very should be kept away from theU, U the air handling unit where in HA floor of a multistoreyed building the air come the threatened air comes over there and the return air mix and all those operations you know. So, there is a fan there is a fan which pump the on circulate the air to that particular flow also. So, that is very noisy that has to be segregated thus duct is should be hang by some resilient adjustable kind of a hanger. So, any flow goes in to that if it is very steep, then it is

vibrate its very noisy, but if it is a resilient layer it can be vibrate and that vibration due to the vibration, the structure borne sound may not propagate use gypsum board enclosure in the duct. Because of the flow of the air inside the duct and the air conditioning duct is circular or sometimes it is rectangular. If it is rectangle, there are some kind of the vertex and all those the turbulence form and it may vibrate. So, it and that maybe a turned, so that can be another kind of a turbulency occur.

So, those noise due to the turbulence has to be the shield or has to be isolated from the outside. So, we can go for some kind of a gyp board duct and if you can introduce some kind of air space between the duct and the enclosure which is good also Of course, those duct or also insulated, because of the thermal point of view because of the loss of ethanol those also gives you very good acoustical barrier or acoustical observer as act as a acoustical observer.

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**Precautions from Air Conditioning System Noise:**

- Provide Gradual reducer from the main duct to branch duct. Do not provide single step reducer.
- Provide acoustical absorptive material layer inside the duct
- Use streamline shaped grilles at discharge end with slow air velocity.
- In highly noise sensitive rooms ducts can be fixed with silencers.

**Air Conditioning Unit Noise**

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Provide gradual reducer is another issue, then instead of suppose you are taking a main duct have some size and from the branch duct will be of different size. So, sudden change of that size will again create a sudden turbulence. So, give some kind of the reducer single step or the double step reducer or sometime you may goes again some (Refer Time: 25:18) some the inside of the this things with the insulated layer, the streamline shaped grilled is also important where the final discharge is made and the

highly noise sensitive room should be kept with the noise silencer are those kind of a attachment.

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So, I have again some photograph from our Kharagpur IIT AC plant where this insulated this particular duct is insulated actually it is there is the castor and duct and there is a insulation and over the insulation this is the aluminum foil has been done.

This second for photograph is reducer see this is the higher diameter pipe. This is a lower diameter pipe. So, there is a reducer it should not be abrupt that suddenly and then if there is a abrupt thing, then it will create a kind of a if these are those noise sorry that turbulence.

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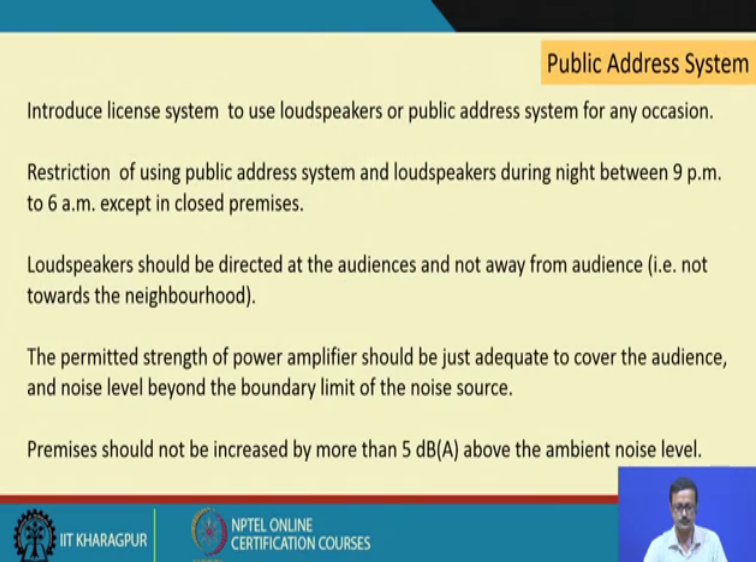
Air Conditioning Unit Noise

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The slide features a photograph of a large, dark-colored industrial air conditioning unit. A large, cylindrical component of the unit is wrapped in a thick, white, porous material, likely foam, which is further covered by a dark, flexible sheet, possibly rubber. The unit is situated in a room with white walls and blue pipes. The slide has a yellow background and a blue header. At the bottom, there are logos for IIT Khargapur and NPTEL Online Certification Courses, along with a small video inset of a man in a white shirt.

This is again the observer or some kind of a foam and then there is a rubber sheet has been wrapped around to that will provide 2 important things one definitely. It will give you a thermal insulation and also it will give you the acoustical insulations also.

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Public Address System

- Introduce license system to use loudspeakers or public address system for any occasion.
- Restriction of using public address system and loudspeakers during night between 9 p.m. to 6 a.m. except in closed premises.
- Loudspeakers should be directed at the audiences and not away from audience (i.e. not towards the neighbourhood).
- The permitted strength of power amplifier should be just adequate to cover the audience, and noise level beyond the boundary limit of the noise source.
- Premises should not be increased by more than 5 dB(A) above the ambient noise level.

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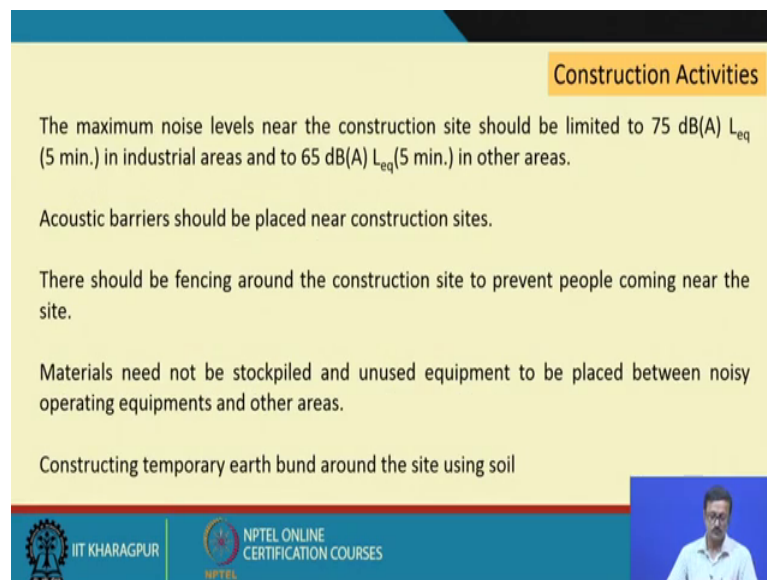
The slide has a yellow background and a blue header. It contains a list of five bullet points regarding public address system regulations. At the bottom, there are logos for IIT Khargapur and NPTEL Online Certification Courses, along with a small video inset of a man in a white shirt.

I have noted down some points from the our central pollution control board, then norms or the public address system that create the noise due to the community noise and all and what are their guidelines. If you just go through a licensing system is proposed because the before you play any public address system or the loudspeaker for any occasion a

licensing system need to be done the restriction of the loudspeaker between the night times is also required and it has been properly monitor. We do not follow always those kinds of guidelines which actually bothering sound and people sometimes they are helpless in that situations. I have notice that in several locations in the in sometimes in the time of some festivals and all the people run the show in still late night and then, it will be disturb for some old people living people and the infant.

The loudspeaker should not be direct directed as to towards should be towards the audience, but not towards the neighborhood or community and the control systems, license system. Control system should also check what is output level of this loudspeaker and the permissible level should not be should not be more than 5 dB a above the ambient, everything is there, everything is there. And as per the norms as per the rules provided by the CPCB what is problem that we sometimes may not monitor regularly very frequently. And people will actually break the law and that create the urban noise scenario that is very poor scenario in that case, we also I mean the community and the people are also very much sensitized to a reach with that.

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**Construction Activities**

The maximum noise levels near the construction site should be limited to 75 dB(A)  $L_{eq}$  (5 min.) in industrial areas and to 65 dB(A)  $L_{eq}$  (5 min.) in other areas.

Acoustic barriers should be placed near construction sites.

There should be fencing around the construction site to prevent people coming near the site.

Materials need not be stockpiled and unused equipment to be placed between noisy operating equipments and other areas.

Constructing temporary earth bund around the site using soil

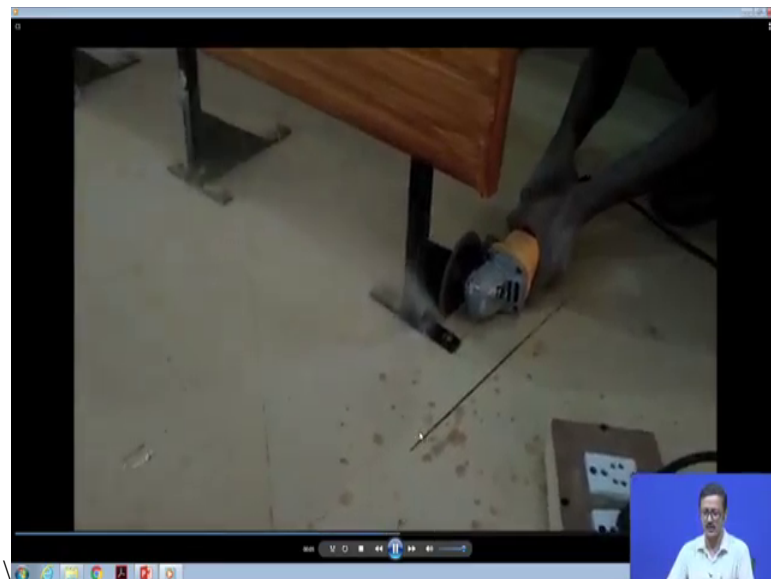
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The construction activity noise it is, I again a very tremendous noise has been sometimes created to this is a limited to 75 dB. If it is industrial area and it is 65 dB of course, for 5 min duration equivalent sound level for other areas is mentioned by CPCB acoustical barrier is should be created. Because if there is a construction, the are the periphery the

surrounded buildings are all come under that particular sound, come under that particular the sound pollution because construction noise are very serious, very very high pitch. There should be fence all around there should be some if there is some kind of a stockpiles that may be placed in that in between the site and the other part of the community through shield the noise construction of temporary earth bund is also sometimes advisable because earth is always available by explanation of the soil.

So, again I have a videos very small video of construction noise of one of the site from one of the site you can actually see how much is the noise form a particular tile cutting machine.

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Tile cutting is one of the issue that create a high pitch and very annoying noise. So, this is 1 only, but there are lot of other activities which actually propagate the construction noise. It is very much essential to take care of that, not only for the people outside, also for the people who are actually working over. They are continuously exposed to that particular sound and of course, it is more than 65 dB or more than 5 minute exposer level also and the burning of crackers is also come under some kind of loss nowadays and the what is the because it is very sensitive issue and sometimes pin code is also intervene that.

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**Burning of Crackers**

Manufacture and sale of crackers having an impulsive noise having an impulsive noise of more than 90 dB at 5 meters distance from the site of bursting should be banned.

Bursting of crackers during night between 9 p.m. and 6 a.m. should be banned.

Bursting of crackers may be permitted only during public festivals.

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So, as per the CPCB once again the it should not be more than 90 dB at a 5 meter distance know a particular cracker will blast, the bursting of the cracker during night is also band and the crackers is permitted only in the public festivals like Diwali and all. But sometimes we also I mean, the enjoy this crackers and all not only Diwali may be in the some other gatherings and some marriage parties and all.

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**Home Work**

Take an example of an old age home located at the edge of a busy urban road. Prepare a schematic layout plan considering outdoor noise mitigation

Prepare a checklist for control air-condition plant noise

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So, that is all for this lecture and that is all for the course on architectural acoustics. I hope you have thoroughly gain some knowledge through this particular course and the

homework for this particular lecture is that taken an example of a old age home located at the edge of a busy urban road and prepare a schematic plan for your this old age home how to mitigate the outdoor noise and prepare a again checklist to control the air condition plant noise for a air condition plant what should be the checklist being architect are being a supervisor level also you can checklist.

So, next is your may be the end semester examination and i hope if you go through the PPTs and the lectures, it will be very helpful for you to score a very good marks in the end semester. And this lecture on architectural acoustics what professor Gupta has taken in that middle portion in the design of auditorium, studios, outdoor radius and all will be helpful for you to design the architectural spaces in future. And being in architect or if you are in a arena of teachers like us it will be helpful for you to explain the future students in architecture and wish you all the best and for the your end semester and also for your future.

(Refer Slide Time: 33:55)

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End of Lecture 40: Urban Noise Control: Architectural Consideration

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Thank you very much.