

4E1210

Roll No. _____

Total No of Pages: **3**

4E1210

B. Tech. IV - Sem. (Main) Exam., May - 2019

PCC Civil Engineering

4CE4 – 07 Building Planning

Time: 2 Hours

Maximum Marks: 80

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. half size sheet

2. NIL

PART – A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

Q.1 Define the term: -

[2]

- (a) Built of area
- (b) Carpet area
- (c) Super built up

Q.2 Write the different methods of drawing the sun chart. What is the utilization of sun chart?

[2]

Q.3 What are the acoustical defects in buildings? Explain in brief.

[2]

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[4620]

Q.4 Write short notes on:-

[2]

- (a) Grouping
- (b) Roominess
- (c) Circulation

Q.5 Write a short essay on Hot arid Zones.

[2]

PART – B

(Analytical/Problem solving questions)

[4×10=40]

Attempt any four questions

Q.1 Discuss the criteria for site selection for a building. How functions of a building affects site selection. <http://www.rtuonline.com> [10]

Q.2 Write short notes on:-

[2.5×4=10]

- (a) Biclimatic chart
- (b) Elegance
- (c) Plinth regulation
- (d) Global climate

Q.3 What are the objectives of building by laws?

[10]

Q.4 Describe briefly the general principles underlying the noise control and various constructional measures adopted for achieving sound insulation in buildings. [10]

Q.5 Which factors should be considered while purchasing a residential building according to the Vastu Shastra? Why we move towards Vastu? [10]

- Q.6 Explain how do you classify doors and windows from their operational point of view. [10]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [2×15=30]

Attempt any two questions

- Q.1 Design and draw the plan of a residential building on a plot of 15m × 25m. Road is on the north side of the plot. [15]
- Q.2 Classify the buildings based on occupancy and types of construction. [15]
- Q.3 Discuss acoustical design of a cinema hall. Support your answer with neat sketch. [15]

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PART A

Ans. 1 Define the term

- (a) **Built up area:** - Built up Area is the carpet area plus the thickness of outer walls and the balcony.
- (b) **Carpet area:** - Carpet Area is the area enclosed within the walls, actual area to lay the carpet. This area does not include the thickness of the inner walls. It is the actual used area of an apartment.
- (c) **Super Built up area:** - Super Built up Area is the built up area plus proportionate area of common areas such as the lobby, lifts shaft, stairs, etc. Sometimes it may also include the common areas such, swimming pool, garden, clubhouse, etc.

Ans. 2 Different methods of drawing the sun chart

1. Graphical plots.
2. Manual trigonometric methods.
3. Computer based trigonometric methods.
4. scale models examined using a sundial device, and natural sunlight or an artificial light source
5. Scale models using a heliodor, a device that mechanically reproduces the geometric movement of the sun.

Utilization of Sun Chart

Sun charts can be used to assess the degree of shading on the building facades due to terrain features, surrounding buildings, facade projections and local landscape features.

Ans. 3 Acoustical defects in building:- There are following general acoustical defects occurs in Building

1. Reverberation
2. Formation of echoes
3. Sound foci
4. Dead spots
5. Insufficient loudness
6. Exterior noises.

Ans 4 Write short notes:-

- (a) **Grouping:** - Grouping consists in arranging various rooms in the layout plan of the building in such a manner that all the rooms are placed in proper co-relation to their functions and in proximity with each other.
- (b) **Roominess:** - The effect produced by deriving the maximum benefit from the minimum dimensions of a room is termed as roominess. Roominess is the accomplishment of economy of space without cramping of the plan.
- (c) **Circulation:** - Circulation means internal through fares or access providing in a room or between rooms on the same floor. Passage, halls and lobbies perform the function of circulation on the same floor.

Ans. 5 Hot and Arid Zones

Hot and arid climatic zones generally occur at this climatic condition generally occurs at latitude between 15 degrees to 30 degrees on both the hemispheres. Maximum daytime summer temperature goes as high as 45 degree centigrade and relative humidity as low up to 20 %.

This type of climate is experienced in areas far from sea coasts and do not receive heavy rainfall. Thus, the humidity is very low. So, the buildings in this climatic zone should be orientated based on solar point of view so that the building receives maximum solar radiation during winter season and minimum radiation during summer season.

PART B

Ans. 1 Criteria for site selection of a Building:-

- The site should be preferably be situated on an elevated and leveled ground. It should not be located in a flood-prone area.
- The soil at site should not be of black cotton soil and should have good value of bearing capacity.
- The water table of ground at the site should not be high.
- The site should not be irregular in shape or have sharp corners. The site should preferably be rectangular or a square in shape.
- The site should be in a developed area having facilities like shopping, educational institutions, recreation, hospital, telegraph, telephone, police station, fire station, transport, and utility service like water supply, drainage system, gas supply, electricity etc.
- The site should be located away from quarries, kilns, industrial plants/buildings emitting smoke, steam, noise or other similar environmental pollutants.
- The site should have unobstructed natural light and air and the building on the proposed site should not get overshadowed from adjacent buildings.
- The site should have clear status of the present ownership of the title of the property.

How function of a Building affects Site selection:-

Factors Affecting Site Selection of Residential Buildings

There are many factors which must be taken in to account while selecting a site for a commercial and residential buildings. Some of these factors are given below. Shape of the Plot Location of the plot Availability of amenities Water Table Sewerage system Geometry of the plot for any kind of construction is very important which can largely effect the appearance of your structure

Factors for Site Selection of Commercial Building

The following are the few factors which must be taken into account while selecting a site for commercial building. Location. Climate of region Availability of raw materials for Cost and time frame Population of the region The value of a commercial building depends upon its location, whether it is located in the center of the region or at the borders or on the main road or away from the main road. For a good commercial building it should be on the main road.

Ans 2 Write short notes:-

- (a) **Bioclimatic Chart:** - A bioclimatic chart is a preliminary analysis tool used during the early planning stages of a building project. In the process known as bioclimatic architecture, an architect uses the bioclimatic chart to design buildings that include the most efficient passive cooling and heating strategies based on the climate and location of a building site, according to the Center for Renewable Energy Sources and Saving.
- (b) **Elegance:** - Elegance is the term used to express the effect produced by the elevation and general layout of the building. Hence for a building to be elegant. It is necessary that its elevation should be evolved that it should be aesthetically pleasing and its layout should fit in well in relation to the site and its environment.

(c) Plinth Regulations:-

Main Building: No plinth or any part of a building or outhouse should be less than 30cm above the determined level of

- i. the central part of the abutting street,
- ii. the footpath of the abutting street,
- iii. the height part of a service lane which determines the drainage of the premises,
- iv. any portion of the ground within 3m distance of such a building, and
- v. undulating or sloping land 1.2 m above the drainage or country water level.

in cases where adequate drainage of the premises is not assured, the plinth should be of a height approved by the authority.

Interior courtyards: Every courtyard should be raised at least 15cm above the level of centre of the nearest street and should be satisfactorily drained. Common courtyards should have independent access. <http://www.rtuonline.com>

Plinth of garages, stables and warehouses: the plinths of such constructions should not be less than 15cm above the level determined in portion (a) above for main building

- (d) **Global Climate:** - The long-term distribution of heat and precipitation on Earth's surface is called global climate. Heat from the sun keeps the Earth's average temperature at about 60°F (16°C), within a range that allows for biological life and maintains the planet's life-sustaining reservoirs of liquid water. Astronomical variations and atmospheric shielding cause incoming solar radiation to fall unevenly on the Earth's surface. Ocean currents and winds further redistribute heat and moisture around the globe, creating climate zones. Climate zones have characteristic annual precipitation, temperature, wind, and ocean current patterns that together

determine local, short-term weather, and affect development of ecologically adapted suites of plants and animals. Changes in the astronomical, oceanographic, atmospheric, and geological factors that determine global climate can lead to global climate change over time. The term climate is reserved for regional patterns of temperature and precipitation that persist for decades and centuries. Local atmospheric, oceanic, and temperature phenomena like storms and droughts that occur over hours, days, or seasons, is generally referred to as weather.

Ans 3. Objectives of Building by Laws.

Building Bye-laws and Regulations:

The rules and regulations which are set forth by the concerned government authorities and updated from time to time are known as "Building Bye-laws and Regulations".

Purposes:

1. It allows disciplined and systematic growth of the buildings and towns and prevent haphazard development. <http://www.rtuonline.com>
2. It protects safety of public against fire, noise, health hazards and structural failures.
3. It provides proper utilization of space.
4. Maximum efficiency in planning can be derived from these byelaws.
5. They provide health, safety and comfort to the people.

In order to provide services, greenery, etc. some spaces are to be left on ground. similarly height/elevation of buildings are regulated for public safety/security reasons, or urban design characteristics. Minimum habitable spaces, conveniences are needed. All these are in short, comprise building byelaws.

Ans. 4 General principles underlying the noise control:-

There are four basic principles of noise control:

1. Sound insulation:

Prevent the transmission of noise by the introduction of a mass barrier. Common materials have high-density properties such as brick, concrete, metal etc.

2. Sound absorption:

A porous material which acts as a 'noise sponge' by converting the sound energy into heat within the material. Common sound absorption materials include open cell foams and fiberglass

3. Vibration damping:

Applicable for large vibrating surfaces. The damping mechanism works by extracting the vibration energy from the thin sheet and dissipating it as heat. A common material is sound deadened steel.

4. Vibration isolation:

Prevents transmission of vibration energy from a source to a receiver by introducing a flexible element or a physical break. Common vibration isolators are springs, rubber mounts, cork etc.

Constructional measures adopted for achieving sound insulation in buildings:-

Noise control inside a building can be achieved by following construction techniques while construction of a building. The construction techniques of walls, windows, doors and floors and selection of appropriate building materials are discussed for better acoustic control in buildings.

Construction of Walls for Noise Control in Buildings: - Wall are an important structural element in all kind of buildings. The methods employed for noise control in buildings are explained in the following <http://www.rtuonline.com>

1. Wall Mass and the Thickness are increased
2. Use of Cavity Partition in Buildings for Noise Control
3. Increase Airspace Width of Walls
4. Increasing the Stud Spacing
5. Usage of Studs in a Staggered Manner
6. Studs and Panels held together by Resilient Materials
7. Panels Used are Dissimilar
8. Sound Absorbing Blankets Used in the Airspace
9. The Cracks and Edges are Sealed

Construction of Windows for Acoustic Control in Buildings

1. Windows can be Closed
2. Windows Size can be Reduced
3. Glass Thickness can be Increased

Construction of Doors for Acoustic Control in Buildings

Construction of Floors for Acoustic Control in Buildings

Noise Control in Buildings by use of Masking

Ans 5 Factors considered while purchasing a residential building according to the Vastu Shastra

Some of the important basic points pertaining to Vastu, which need to be kept in mind while choosing a residential building, are:

In case of a row house or villa, the important parameters to consider are the area of the plot, soil, negative energies, etc.

The north/north-east side should be open and construction should be on the south/south-west side.

Landscaping should be in such a way that the north/north-east quadrant should be low and the south-west quadrant should be higher. <http://www.rtuonline.com>

Try to buy a house, which has an entry from the north-east direction.

The master bedroom should be in the south-west zone of the house.

The kitchen should be in the south-east zone.

The puja room should be in the north-east, east or north of the house.

The north-west zone is ideal for the guest room or drawing room.

The basement in a villa or row house, should be under the entire house or if it is partial, it should be in the north/north-east zone.”

Why we move towards Vastu

Vastu Shastra is the scientific study of directions, which aims at creating equilibrium by balancing the different elements of nature and using them for the benefit of humans. There is a great importance of Vastu shastra in our life, as it paves way for happiness and prosperity to knock our doors

Ans 6 Classification of doors and windows from their operational point of view

Doors are generally classified either on the basis of their working operations or the materials used in their manufacture or fabrication. Doors are also classified according to the basic function being performed by them.

Classification Based on Working Operations

From the operational point of view, the doors are classified as given below :

1. Swinging Doors

2. Folding and Accordion Doors
3. Sliding Doors
4. Revolving Doors
5. Rolling Doors
6. Collapsible Doors

Swinging Doors

In these doors, the shutters are hung from the door frame by means of hinges or butts fixed to one side of the shutter's that they swing on a vertical axis. These doors may be of single swinging, double swinging or double acting type.

Folding or Accordion Doors

These doors are used singly or as folding partitions so that two rooms may be used together as a single room or separately if so desired. They are made of wood or metal and are used for very large openings, these doors are also hinged together. <http://www.rtuonline.com>

Sliding Doors

The sliding doors which slide sideways were extensively used in the past for residences. These door shutters can also slide either upward, and do not cause any obstruction to the movement of the people. The vertical sliding doors are pulled up by cables or chains and are used for large openings in industrial buildings and for freight elevator doors

Revolving Doors

These doors are extensively used where frequent opening and closing of a door is to be avoided due to heavy foot traffic, e.g. fish market, public buildings, banks, hotels, stores, theaters, hospitals etc. Arrangements are made to rotate the door about a central pivot and also to lock the door.

Rolling Doors

Rolling doors are a modification over sliding doors. These doors are generally made of steel or slats of sheet metal which can be easily closed or opened by slightly pulling or pushing the shutter. They do not require much space and are commonly used for garages, show rooms, shops, god owns, factory buildings etc

Collapsible Doors

These doors consist of a mild steel frame which is made up of light steel channel sections. They are provided with rollers at bottom and top to roll on rails when they open or collapse. These doors work without hinges and can be opened or closed by a slight pull or push

From the operational point of view, the windows are classified as given below:

1. Fixed Windows

Fixed windows are fixed to the wall without any closing or opening operation. In general, they are provided to transmit the light into the room. Fully glazed shutters are fixed to the window frame.

2. Sliding Windows

In this case, window shutters are movable in the frame. The movement may be horizontal or vertical based on our requirement. The movement of shutters is done by the provision of roller bearings.

3. Pivoted Windows

In this type of windows, pivots are provided to window frames. Pivot is a shaft which helps to oscillate the shutter. No rebates are required for the frame.

4. Double Hung Windows

Double hung windows consist of pair of shutters attached to one frame. The shutters are arranged one above the other. These two shutters can slide vertically with in the frame.

5. Louvered Windows

Louvered windows are similar to louvered doors which are provided for the ventilation without any outside vision. The louvers may be made of wood, glass or metal.

6. Casement Windows

Casement windows are the widely used and common windows nowadays. The shutters are attached to frame and these can be opened and closed like door shutters. Rebates are provided to the frame to receive the shutters. <http://www.rtuonline.com>

7. Metal Windows

Metal windows, generally mild steel is used for making metal windows. These are very cheap and have more strength. So, now days these are widely using especially for public buildings, private building etc.

8. Sash Windows

Sash window is type of casement window, but in this case panels are fully glazed. It consists top, bottom and intermediate rails. The space between the rails is divided into small panels by mean of small timber members called sash bars or glazing bars.

9. Corner Windows

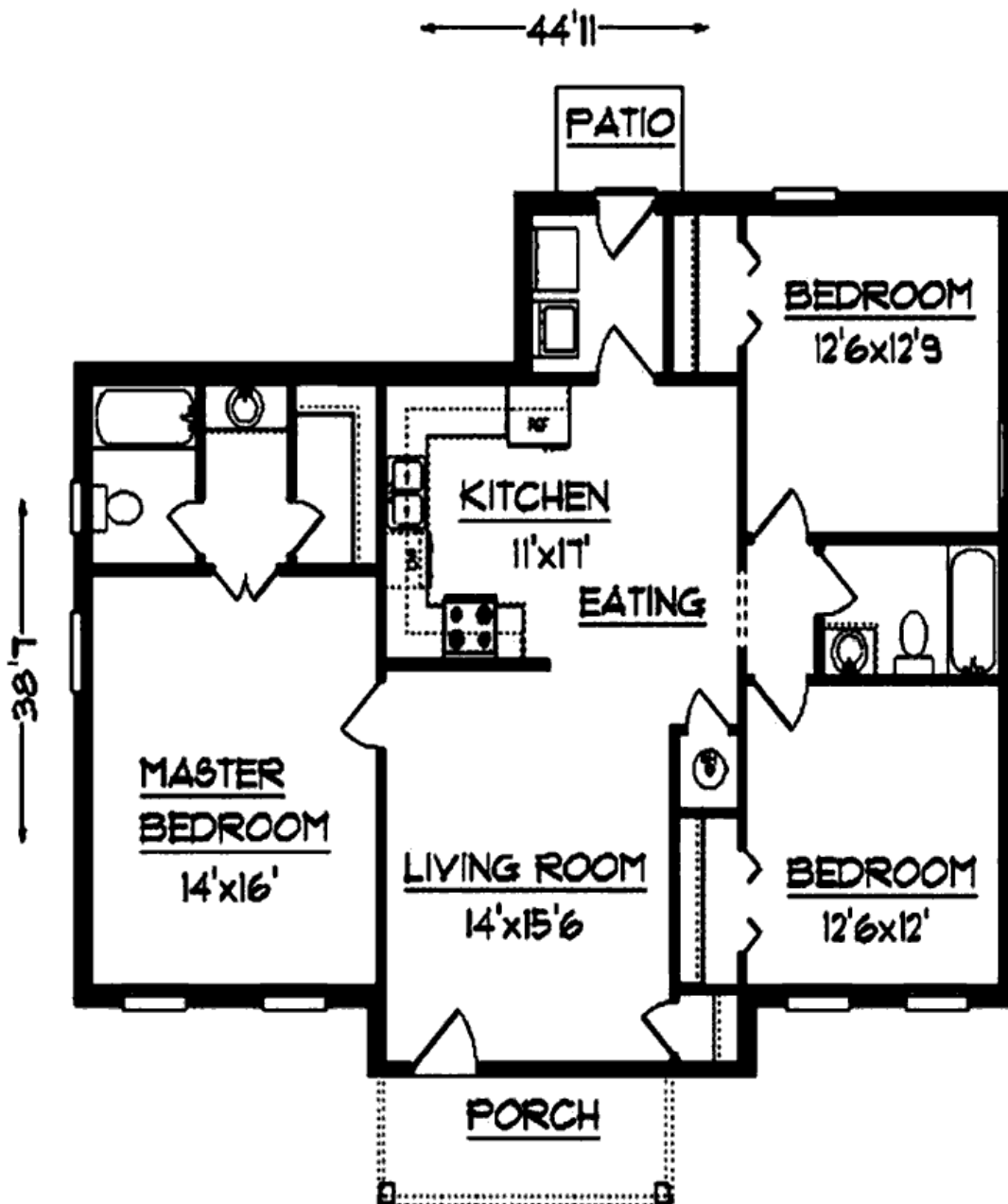
As in the name itself corner windows are provided at the corners of room. That means corner windows has two faces in perpendicular directions. By providing this type of windows, light or air can be entered into room in two different directions.

10. Bay Windows

Bay windows are projected windows from wall which are provided to increase the area of opening, which enables more ventilation and light from outside. The projection of bay windows are of different shapes. It may be triangular or rectangular or polygonal etc. They give beautiful appearance to the structure.

PART C

Ans.1 Design of the plan of a residential building on a plot.



Ans 2 Classify the buildings based on occupancy

A building may be classified based on different parameters like occupancy, load transfer in the structure, materials used, degree of fire resistance, etc. The National Building Code of India Part IV – 2005, classifies the buildings in the following nine groups based on occupancy:

1. Residential
2. Educational
3. Institutional
4. Assembly
5. Business
6. Mercantile
7. Industrial
8. Storage
9. Hazardous

1. RESIDENTIAL BUILDINGS:

These buildings include one or two private dwellings, apartment houses (flats), hotels, dormitories etc.

2. EDUCATIONAL BUILDINGS:

These buildings include any building used for school, college or day care purposes involving assembly for instruction, education or recreation. <http://www.rtuonline.com>

3. INSTITUTIONAL BUILDINGS:

These buildings include any building or part which is used for medical treatment etc. Such as Hospitals, nursing homes, orphanages, sanatoria, jails, prisons, mental hospitals etc.

4. ASSEMBLY BUILDINGS:

These buildings may include any building or part of a building where a group of people gathers for recreation, amusement, social, religious or such types of purposes such as theaters, assembly halls, exhibition halls, restaurants, museum, club rooms, auditoria etc.

5. BUSINESS BUILDINGS:

These shall include any building or part of a building which is used for business transactions, keeping records of accounts, town halls, city halls, court houses etc.

6. MERCANTILE BUILDINGS:

These shall include those buildings which are used for soap, market, stores, wholesale or retail.

7. INDUSTRIAL BUILDINGS:

This types of building mainly used for manufacturing purposes. Here products or materials of all kinds and properties are fabricated, assembled or processed, for example, gas plants, refineries, mills, dairies etc.

8. STORAGE BUILDINGS:

These buildings are generally used for the storage or sheltering of goods, wares, or merchandise like warehouses, cold storages, garages, stables, transit sheds etc.

9. HAZARDOUS BUILDINGS:

These buildings include any building which is used for storage, handling, manufacture or processing of highly combustible explosive materials or products which are liable to burn with extreme rapidly which may produce poisonous fumes, building which is used for storage, handling or manufacturing highly corrosive, toxic, acid or other liquids or chemicals producing flame, fumes explosive etc.

Classify the buildings based on construction

Construction Type identifies the type of materials utilized for constructing a building and classifies the level of combustibility and fire resistance associated with the building elements of a structure <http://www.rtuonline.com>

- Types I and II – All building elements are of non-combustible materials.
- Type III – Exterior walls are of non-combustible materials or fire-retardant wood framing with a 2-hour fire rating or less and interior building elements are of any code permitted materials, combustible or non-combustible.
- Type IV – Heavy Timber (HT) construction. Exterior walls are of non-combustible materials or fire-retardant wood framing with a 2-hour fire rating or less, and interior building elements are of unconcealed solid or laminated wood members that meet minimum dimension requirements required by the code.
- Type V – Structural elements, exterior walls, and interior walls are of any materials permitted by the code, combustible or non-combustible.

Ans 3 Acoustical design of a Cinema hall

- Sound insulation between cinema halls (insulation of walls and partitions, sound insulation of ceilings and floors);
- Sound and vibration insulation of engineering systems: reducing the noise from ventilation and air conditioning systems, the noise from cinema equipment as well as other adjacent service premises (vibration insulation of refrigerators, sound insulation of chillers, vibration protection of backup power sources, etc.);
- Sound insulation between cinema halls and adjoining public spaces (concert and conference halls, catering enterprises, entertainment centers);
- Acoustic environment of the cinema halls, acoustic comfort in the lobby and hallways.

Some Consideration for Acoustical Design

- Recommended reverberation time is 1.0-1.5 seconds (might be higher for some auditoriums).
- Although the seating area will provide absorption, thereby reducing the reverberation time, you will most likely need to add absorptive materials to the other surfaces within the space.
- It is vital to control the reflections from the back wall. If you don't control them, the presentation could reflect off the back wall and "slap back" to the presenter(s). This won't necessarily impact the audience, but could be disastrous and distracting for the people on stage. Because of this, it's usually necessary to treat the back wall with an absorptive material. A concave back wall could compound this problem. If you can't avoid a concave back wall, it's imperative that it be treated with absorptive material.
- Splay or use irregular surfaces on the walls to avoid flutter echoes. Parallel reflective surfaces can allow sound to "ricochet" back and forth between the surfaces. This potentially annoying condition is referred to as standing wave or flutter echo. It is avoided by constructing non-parallel surfaces or by adding absorptive materials to the surface(s). <http://www.rtuonline.com>
- Consider faceting the ceiling to help with sound dispersion.
- Control the reverberation time on the stage. Ideally, the reverberation time in the stage area should be the same as in the house. Since the stage area might have a higher ceiling than the rest of the auditorium, more absorptive materials might be required in this area. Frequently, the back wall of the stage, and possibly one or two of the side walls, is treated with an acoustically absorptive material, typically black in color.
- Remember the space will be less absorptive when only half full, since the audience itself is absorptive. By using absorptive seating areas, the reverberation time will remain more consistent regardless of the audience size.
- Noise from the lobby area can be disruptive. Be sure openings such as doorways are properly sealed. Consider a vestibule door system.

- Persons seated deep under a balcony might experience auditory distortion. To avoid this, the balcony should be no deeper than twice its height. Ideally, the balcony should not be any deeper than its height.
- Even if everything else is controlled perfectly, the space might not be usable if the background noise (e.g. HVAC system) is too loud. To help protect your design, the NC level should not exceed 20 to 35. When specifying NC, specify an actual rating, such as NC 20, rather than a range, such as NC 20-30. Although specifying a lower number will ensure minimal background noise, it might be cost prohibitive to achieve. Be realistic about the amount of acceptable noise and the project's budget when specifying an NC level.
- Beware of potential outdoor noise impacting your space. For example, is your location near a flight path, a railroad or freeway? If so, you might have to pay critical attention to blocking this noise. To do so effectively, you must address not only the STC or isolation quality of the exterior wall, but also for the possibly weaker building elements, such as the windows, doors and HVAC systems.

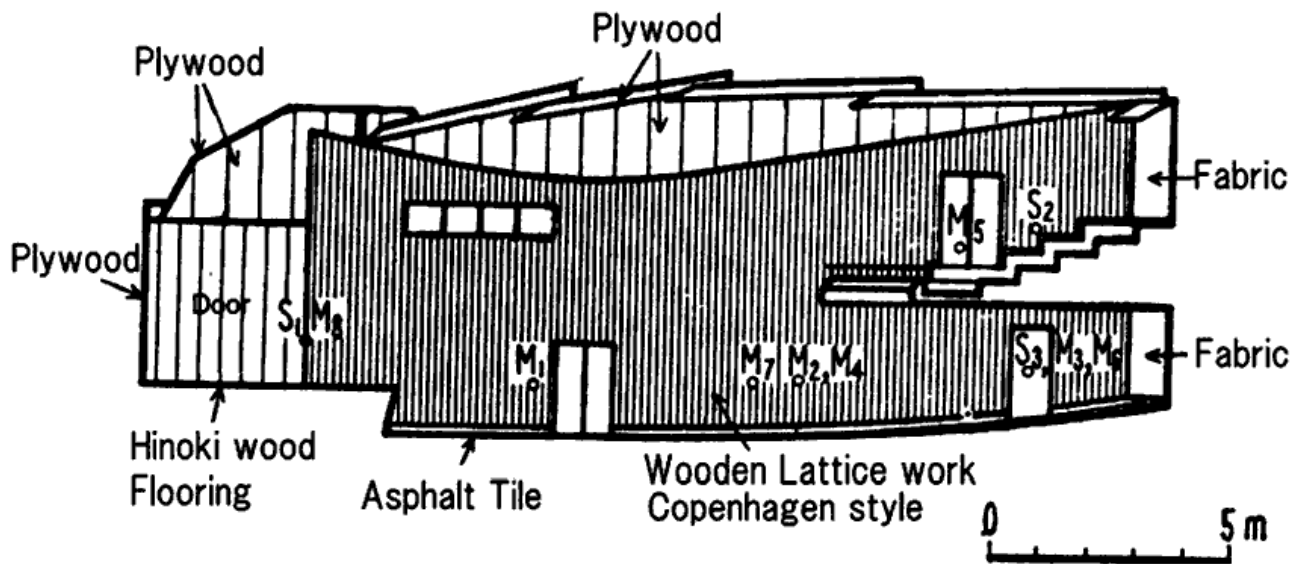


Fig. Acoustic Design of a Cinema Hall

<http://www.rtuonline.com>

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