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Subject Name: **Building Planning & Architecture**

Subject Code: **CE-4004**

Semester: **4th**

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Unit: -3

Building Services- Introduction of Building Services like water supply, sewerage and drainage systems, sanitary fittings and fixtures, plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings, intelligent buildings, elevators & escalators their standards and uses, air-conditioning systems, firefighting systems, building safety and security systems, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings.

Introduction of Building Services

Water supply & sanitary fittings and fixtures

(i) Stop Cock: Stop cock is a control value fixed by the authority at the end of communication pipe. It is fixed in the street, close to the boundary wall in an accessible position in a suitable masonry chamber. It controls the supply to the building from the water main

(ii) Ferrule: Ferrule is a right angled sleeve made of brass or gun metal. It is jointed to an opening drilled in the water main to which it is screwed down with a plug and then connected to a goose neck or communication pipe. The Ferrule is usually made in a size varying from 10 to 50mm diameter

(iii) Goose week: It is flexible curved pipe about 75cm in length. It forms a flexible connections between the water main and service pipe to expansion and contraction of the service pipe and also due to small earth movements and vibrations

VARIOUS WATER SUPPLY AND SANITARY FITTINGS IN BATH AND W.C

The different types of water supply pipes like communication pipes, supply pipes, distribution pipes, consumer's pipes and location of ferrules stop cocks and storage tanks are as shown in the Fig 4.1.

They may be of any shape like rectangle, circular or elliptical. The R.C.C. overhead tank resting on R.C.C. columns having footings. The columns are connected by R.C.C. braces (beams) at 3.0m intervals. A R.C.C slab is cover is provided on top with manhole opening. Following accessories provided may be identified on the drawing.

(i) Water level indicator to show the level of water in the tank.

(ii) An automatic float to close the inlet value when water reaches full tank level

(iii) A ladder to go up the tank for cleaning programmer

(iv) Pipelines.

PIPE LINES:

The pipelines for an overhead tank consists of

(i) **Inlet pipe:** Water enters the tank through the inlet pipe. A bell mouth is provided at the top of pipe and duct foot bend at bottom connecting horizontal and vertical pipes. A reflux valve is provided to prevent Water from returning into the pipe.

(ii) **Outlet pipe:** The water is drawn from the tank through the outlet pipe.

(iii) **Overflow pipe:** Excess water is drained away through the overflow pipe.

(iv) **Scour pipe**: The scour pipe is used for cleaning purpose

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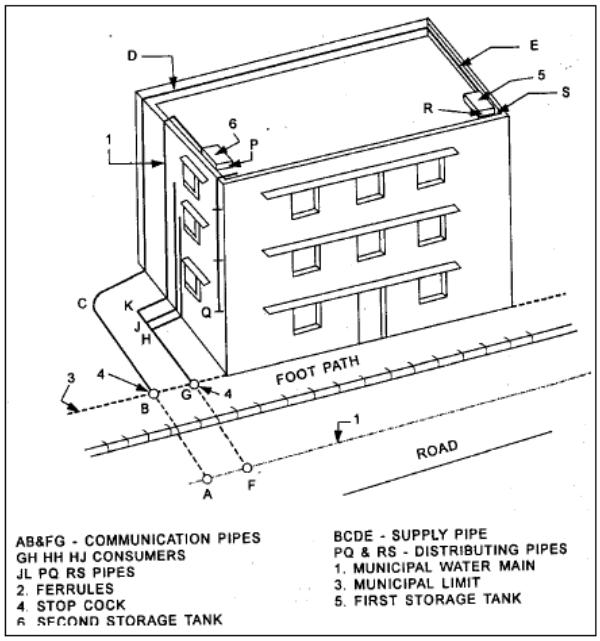
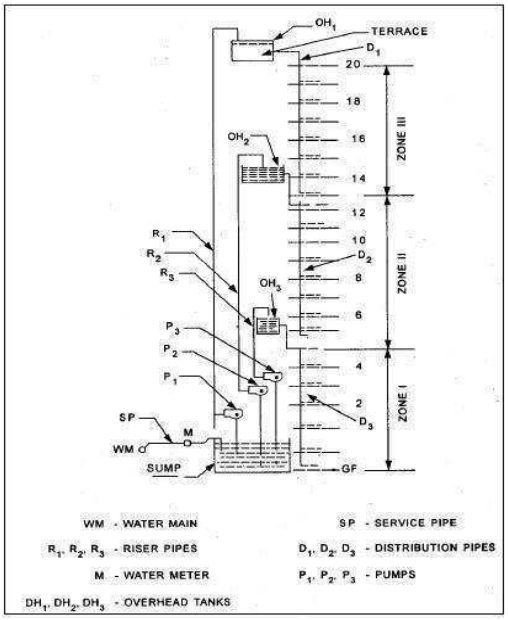
General layout of water supply arrangements single story buildings:

The plan of layout of water supply arrangements is as shown in fig.





Drainage systems TO BUILDING:

The wastewater coming from Kitchens, Bathrooms, water Closets, Urinals etc. has to be properly drained in order to maintain healthy environment. If the waste water is not drained, it leads to stagnation in and around the building causing nuisance.

Requirements of good drainage system in buildings:

1. The foul matter should be quickly removed away from the sanitary fixtures
2. The drainage system should be able to prevent the entry of gases, vermin etc. from the sewers into the buildings
3. The drainage pipes should be strong and durable
4. The pipes and joints should be air tight to prevent any leakage of waste water or gases
5. The network of pipes should have sufficient accessibility for inspection, cleaning and removing obstructions
6. The levels of building, sewer and other points of outlet should be fixed accurately
7. The pipes should be of non-absorbent material
8. The branch drains should be as short as possible
9. The drains should not pass near or under the trees to avoid the damage of pipes by the roots
10. As far as possible drains should not pass under building
11. The drains should be provided with proper ventilation to avoid air locks syphon age

The following pipes are used in drainage arrangements of a building

1. Soil pipe (SP): The soil pipes are those connected to water closets and through which liquid waste including human excreta flows.
2. Waste pipe (WP): The pipe carrying liquid waste from kitchens, bathrooms, wash basins etc. which does not contain human excreta is called waste pipe.
3. Vent pipe (VP): Ventilating pipe is one which enables the foul gases produced in pipes to escape into the atmosphere
4. Anti-syphon age pipe: Anti syphon age pipe prevents the self or induced syphon age action. If symphonize takes place, the water seals of traps are sucked and give way for the entry of foul gases into the building through fittings, causing nuisance.

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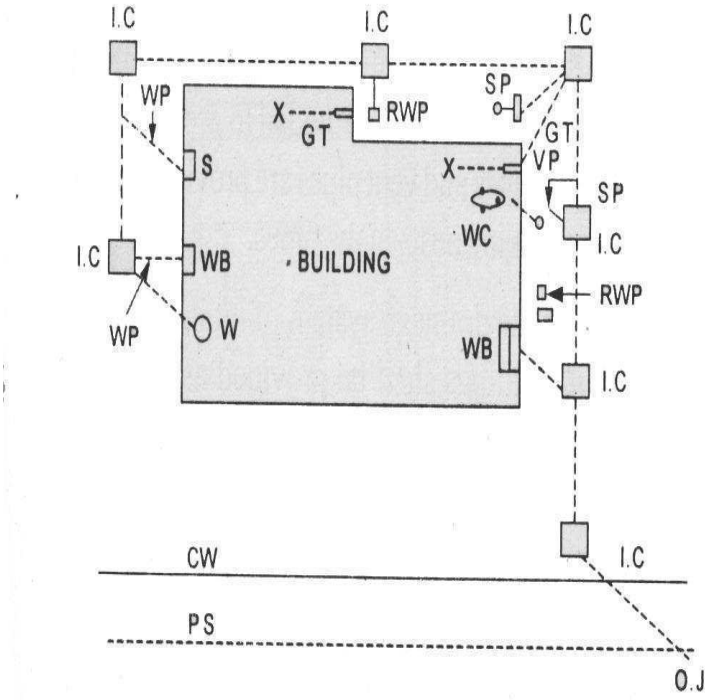
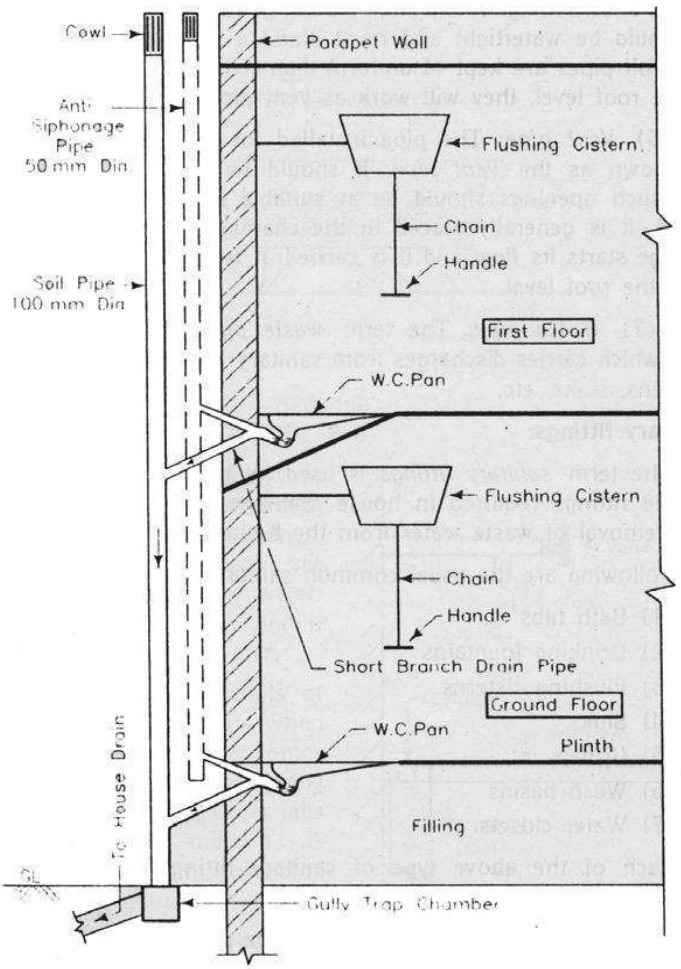
The following points should be considered in planning the layout of drainage connections to the various sanitary fittings

1. The layout should be simple and direct.
2. Designed slope should be maintained.
3. Concrete pads should be provided to support the pipes laid on the earth full.
4. Only sanitary tees and quarter bends are used for a change of pipe from horizontal to vertical.
5. Manholes should be provided at all points of intersection of pipes.
6. All soil pipes, waste pipes and ventilating pipes may be conveniently grouped in shafts or ducts for easy inspection or maintenance.
7. All surface pipes should have minimum clear distance of 5 cm from the wall.
8. The waste pipes should be separated from house drain by means of gully traps to prevent the entry of foul gases, vermin etc. into the building.
9. Traps are required for very sanitary fixture and they should be as close to the fixtures as possible.

The typical layout of single story building drainage system is shown in



I.C. - INSPECTION CHAMBER
W.S - WASH BASIN
WC - WATER CLOSET
SP - SOIL PIPE
RWP - RAIN WATER PIPE
CW - COMPOUND WALL
O.J - OBLIQUE JUNCTION
W - WATER COOLER
WP - WASTE PIPE
S - SINK
VP - VENT PIPE
GT - GULLY TRAP
PS - PUBLIC SEWER



Section of a building showing house drainage arrangement

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Plumbing system

Plumbing system is used for water supply in building .It supplies water to kitchen toilet outlets via distribution system of pipes. Drainage system is used to get rid of human wastes through well-arranged network of drainage pipes.

Types of Plumbing Systems in Buildings

Plumbing system in buildings consists of underground tank which is supplied water via municipal or water department supply lines, from there with the help of pumps and piping distribution system water is supplied to overhead tank and thereby due to gravity water reaches to home outlets.

The overhead tank can however be eliminated if water is supplied directly from underground tank to kitchen toilet outlets, there comes the need of pumps which can give uninterrupted supply of water with required pressure to outlets so that when one opens the tap he gets continuous supply of water. Such pumps are called hydro-pneumatic system.

Principles of internal & external drainage systems

Drainage systems help by removing water from your basement. When you've got standing water down there, it will attract bugs and create a perfect breeding ground for mold. Since the basement air rises and brings everything with it, you could easily find mold spores floating all over your home. In this article we're going to look at two waterproofing options - internal and external drains.

External Drains

External drainage systems work by drawing water away from your basement through a drain pipe that eventually leads to a storm drain. This is a highly effective system for getting moisture out of basements and keeping things dry. However, one of the problems with this type of drain is that it's not suitable for every house. You need somewhere for the water to drain away to. This means there has to be a storm drain that is positioned lower than your basement floor.

This type also often requires serious construction work. There has to be work done around the perimeter of the house, especially if the garage slab floors, driveways and other adjoining areas were improperly constructed. If you have an attached garage or crawlspace, it might be impossible to install an external drain entirely.

External drains also have a tendency to become clogged with dirt and debris. This is possible with internal drains as well, but it's especially difficult to fix when the drains are external. Finally, because of the work required to install them, external drain systems are more expensive than internal ones.

Internal Drains

If you don't have a storm drain to empty into, internal drainage systems are going to be better for your home. With this type, there is no external construction necessary. They just have to jackhammer your basement floor to create a trench, and then lay pipe and enclose it. In general, this is a much easier way to get a system installed and it is more cost efficient.

The only downside of internal drains is that they don't necessarily help with water that seeps in through the foundation walls. They'll keep basement slabs dry and cut down on moisture in the basement, but water will usually still come in from the soil around the house. However, with a little landscaping, you can limit the amount of water that seeps in this way. Make sure that your yard slopes away from the house and also that there aren't plant roots that come into contact with your basement foundation's walls.

Other options include combinations of both internal and external drains, and using sump pumps. Sump pumps

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help by removing water from the basement and they can be a great addition to any type of waterproofing system that you get installed.
Although waterproofing experts argue over which of these drainage systems is best (and there is no truly best answer for everyone), most these days prefer internal drains. They're easier to install, more cost effective and very good at keeping water out of your home. You can always talk to a waterproofing professional about which option they recommend for you.

Principles of electrification of buildings
Intelligent buildings

The first definition, coined by the Intelligent Buildings Institute, defines an intelligent building as "one which provides a productive and cost-effective environment through optimization of four basic elements: structure, systems, services and management, and the interrelationship between them." According to this initial definition, an intelligent building is one that optimally matches its four elements to the users' needs with an emphasis on the technology that makes the interrelationship between the elements possible.

As intelligent buildings began to take hold around the world in the late 1980s and 1990s, many competing definitions were put forward. In Europe, the European Intelligent Buildings Group coined a new definition stating that an intelligent building "creates an environment which maximizes the effectiveness of the building's occupants while at the same time enabling efficient management of resources with minimum life-time costs of hardware and facilities," tilting the spotlight towards the occupant's needs to be served by technology. In Asia, the definitions focused on the role of technology for automation and control of building functions.

Elevators & escalators their standards and uses

An escalator is a type of vertical transportation in the form of a moving staircase which carries people between floors of a building. It consists of a motor-driven chain of individually linked steps on a track which cycle on a pair of tracks which keep them horizontal.

Escalators are used around the world in places where elevators would be impractical. Principal areas of usage include department stores, shopping malls, airports, transit systems (railway/railroad stations), convention centers, hotels, arenas, stadiums and public buildings.

Safety on escalator

Safety is a major concern in escalator design, as escalators are powerful machines that can become entangled with clothing and other items. Such entanglements can injure or kill riders. In India many women wear saris, increasing the likelihood of entangling the pallu. To prevent this, *sari guards* are built into most escalators in India.

Children wearing footwear such as Crocs and flip-flops are especially at risk of being caught in escalator mechanisms. The softness of the shoe's material combined with the smaller size of children's feet makes this sort of accident especially common.[7]

Elevators and its Usages
An elevator is a platform, either open or enclosed, used for moving people or freight vertically, from one floor to another within a building. Elevators are a standard part of any tall commercial or residential building. These days elevators are often a legal requirement in new buildings with multiple floors. All elevators are required to have communication connection to an outside 24 hour emergency service, automatic recall capability in a fire emergency, and special access for fire fighters use in a fire.

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Uses of elevators

1. Passenger Elevators are designed to move people between different floors of a building, their capacity being related to available floor space.
2. Passenger elevators may be specialized for the service they perform, including: Hospital emergency (Code blue), front and rear entrances, double Decker, and other uses.
3. Express elevators are designed to move people from ground floor to a sky lobby skipping several floors in between at a high speed.
4. Wheelchair, or platform lifts, a specialized type of elevator designed to move a wheelchair 6 ft (1.8 m) or less, often can accommodate just one person in a wheelchair at a time with a maximum load of 1000 lb (455 kg).
5. Freight Elevators are meant to carry heavy loads generally 2300 to 4500 kg. They usually don't comply with fire service requirements and carrying passengers is generally prohibited unless specified.
6. On aircraft carriers, elevators carry aircraft between the flight deck and the hangar deck for operations or repairs. These elevators are designed for much greater capacity than any other elevator.
7. A small freight elevator is often called a dumbwaiter, often used for the moving of small items such as dishes in a 2-story kitchen or books in a multi-story rack assembly. Passengers are never permitted on dumbwaiters.
8. A special type of elevator is the paternoster, a constantly moving chain of boxes, generally used in industrial plants.
9. Grain Elevators are used to elevate grain for storage in large vertical silos

Air-conditioning systems

Air conditioning (often referred to as AC, A.C., or A/C) is the process of removing or adding heat from/to a space, thus cooling or heating the space's average temperature.

Air conditioning can be used in both domestic and commercial environments. This process is most commonly used to achieve a more comfortable interior environment, typically for humans or animals; however, air conditioning is also used to cool/dehumidify rooms filled with heat-producing electronic devices, such as computer servers, power amplifiers, and even to display and store artwork.

Air conditioning makes deep plan buildings feasible, for otherwise they would have to be built narrower or with light wells so that inner spaces received sufficient outdoor air via natural ventilation. Air conditioning also allows buildings to be taller, since wind speed increases significantly with altitude making natural ventilation impractical for very tall buildings. Comfort applications are quite different for various building types and may be categorized as:

- Commercial buildings, which are built for commerce, including offices, malls, shopping centers, restaurants, etc.
- High-rise residential buildings, such as tall dormitories and apartment blocks
- Industrial spaces where thermal comfort of workers is desired
- Cars, aircraft, boats, which transport passenger or fresh goods
- Institutional buildings, which includes government buildings, hospitals, schools, etc.
- Low-rise residential buildings, including single-family houses, duplexes, and small apartment buildings
- Sports stadiums, such as the University of Phoenix Stadium[41] and in Qatar for the 2022 FIFA World Cup

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Firefighting systems & fire safety

A firefighting system is probably the most important of the building services, as its aim is to protect human life and property, strictly in that order.

General Fire Fighting Equipment

Firefighting systems and equipment vary depending on the age, size, use and type of building construction. A building may contain some or all of the following features:

- Fire extinguishers
- Fire hose reels
- Fire hydrant systems
- Automatic sprinkler systems

Fire Extinguishers

Fire extinguishers are provided for a 'first attack' firefighting measure generally undertaken by the occupants of the building before the fire service arrives. It is important that occupants are familiar with which extinguisher type to use on which fire.

Most fires start as a small fire and may be extinguished if the correct type and amount of extinguishing agent is applied whilst the fire is small and controllable.

The principle fire extinguisher types currently available include:

Extinguishing Agent	Principle Use
Water	wood and paper fires - not electrical
Foam	flammable liquid fires - not electrical
Carbon dioxide	electrical fires
Dry Chemical	flammable liquids and electrical fires
Wet chemical	fat fires - not electrical
Special Purpose	various (eg metal fires)

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Fire extinguisher locations must be clearly identified. Extinguishers are color coded according to the extinguishing agent.

Building safety and security systems

In building safety and security management, the focus has shifted toward preemptive security and safety measures like structural fire protection. When you identify the risks, you will be better equipped against them. Versatile services and well-functioning systems contribute to a high level of security and safety. We provide security and safety advisory services to ensure good overall security and safety management.

Regular maintenance ensures functionality

Good and regular maintenance ensures that the security and safety systems of a building or facility operate as they should. In security and safety matters, one must be sure that the systems are operational and that they can be monitored.

We repair faults and carry out annual and other scheduled maintenance. If required, we inspect and test the systems regularly.

We provide safety and security system remote control and monitoring and remote programming services to our clients. We also prepare rescue and security and safety plans and inspect and test installed systems. We always make records of the inspections and tests, and give reports of the results to the client.

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Our offering

- Perimeter protection
- Nurse call and personal attack alarm systems
- Alarm transfer systems
- CCTV monitoring systems
- Access control systems
- Door and gate phones
- Fire detection systems
- Sprinkler systems
- Intrusion detection system
- Smoke exhaust systems
- Data communication systems
- Emergency lighting and signage systems
- Time tracking
- UPS systems
- Visitor management systems
- PA and audio evacuation systems

Ventilation and lightening and staircases

LIGHTING AND VENTILATION OF ROOMS

a) Rooms: Every habitable room which should have for the admission of air and light, one or more apertures such as windows and fanlights, opening directly to the external air or into an open verandah and of an aggregate area, inclusive of frames, of not less than

i. One-tenth of the floor area excluding doors for dry hot climate.

ii. One-sixth of the floor area excluding doors for wet/hot climate.

No portion of a room should be assumed as lighted if is more than 7.5m away from the door or window which is taken for calculation as ventilating that portion.

Cross-ventilation by means of windows and ventilators or both shall be effected in at least living room of tenement either by means of windows in opposite walls or if this is not possible or advisable, then atleast in the adjoining walls.

b) Bathrooms and water closets: The rooms should be provided with natural light and permanent ventilation by one of the following means:

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i. Windows having an area of not less than 10% of the floor area and located in an exterior wall facing a street alley, yard or an air shaft whose dimensions in the direction perpendicular to the window is not less than one-third the height of the building on which the window is located, subject to a minimum limit of 1m and maximum 6m.

ii. Skylights, the construction of which shall provide light and ventilation required in (i) above.

iii. Ventilation ducts: Provided such ducts have 130 square cm of area for each square meter of area with a minimum total area of 300 square cm and least dimension of 9cm.

c) Stores, backrooms: These will have at least half the ventilation required for living room.

d) Basement and floors: Basements and rooms located therein except room shall be lighten and ventilated by windows in exterior walls having a ventilating area of not less than 2.5% of the floor area.

e) Kitchen shall be ventilated according to standards prescribed for habitable rooms near the ceiling as far as possible.

f) Stairways: every staircase should be lighted and ventilated from an open air space of not less than 3m depth measured horizontally in case of ground and one upper floor structure, 4.5 m in case of ground and two upper and in higher structure than this, the open air space shall not be less than 6m, provided that the lighting area shall not be less than 1 sq.m per floor height. Every staircase shall be ventilated properly.

Thermal insulation

Thermal insulation is the reduction of heat transfer (the transfer of thermal energy between objects of differing temperature) between objects in thermal contact or in range of radiative influence. Thermal insulation can be achieved with specially engineered methods or processes, as well as with suitable object shapes and materials.

Heat flow is an inevitable consequence of contact between objects of differing temperature. Thermal insulation provides a region of insulation in which thermal conduction is reduced or thermal radiation is reflected rather than absorbed by the lower-temperature body.

Acoustics of buildings

To help develop this article, click 'Edit this article' above.

Introduction

Building acoustics is the complex science of controlling noise in buildings. This includes the minimization of noise transmission from one space to another and the control of the characteristics of sound within spaces themselves.

Building acoustics are an important consideration in the design, operation and construction of most buildings, and can have a significant impact on health, communication and productivity. They can be particularly significant in spaces such as concert halls, recording studios, and lecture theatres and so on, where the quality of sound and its intelligibility are very important.

Building acoustics can be influenced by:

- The geometry and volume of a space.
- The sound absorption, transmission and reflection characteristics of surfaces enclosing the space and
- Within the space.

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- The sound absorption, transmission and reflection characteristics of materials separating spaces.
- The generation of sound inside or outside the space.
- Airborne sound transmission.
- Impact noise.

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