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New Scheme Based On AICTE Flexible Curricula
Civil Engineering, III-Semester
CE303 Building Planning & Architecture

UNIT-I

Drawing of Building Elements- Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.

UNIT-II

Building Planning- Classification of buildings, Provisions of National Building Codes and Rules, Building bye-laws, open area, Setbacks, FAR terminology, Design and drawing of Building, Design concepts and philosophies, Preparing sketch plans and working drawings of various types of buildings like residential building, institutional buildings and commercial buildings, site plans, presentation techniques, pictorial drawings, perspective and rendering, model making, introduction to computer aided design and drafting, Applying of principle of architectural composition (i.e. unity, contrast, etc.), Principles of planning, orientation in detailed drawings.

UNIT-III

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, fire-fighting systems, building safety and security systems, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings.

UNIT-IV

Principles of architectural design- Definition of architecture, factors influencing architectural development, characteristics features of style, historic examples, creative principles.
Principles of architectural composition– Unity, balance, proportion, scale, rhythm, harmony, Accentuation and contrast.
Organising principles in architecture– Symmetry, hierarchy, axis, linear, concentric, radial, and asymmetric grouping, primary and secondary masses, Role of colour, texture, shapes/ forms in architecture.
Architectural space and mass, visual and emotional effects of geometric forms, space activity and tolerance space. Forms related to materials and structural systems.
Elements of architecture : Functions – Pragmatic utility, circulatory function, symbolic function, Physiological function. Structure – Physical structure, Perceptual structure. Space in architecture Positive and negative space. Aesthetics: Visual perception. Protective: Protection from climate andother elements, architecture a part of the environment. Comfort factors.

UNIT-V

Perspective Drawing and Town Planning- Elements of perspective drawing involving simple problems, one point and two point perspectives, energy efficient buildings.Concepts of master plan, structure plan, detailed town planning scheme and action plan, estimating future needs - planning standards for different land use, allocation for commerce, industries, public amenities, open areas etc., planning standards for density distributions, density zones, planning standards for traffic network, standard of roads and paths, provision for urban growth, growth models, plan implementation, town planning legislation and municipal acts, panning of control development schemes, urban financing, land acquisition, slum clearance schemes, pollution control aspects

References Books:

1. Shah, Kale &Patki; Building Design and Drawing; TMH
2. Malik &Meo; Building Design and Drawing
3. W B Mckay,OrientBlackswan Building Construction Vol 1 -4, Pearson
4. Gurucharan Singh and Jagdish Singh, Building Planning, Designing and Scheduling, Standard Publishers Distributors.
5. Layal JS, Dongre A, Building Design and Drawing, SatyaPrakashan
6. Ghose D.N., Civil Engineering Design and Drawing, CBS publisher
7. Das B M, Principles of Foundation Engineering, Cengage Learning.
8. Agrawal S. C., Architecture and Town Planning, DhanpatRai& Co.
9. S.C. Rangwala, Town Planning, Charotar Publishing House.
10. Lewis Keeble, Principles and Practice of Town and Country Planning.
11. Rame Gouda, Principles & Practices of Town Planning, University of Mysore, ManasaGangotri.

List of Experiments

1. Sketches of various building components.
2. Drawing of various building components containing doors, windows ventilators, lintels and arches stairs foundations etc.
3. Drawings for services and interiors of buildings.
4. Drawings containing detailed planning of one/two bed room residential building (common to all student)
5. Drawing of residential and institutional building (Each student performs a different drawing).
6. Use of Auto CAD for preparation of drawings.

Unit: -1

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

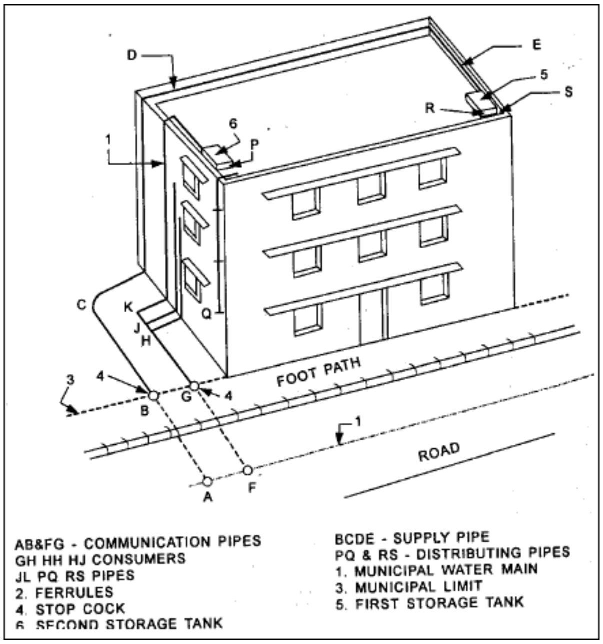
(i) **Inlet pipe:** Water enters the tank through the inlet pipe. A bell mouth is provided at the top of pipe and duct foot bend at bottom connecting horizontal and vertical pipes. A reflux valve is provided to prevent Water from returning into the pipe.

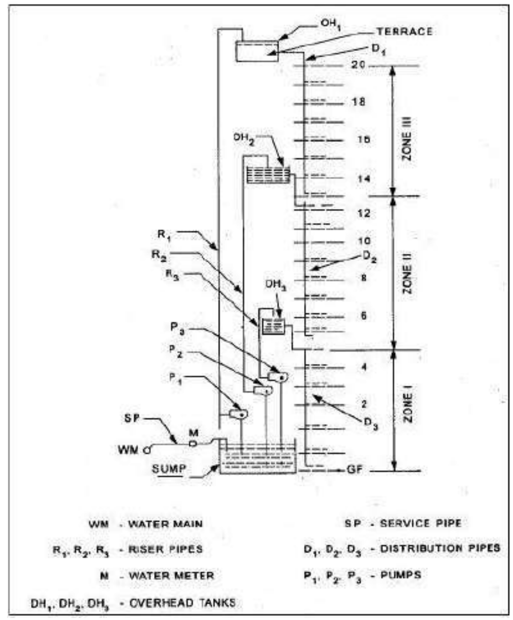
(ii) **Outlet pipe:** The water is drawn from the tank through the outlet pipe.

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

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

General layout of water supply arrangements single story buildings:
The plan of layout of water supply arrangements is as shown in fig.



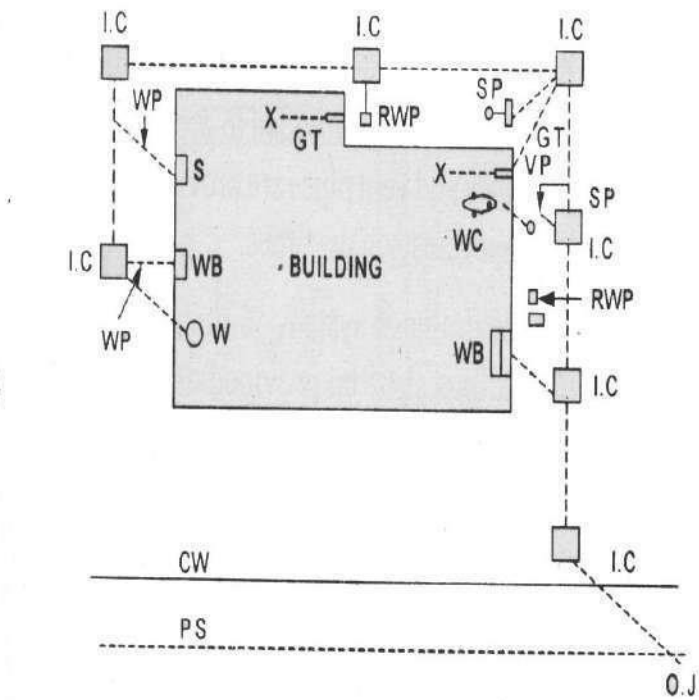


Drainage systems TO BUILDING:
The wastewater coming from Kitchens, Bathrooms, water Closets, Urinals etc. has to be properly drained in order to maintain healthy environment. If the waste water is not drained, it leads to stagnation in and around the building causing nuisance.
Requirements of good drainage 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.

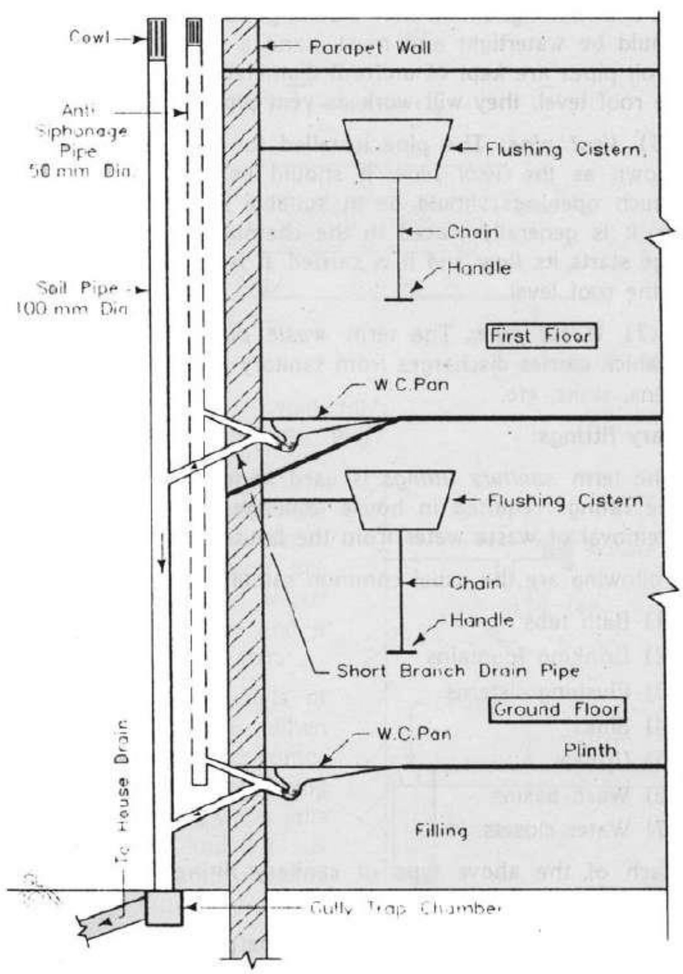
The following points should be considered in planning the layout of drainage connections to the various sanitary fittings

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

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

help by removing water from the basement and they can be a great addition to any type s 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.

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

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)

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.

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:

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.

- 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.

Unit-II

Principles of architectural design – Definition of architecture, factors influencing architectural development, characteristics feature of style, historic examples, and creative principles. Principles of architectural composition – Unity, balance, proportion, scale, rhythm, harmony, Accentuation and contrast. Organizing principles in architecture-Symmetry, hierarchy, axis linear, concentric, radial, and asymmetric grouping, primary and secondary masses, Role of color, texture, shapes/forms in architecture. Architectural space and mass, visual and emotional effects of geometric forms, space activity and tolerance space. Forms related to materials and structural systems. Elements of architecture: Functions – Pragmatic utility, circulatory function, symbolic function, physiological function. Structure– Physical structure, Perceptual structures. Space in architecture –Positive and negative space. Aesthetics: Visual perception. Protective: Protection from climate and other elements, architecture a part of the environment. Comfort factors.

Definition of architecture

Architecture is the process and the product of planning, designing, and constructing buildings and other physical structures. Architectural works, in the material form of buildings, are often perceived as cultural symbols and as works of art. Historical civilizations are often identified with their surviving architectural achievements.

"Architecture" can mean:

- A general term to describe buildings and other physical structures.
- The art and science of designing buildings and (some) no building structures.
- The style of design and method of construction of buildings and other physical structures.
- A unifying or coherent form or structure
- Knowledge of art, science, technology, and humanity.
- The design activity of the architect, from the macro-level (urban design, landscape architecture) to the micro-level (construction details and furniture). The practice of the architect, where architecture means offering or rendering professional services in connection with the design and construction of buildings, or built environments.

Factors influencing architectural development

FACTORS THAT AFFECT DESIGN

Every project situation is different. Each presents a different set of requirements and limitations. Each presents a unique set of cultural, environmental, technological, and aesthetic contexts to be considered. Each presents its own set of challenges and opportunities. Design brings to the surface the major considerations inherent in a situation. It is a process that is both problem- seeking and problem-solving. While every project has a unique combination of design influences, some of the more important ones are discussed here.

Client

Some clients have a clear idea of a program, budget, and other project objectives, including the final appearance of the building. Others look to their architect to help them define the project objectives and to design a building that meets those objectives. In both cases the effectiveness of the relationship between client and architect is a major factor in making design decisions throughout the project.

Program

All clients have a series of aspirations, requirements, and limitations to be met in design. The program provides a place for identifying and delineating these factors and any number of related considerations. The program may be short or long, general or specific, descriptive of needs, or suggestive of solutions.

Community Concerns

Clients and their architects may need to adjust their designs to satisfy community groups, neighbors, and public officials. These design adjustments are often ad hoc efforts to meet objections or to gain support rather than direct responses to codified requirements.

Codes and Regulations

Regulatory constraints on design have increased steadily. Beginning with simple safety requirements and minimal land-use and light-and-air zoning, building codes and regulations have grown into a major force in design that regulates every aspect of design and construction.

Context and Climate

Contextual factors include the nature of the surrounding fabric of natural and built elements. Existing patterns and characteristics of this fabric can provide clues or starting points for approaching site development as well as the building design, influencing its configuration and use of materials, colors, and textures. Climatic factors include the nature of regional microclimates defined by solar radiation, temperatures, humidity, wind, and precipitation.

Site

These factors include site size; configuration; topography; geotechnical characteristics; ecological features, including vegetation, wildlife habitats, water elements, and drainage; and accessibility to property.

Building Technology

Building configuration, materials, and systems are rarely arbitrarily chosen and are only partially based on aesthetic criteria. For example, floor-to-floor height required to accommodate structural, mechanical, lighting and ceiling systems in a cost-effective manner varies significantly from an apartment house to an office building to a research facility. Similarly, office fenestration may be based on one module and housing on another module. In still other cases, these dimensions may be dictated largely by mechanical systems or even by the knowledge and preferences of the local construction industry.

Sustainability

In its broadest scope, sustainability refers to the ability of a society, ecosystem, or any such ongoing system to continue functioning into the future, without being forced into decline through exhaustion or overloading of the key resources on which that system depends. For architecture, this means design that delivers buildings and communities with lower environmental impacts while enhancing health, productivity, community and quality of life.

Cost

In most cases, there is a limit to the funds available for construction. Once defined, this limit has a major influence on subsequent design decisions, from building size and configuration to material selection and detailing. Although most budgets are fixed, (often by the amount of financing available) others may be flexible. For example, some owners are willing to increase initial budgets to achieve overall life-cycle cost savings.

Schedule

The demands and constraints set by the project schedule may influence how specific issues are explored and considered. For example, an alternative requiring a time-consuming zoning variance may be discarded in favor of one that can keep the project on schedule. Another example may include committing to a final site plan early in the process-before the building footprint on the site plan is fully designed.

Historic examples

Lotus Temple

The temple welcomes worshippers of all faiths The Lotus Temple is a Baha'i House of Worship in New Delhi consisting of 27 structures resembling petals of the lotus flower that open onto a central hall around 40m high. It has nine sides, nine doors, and can accommodate 2,500 people. It's surface is made of white marble from Mount Pantelakos in Greece, the same marble used to build the Parthenon. Since its completion in 1986 it has become one of the most visited buildings in the world, attracting over 100 million people.

Cologne Cathedral

Germany's most-visited landmark Cologne Cathedral is a High Gothic five-aisled basilica, the construction of which began in 1248 and stopped in 1473, before the building was complete. Work did not resume until the 1800s, and it was finally finished in 1880. Later work follows the original medieval plan faithfully.
It is renowned as a Gothic masterpiece and houses many works of art as well as the tombs of 12 archbishops.

Dome of the Rock, Jerusalem

The Dome of the Rock is a masterpiece of Islamic architecture A masterpiece of Islamic architecture, the Dome of the Rock is a 7th century building, located in Jerusalem. Built by Caliph Abd al-Malik between 687 and 691, the octagonal plan and the rotunda dome of wood are of Byzantine design. The Persian tiles on the exterior and the marble slabs that decorate the interior were added by Suleiman I in 1561.
The oldest extant Islamic monument, the Dome of the Rock has served as a model for architecture and other artistic endeavors for over a millennium.

La Pedrera, Barcelona

Gaudi's La Pedrera is one of the most imaginative houses in the history of architecture Nested among the urban streets of Barcelona are some unusual and beautiful buildings by infamous architect Antoni Gaudi. His unique approach to the Art Nouveau movement generated some of the most creative buildings the world has ever seen. And La Pedrera is no exception.

One of the most imaginative houses in the history of architecture, this is more sculpture than building. The façade is a varied and harmonious mass of undulating stone that, along with its forged iron balconies, explores the irregularities of the natural world. The United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized this building as World Heritage in 1984.

One World Trade Center, New York

The One World Trade Center is the tallest skyscraper in the Western Hemisphere. One World Trade Center the latest addition to New York's skyline, the One World Trade Center, is the tallest skyscraper in the Western Hemisphere. Construction began in April 2006 and the final component of the building's spire installed five years later in 2013, making it the fourth tallest skyscraper in the world.

The One World Trade Center's design is no coincidence, standing at a symbolic height of 1,776 feet (541m) in a direct nod to the year of the US Declaration of Independence.

Designed by David M Childs of Skidmore, Owings & Merrill, the 104-story glass tower raises from a cube base before transforming from the 20th floor into eight sleek isosceles triangles. Stood adjacent to the city's beautiful 9/11 memorial, the One World Trade Center is a shining beacon for the city.

St Paul's Cathedral, London

British architect Sir Christopher Wren took 10 years to finalize his designs for St Paul's London's most iconic building, St Paul's Cathedral, was designed by English architect Sir Christopher Wren. Sitting at the top of Ludgate Hill, the highest point in the City of London, its famous dome is one of the world's largest, measuring nearly 112 meters high.

The original church on the site was founded in the year 604AD. Work on the present English Baroque church began in the 17th Century by Christopher Wren as part of a major rebuilding program after the Great Fire of London. Wren started working on St Paul's in 1668, his designs for the cathedral taking a decade to complete and the actual construction taking a further 40 years. St Paul's has played an integral part of London life ever since – as a domineering element in the city's skyline, as a center for tourism and religious worship, and most recently as a focal point for anticapitalistic protests.

Petronas Towers, Kuala Lumpur

The Petronas Towers are an iconic landmark in Malaysia's capital city Kuala Lumpur Standing at 170 meters above ground; the Petronas Towers are twin skyscrapers in Kuala Lumpur, Malaysia. The buildings, which held the titled of tallest in the world between 1998-2004, are an iconic landmark of the capital city.

The distinctive postmodern style was created by architects Cesar Pelli and Achmad Murdijat, engineer Deejay Cerico and designer Dominic Saibo under the consultancy of JC Guinto.

The White House, Washington

The White House, designed by Irish architect James Hoban, took eight years to construct. Image © Matt Wade Irish architect James Hoban was the man behind the design of the White House. In 1792 Hoban submitted a plan for the presidential mansion and subsequently got the commission to build the White House. Constructed began in 1793 through to completion in 1801. The mansion, which has been home to every US leader since the country's second president John Adams, is made from white-painted Aqua sandstone.

Leaning Tower of Pisa

Due to restoration work carried out in 2001, the tower currently leans at just under 4 degrees. It is estimated that it will collapse in the next 75-100 years. Image

The Leaning Tower of Pisa is one of the most remarkable architectural structures in Europe. Most famous for its tilt, the tower began to lean during construction after soft ground on one side was unable to properly support the structure's weight.

Building work on the tower began in 1173 and went on for over a whopping 300 years. There has been much controversy surrounding the true identity of the architect behind the tower – the design originally attributed to artist Bonnano Pisano but studies have also implicated architect.

The Kaaba, Mecca

The Kaaba is a most sacred space in Islam the Kaaba, meaning cube in Arabic, is a square building located in Mecca, Saudi Arabia. A most sacred place in Islam, the Kaaba is elegantly draped in a silk and cotton veil. Every year millions of Muslims travel to the Kabba for the hajj, an annual Islamic pilgrimage to Mecca.

The small square building is about 60 feet high and it's walls a meter wide, with its total size occupying roughly 627 square feet.

Creative principles

Balance

Balance is the equal distribution of visual weight in a design. Visual balance occurs around a vertical axis; our eyes require the visual weight to be equal on the two sides of the axis. We are bilateral creatures and our sense of balance is innate. When elements are not balanced around a vertical axis, the effect is disturbing and makes us uncomfortable.

Proportion

Rhythm:

Continuity, recurrence or organized movement in space & time. Sequence is the experience of the rhythm. One space may have several different rhythms

Harmony:

The pleasing agreement of parts or combination of parts in a composition. Harmony involves the selection design of elements that share a common trait, however, Harmony becomes monotony without Variety. Common traits orientation colors or values shape/size materials variety: the extent of the differences in design elements -- visual interest is enhanced by introducing dissimilar elements and spatial arrangements.

Proportion is a central principle of architectural theory and an important connection between mathematics and art. It is the visual effect of the relationships of the various objects and spaces that make up a structure to one another and to the whole. These relationships are often governed by multiples of a standard unit of length known as a "module".[1]

Accentuation and contrast

- Mass composition with harmonious unity should create interest in the design so as to catch the attention of the observer.
- Monotony may reduce interest.
- Contrast reduces monotony.
- A well- conceived contrast of form, size, tone and direction may result in serious harm to unity. Such harms should be minimized.
- Contrast may be achieved in mass, in space, in mass and space, in surfaces, in color and with light.

Principles of Architecture: Accentuation and Rhythm

- After viewing any space (internally and externally) a person always has a special feeling about a special element.
- This feeling is because of the impression, emphasis, rigidity, firmness, function, decisively of the element.
- This emphasis of the element is termed as accentuation.
- Any repetitive occurrence of a particular pattern is called

Hierarchy

There are several ordering principles used by architects and art historians, but today we're only going to be dealing with one specific principle: hierarchy. Hierarchy describes components of a structure by how noticeable they are. The more obviously noticeable a component is, the more important it is to the architect and to the structure's overall aesthetic. Basically, hierarchy is about understanding how and why some parts carry more visual weight than others, and using that to create balanced (or unbalanced) structures, depending on your overall plans.

Axis: An axis is a central line that helps to organize a design. Often there is an axis at the center of a building or over a doorway. When architects use an axis or focal point in their design it acts like a straight arrow on a sign, pointing you in the right direction.

Symmetry: Symmetry refers to the geometry of a building and occurs if the building is the same on either side of an axis. There are many types of symmetry but the three that are most commonly used in architecture are lateral (the two sides are mirror images of each other), and can be vertical (up and down axis) or horizontal (across axis)

Radial

Radial structure, or graded centrality, is a primary feature of a prototype category. It is a center-periphery taxonomy with the abstract or schematic prototype placed at the center. Those instances of category C that display the highest degree of C-ness are placed towards the center, and are more prototypical instances of category C, while those that display a low degree of C-ness are placed towards the periphery, and are less prototypical instances of category C (and are often also extensions of the category).

Concentric

A structure in which approximately parallel layers of a mineral are arranged around a common center.

Asymmetric grouping

Asymmetry is the absence of, or a violation of, symmetry (the property of an object being invariant to a transformation, such as reflection). Symmetry is an important property of both physical and abstract systems and it may be displayed in precise terms or in more aesthetic terms. The absence of or violation of symmetry that are either expected or desired can have important consequences for a system.

Radial

The building's main advantage is the fact that the rooms can be simultaneously and flexibly used for different art productions and events by Radial system GmbH as well as by other users. The machine hall and boiler room of the former pumping station were transformed into a main hall of 600 square meters and a smaller hall of 400 square meters. The new addition provided the building with a foyer for visitors and artists, as well as wardrobes, office space and three studios facing south onto the Spree river: Studio A with 400 square meters, and Studios B and C with 200 square meters of space each. Also, there is a two story cube with a glass facade facing southwest, a 400 square meter covered deck and a large terrace by the banks of the Spree River with a boat landing. The former work quarter on the premises of RADIALSYSTEM. V. has been turned into a guest-house. All of this makes RADIALSYSTEM. V. an extremely attractive place during the entire year. RADIALSYSTEM. V. is a prime example of the successful metamorphosis of an industrial age building, allowing it to both tell and create history at the same time.

Primary and secondary masses

Primary vs Secondary Sources

When evaluating the quality of the information you are using, it is useful to identify if you are using a **Primary, Secondary, or Tertiary source**. By doing so, you will be able recognize if the author is reporting on his/her own first hand experiences, or relying on the views of others.

Source Type	Examples
Primary A primary source is a first person account by someone who experienced or witnessed an event. This original document has not been	• First person account of an event • First publication of a scientific study • Speech or lecture

previously published or interpreted by anyone else.	• Original artwork • Novel (fiction) or film • Handwritten manuscript • Letters between two people • A diary • Historical documents, e.g. Bill of Rights
Secondary A secondary source is one step removed from the primary original source. The author is reexamining, interpreting and forming conclusions based on the information that is conveyed in the primary source.	• Journal article reporting on a scientific study • Newspaper and Magazine articles • Review of a music CD or art show • Critique of a work of fiction or film • Biography
Tertiary A tertiary source is further removed from primary source. It leads the researcher to a secondary source, rather than to the primary source.	• Indexes and Bibliography • Encyclopedias and Dictionaries • Library catalog • Most textbooks • Guidebooks

Role of colour

Just as the visual artist has a palette of colors to work with when creating a work of art, the musical composer's palette consists of tone colors, also called timbres (TAM-bers). The timbre is defined by the type of waveform created by a particular instrument and the harmonics present in that sound. The basic waveform or timbre is often considered to be the sine wave, whose graph of pitch vs. time equals that of y=sin x. The description of a timbre as simple-sounding as that of a clarinet is actually enormously complex. Because of this, synthesized sounds are often rather different than acoustic sounds they attempt to emulate. Recent synthesizers use sampling, a method of recording real-life sounds and using them as a basis for synthesis. This allows modern synthesizers to create more authentic sounds.

Shape

Space exists in music as silence. In a work for a large group, the composer may instruct certain instruments to not play during specific passages to create different timbres of sound. Complete silence is often used for varying effects; In Mahler's third symphony the composer instructed the orchestra to maintain a silence of at least ten minutes between two movements to create a perceptual separation. John Cage wrote a piece called _4'33"_ which involves a pianist to sit silently at the piano for more than four and a half minutes. (It should be noted, however, that Cage was not actually writing complete silence; he intended that the music consist of the background noises of the performing area.)

Texture

The musical counterpart of texture is harmony. Harmony is the sounding of more than one note at an instant of time. The harmonic series, which is the set of pitches created by continuously dividing a vibrating string in half, is the basis for harmony in all cultures. The concepts of consonance and dissonance are based on the perception of different harmonies and are grounded in the harmonic series.

Architectural space and mass

Form and Shape occur on many different levels in music. At the most basic level, each note has a shape, commonly called an envelope. The envelope is usually divided into four parts:

- Attack, which is the speed at which the volume increases from silence to full volume ("tah" has a short attack; "lah" has a long attack);
- Decay, which is the speed at which the volume decreases from the initial burst of sound to the sustaining volume;
- Sustain, which is the volume level at which the sound settles after the initial attack; and
- Release, which is the speed at which the volume discourses from the sustaining volume to silence.

The envelope is often considered to be part of the timbre of a particular sound. Much like tone color, envelopes can be extremely complex; many sounds actually consist of several envelopes sounding at once or in succession.

Another, more obvious instance of form and shape in music is the form of a musical piece as a whole. Some of the more popular forms in western history include binary form (AABB), sonata form (ABCAB'), rondo form (ABACADA), and modern song form (ABABCBB). Form can exist on larger levels, such as the overall form of multi movement works, operas or cyclic works. This aspect of form, however, might be better listed as a Principle of Design.

Visual and emotional effects of geometric forms

According to the literature, simple shapes induce emotional responses. Current evaluations suggest that humans consider angular shapes as “bad” and curvilinear forms as “good,” but no behavioral data are available to support this hypothesis. Atypical development, such as autism spectrum disorder (ASD), could modify humans’ perception of visual stimuli and thereby their emotional effect. This study assessed the effects of simple stimuli (i.e., jagged edges shape, disk, star, spiral, eye-like shape, and head character) on the emotional responses of different groups of humans. First, we assessed the effects of a looming movement on neurotypical adults’ emotional responses. Second, we assessed the effects of atypical development on emotional responses by comparing the reactions of neurotypical children and of children with ASD. We used different methodological approaches: self-evaluation through questionnaires and direct observation of participants’ behavior. We found that (1) neurotypical adults tended to perceive looming stimuli negatively as they associated more negative feelings with them although few behavioral responses could be evidenced and (2) the emotional responses of neurotypical children and of children with ASD differed significantly. Neurotypical children perceived the spiral stimulus positively, i.e., a curvilinear shape, whereas children with ASD perceived the jagged edges stimulus positively, i.e., an angular shape. Although neurotypical children and children with ASD presented some behavioral responses in common, children with ASD smiled and vocalized more than did neurotypical children during stimuli presentations. We discuss our results in relation to the literature on humans' perception of simple shapes and we stress the importance of studying behavioral components for visual cognition research.

Space architecture, in its simplest definition, is the theory and practice of designing and building inhabited environments in outer space.

The architectural approach to spacecraft design addresses the total built environment. It is mainly based on the field of engineering (especially aerospace engineering), but also involves diverse disciplines such as physiology, psychology, and sociology. Like architecture on Earth, the attempt is to go beyond the component elements and systems and gain a broad understanding of the issues that affect design success.[2] Much space architecture work has been in designing concepts for orbital space stations and lunar and Martian exploration ships and surface bases for the world's space agencies, chiefly NASA.

The practice of involving architects in the space program grew out of the Space Race, although its origins can be seen much earlier. The need for their involvement stemmed from the push to extend space mission durations and address the needs of astronauts including but beyond minimum survival needs. Space architecture is currently represented in several institutions. The Sasakawa International Center for Space Architecture (SICSA) is an academic organization with the University of Houston that offers a Master of Science in Space Architecture. SICSA also works design contracts with corporations and space agencies. In Europe, International Space University is deeply involved in space architecture research. The International Conference on Environmental Systems meets annually to present sessions on human spaceflight and space human factors. Within the American Institute of Aeronautics and Astronautics, the Space Architecture Technical Committee has been formed. Despite the historical pattern of large government-led space projects and university-level conceptual design, the advent of space tourism threatens to shift the outlook for space architecture work.

Forms related to materials and structural systems

Columns

Columns are elements that carry only axial force (compression) or both axial force and bending (which is technically called a beam-column but practically, just a column). The design of a column must check the axial capacity of the element, and the buckling capacity.

The buckling capacity is the capacity of the element to withstand the propensity to buckle. Its capacity depends upon its geometry, material, and the effective length of the column, which depends upon the restraint conditions at the top and bottom of the column. The effective length is where the real length of the column is and K is the factor dependent on the restraint conditions.

The capacity of a column to carry axial load depends on the degree of bending it is subjected to, and vice versa. This is represented on an interaction chart and is a complex non-linear relationship.

Beams

A beam may be defined as an element in which one dimension is much greater than the other two and the applied loads are usually normal to the main axis of the element. Beams and columns are called line elements and are often represented by simple lines in structural modeling.

- cantilevered (supported at one end only with a fixed connection)
- simply supported (fixed against vertical translation at each end and horizontal translation at one end only, and able to rotate at the supports)
- fixed (supported in all directions for translation and rotation at each end)
- continuous (supported by three or more supports)
- a combination of the above (ex. supported at one end and in the middle)

Beams are elements which carry pure bending only. Bending causes one part of the section of a beam (divided along its length) to go into compression and the other part into tension. The compression part must be designed to resist buckling and crushing, while the tension part must be able to adequately resist the tension.

Trusses

A truss is a structure comprising members and connection points or nodes. When members are connected at nodes and forces are applied at nodes members can act in tension or in compression. Members acting in compression are referred to as compression members or struts while members acting in tension are referred to as tension members or ties. Most trusses use gusset plates to connect intersecting elements. Gusset plates are relatively flexible and unable to transfer bending moments. The connection is usually arranged so that the lines of force in the members are coincident at the joint thus allowing the truss members to act in pure tension or compression.

Trusses are usually utilized in large-span structures, where it would be uneconomical to use solid beams.

Plates

Plates carry bending in two directions. A concrete flat slab is an example of a plate. Plates are understood by using continuum mechanics, but due to the complexity involved they are most often designed using a codified empirical approach, or computer analysis.

They can also be designed with yield line theory, where an assumed collapse mechanism is analyzed to give an upper bound on the collapse load (see Plasticity). This technique is used in practice [8] but because the method provides an upper-bound, i.e. an unsafe prediction of the collapse load, for poorly conceived collapse mechanisms great care is needed to ensure that the assumed collapse mechanism is realistic.[9]

Shells

Shells derive their strength from their form, and carry forces in compression in two directions. A dome is an example of a shell. They can be designed by making a hanging-chain model, which will act as a catenary in pure tension, and inverting the form to achieve pure compression.

Arches

Arches carry forces in compression in one direction only, which is why it is appropriate to build arches out of masonry. They are designed by ensuring that the line of thrust of the force remains within the depth of the arch. It is mainly used to increase the bountifulness of any structure.

Catenaries

Catenaries derive their strength from their form, and carry transverse forces in pure tension by deflecting (just as a tightrope will sag when someone walks on it). They are almost always cable or fabric structures. A fabric structure acts as a catenary in two directions.

Elements of architecture: Functions – Pragmatic utility

The Elements

These elements are the bare essentials and hold the greatest importance in a work. There are 6 main elements and form, space are some of them. The other 5 more elements include dot, line, shape, texture, and color. All works should incorporate these elements in the design because it defines the creation on the platform of art and functionality it stands on.

Dot

A dot is a mark that is shows the beginning of a work or the end of it. It is the very basic element whereby an art work or a design starts. Nothing will be done without the dots. It's the basic. One dot marks a point where people will look and concentrate at as it directs attentions. Dots are used to amplify perception and it does not mean one dot, a dot in architecture can mean a center or a mole or a concentration of forms or objects near or close together. Dots that are aligned together create a line. Dots are use to create feel or texture to create form, space and texture. Dots are used to create tones and more. One dot is a point, a number of dots create different elements that are important to showcase a design. A dot does not mean that it is rounded, it dot can have any shape imaginable. A dot just means a point or a mark and that mark could be a circle, triangular, square or uneven shapes. The main purpose of the dot is there regardless of its shape.

Line

A line is a combination of a series of dots that are continuous, with an exact distance in between each dot. They are a number of lines that are all around us, they vary from size of its thickness to the smoothness of the line: lines can be jagged, twisted, and bold or anything. Line can be the outer layer of a form. It defines a shape and also space. Lines creates shapes, Lines could also show texture, lines creates patterns, Lines create color tones, lines create texture and space, line creates form and texture, line creates form and patterns and most importantly lines creates form and space. By using the right lines in a work, you are able to create something that has all of the elements which include the above: form, texture, tone, pattern, space and movement.

Shape

Shape is the creation when the end of a line meets the start of that line itself. Shape can be just a flat plane that is surrounded by outer line and does not hold any mass. Shape is perceived as an idea of the form or how it looks. Shape is composed in positive and negative shapes. Positive shapes mean the shape of the object on the area it is located. Negative shapes are the shape of the area the object is on. Normally to emphasize on the object or area, they are usually darken to show concentration.

Form

From the evolution of dot, to lines, and to shape; it evolved from 1 dimension (dot &line) to 2 dimension (shape) and form is the 3 dimensional combination of the previous products. Form has an area, height, mass and more than one surface. The outline is a forms structure and form will have a different perspective from different point of view, front, left, right, rear, top and bottom. In terms of presentation of form, it is done by using a few elements such as lines, renderings, and texture and tone value.

Texture

Normally we define texture as feel of the surface of an object. Texture is everywhere from every material and object whether it was man-made or natural. Texture give a sense of individuality on the material and using the right material on a design will help emphasize and create a feel that is called home or anything that the space is design for. Texture tells a whole lot more than just feel, it tells emotions and thoughts. Rough edges tell of anger and masculinity, and smooth surfaces are the opposite.

Color

Color is the most important element in the creation of a work. Color has the power to influence and brings out our feelings. Take for example, bright colors creates a sense of joy and happiness. Dark and gloomy colors create a sense of sadness and dread.

Circulatory function

In architecture, **circulation** refers to the way people move through and interact with a building.[1] In public buildings, circulation is of high importance; Structures such as elevators, escalators, and staircases are often referred to as circulation elements, as they are positioned and designed to optimize the flow of people through a building, sometimes through the use of a core.

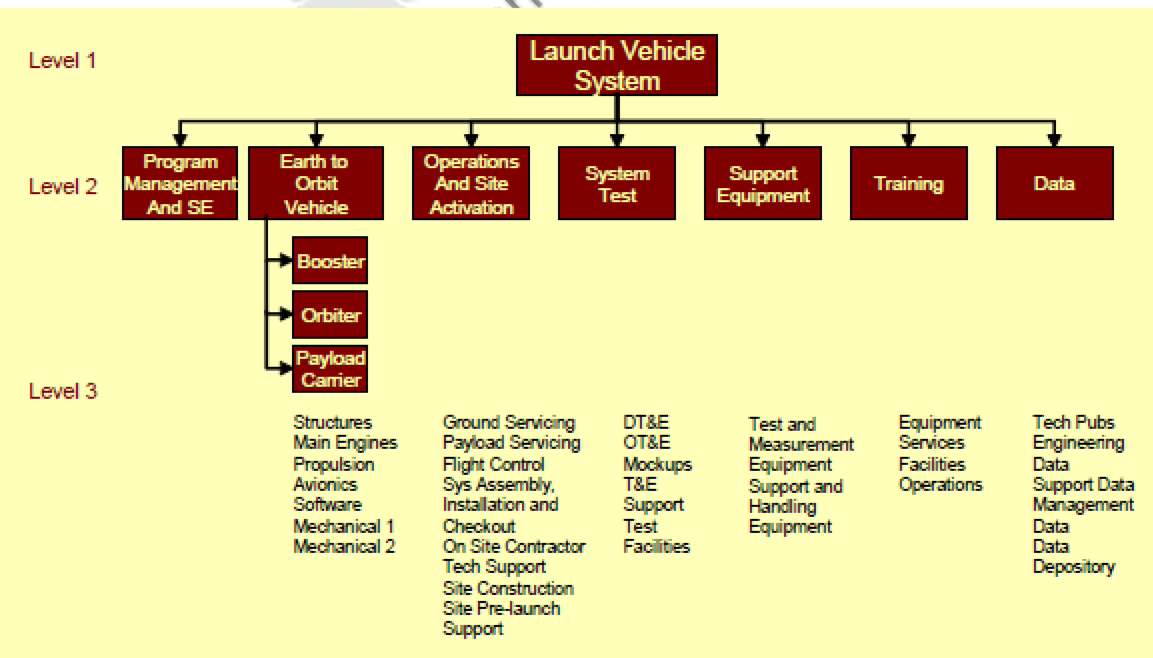
Symbols of function

Society requires that architecture not only communicate the aspirations of its institutions but also fulfill their practical needs. Differences in expression, apart from differences in planning, distinguish the forms of architectural types (the house from the church, etc.), the kinds of use (the Catholic from the Protestant church), and the traditions and customs of users (the English from the Swiss Protestant church). When architectural forms become the vehicles of content—in plan, elevation, and decoration—they are symbolic. Their symbolism can be understood consciously or unconsciously, by association (*e.g.,* spire = church) to a building one has seen before and by the fact that it suggests certain universal experiences (*e.g.,* vertical forms “rise”; low roofs “envelop”). One comprehends the meaning of symbols that are new, as well as those that are known, by association, because the laws of statics restrain builders from putting them into forms so completely unfamiliar that they do not suggest some tradition, just as the structure of language permits endless new meanings but retains a fairly constant vocabulary. The meaning of architectural symbols—or of words—may even change, but the process must be both logical and gradual, for, if the change is irrational, the purpose—communication—is lost.

Physiological function

Physical structure

The physical architecture is the physical layout of a system and its components in a schema. It refers to some representation of the structure or organization of the physical elements of the system. The physical architecture should be part of the Allocated and Product.



The development of the physical architecture consists of one or more logical models or views of the physical solution. The logical models or views may consist of conceptual design drawings, schematics, and block diagrams that define the systems form and the arrangement of the system components and associated interfaces. The development of a physical architecture is an iterative and recursive process and will evolve together with the requirements and functional architecture. Development of the physical architecture is complete when the system has been decomposed down to lowest system element or configuration item level, and it is critical that this process identify the design drivers as early as possible. Therefore, it is imperative that the driving requirements be identified and the combined processes—Stakeholder Requirements Definition, Requirements Analysis, and Architecture Design—will provide key insights to risk early in the development life cycle, allowing for mitigating strategies. [1]

Key activities performed when developing a physical architecture and design includes:

- Analysis and synthesis of the physical architecture and the appropriate allocation,
- Analysis of the constraint requirements,
- Identify and define physical interfaces and components, and
- Identify and define critical attributes of the physical components, including design budgets (e.g., weight, reliability) and open system principles.

Perceptual structures

The implicit nature of our daily surroundings often impedes individual perception. The shortage of learnt parameters, units of value and knowledge around spatial relationships and form making creates the basis for uncertainty in times of change and in urban decision-making processes. The creeping privatization of public space, the loss of common ground, issues of territory and privacy as well as the question of who determines and designs the physical and virtual realms increasingly escape the individual as well as the collective consciousness.

Space in architecture –Positive and negative space

One of the simplest yet least applied concepts in architecture is that of positive versus negative space. However esoteric it may sound, its applications to home and landscape design are immediate and tangible. The basic concept is simple. Imagine a rolled-out sheet of cookie dough. Think of positive space as being the cookies cut out from the dough, and negative space as the pointy scraps left behind.

In planning, just as in cookie cutting, the name of the game is to minimize the sharp-angled or unusable scraps of negative space that are left over. Alas, unlike baking, you can't just gather them up and knead them into more dough – you have to figure out what to do with them ahead of time. The desirability of positive space is rooted in the fact that nature's fundamental closed shape is the circle, or at least some approximation thereof. And regardless of how far man removes himself from his primitive beginnings, circular shapes remain the most psychologically comforting for human habitation – a fact borne out by the widespread persistence of circular dwellings, from the mud huts to yurts to igloos, despite the fact that they are not necessarily the simplest shapes to construct.

We in the industrialized nations, however, live in a rectilinear world that's chock full of negative space. Outdoors, common examples would include those useless slivers of side yard that zoning ordinances insist on having between houses – the house, in this case, being the "cookie". Inside, negative could include that dust-catching wedge of space under a stair, or that inaccessible corner of the living room that always seems to gather dust bunnies.

There are a few simple ways to avoid negative space in architecture:

• Avoid shapes having acute angles, both in plan and elevation. Modern architects were (some still are) smitten with acute angles precisely because they're rare in traditional architecture. But while razor-sharp angles make for cheap drama, they don't make for comfortable living – fact vernacular builders have recognized for centuries.

• Strive for areas with a circular sense of enclosure. The closer a room arrangement approaches a circular shape, the more comfortable it'll be. This doesn't mean the room itself should be rounded – just that the arrangement of the objects within it should be reasonably equidistant from a central focal point.

• Apply these concepts to exterior design as well. Take a typical rectangular plot of land with an ell-shaped house in the middle: the structure's presence necessarily subdivides the outdoor area into smaller rectangular pieces, many of them awkwardly proportioned.

What to do with these negative leftovers?

The best solution is to break down awkward negative spaces into a series of organically-shaped positive spaces – as many as are useful – and fill the leftover negative space with planting. Note that size doesn't determine whether the space is positive or negative; even a triangular scrap of land a few yards on a side could be transformed into positive space by adding, say, a garden bench comfortably surrounded by a cloak of plants.

Aesthetics: Visual perception

Visual perception is human's main source of information. Therefore understanding and modeling human interaction with environment, inevitably involves this subject. Developing models of visual perception is relevant to the diverse fields where human interaction with environment is concerned, such as cybernetics, robotics, medicine, architecture, and industrial design, making the subject an important one. Perception has been extensively treated in the literature, for instance in philosophy and psychology. Descriptions of the phenomenon in these fields are generally qualitative or statistical in nature. Despite their validity, descriptions of the basic nature of perception are lacking in precision. The same issue also applies to other areas dealing with perception, such as psychophysics and image processing [3-8], where the perception concept referred to is generally expressed not mathematically but linguistically. For instance, in the psychophysics and cognition works, brain processing in human visual system is explained via neurobiological terms rather than mathematical ones. Yet, establishing a model of human perception implies that the phenomenon should be treated in computational form for minimal ambiguity. Although image processing studies are a matter of computation, and they traditionally do make reference to biological vision in order to justify or have inspiration in the development of machine vision algorithms, the algorithms resemble to human vision only in a restricted sense. Generally an image processing algorithm singles-out a component of perception process occurring in human visual system. Examples are the ample edge detection studies in the literature, and works on recovering three-dimensional object information from two-dimensional image data, e.g. However, due to the specific nature of the image processing applications, there is no need on that the computations reflect some general characteristics of human vision that are due to the totality of interrelated brain processes. One of the most observable of such characteristics is the uncertainty of remembering visual information.

Protection from climate and other elements

There are other factors too, but the above predominate. These are also inter related and are to be properly coordinated in a successful design. However, in this paper it is intended to study the effect of climate on architectural expression of buildings.

As we know, the climatic conditions have almost remained the same throughout the ages, but the expression in architecture has varied due to various factors. These are mainly the building materials used, the method of construction adopted, and the economic and social conditions of the day. Considerable changes have taken place owing to the present-day technological developments, and hence the same old climatic conditions are being dealt with in the present-day, by different means and in different manner.

In these days of geodesic dome, shell roof and pre stressed concrete, very unusual and new forms have come into being. The new structural forms determine the design of buildings and the same are to be provided with suitable climatic protection.

Just as different buildings can be distinguished by their expression of purpose, like a school, office or a residence, the external appearance and the planning should also express the climate for which it is built. The effect of climate will determine the general planning and also the external treatment. Though all the sides of a building should have harmonious façade, the different faces may need a particular treatment according to its orientation.

Natural light and fresh air is desirable in buildings. In temperate climates where air-conditioning is not needed, free flow of natural air is sought for. The size and shape of windows will depend upon the amount of light and air desired to be admitted.

From time immemorial, different ways and means have been adopted to provide protection against sun. Awnings which form typical features of our tropical bazars, projected roof overhanging's which provide deep shadows, and well projected cornices and chhajjas have been freely used. Tropical countries in other parts of the world have similar methods. Such methods to suit the present-day conditions can be well adopted.

CLIMATIC REGIONS

Different climatic regions of India will have its own type of building. To suit the climatic and other conditions. The main regions are Delhi and Northern India Region, Central India Region, Bombay and Western Region, Madras and Southern Region, Calcutta and Eastern Region. Assam Region and other Hill Regions. It is not possible to go into detail for all types of problems in each of the regions in this paper and, therefore, only important features of some of the regions have been dealt with.

Architecture a part of the environment

Architecture and Environmental Studies are natural companions. It is impossible to design good buildings without understanding their relationship to natural systems. It is also impossible to understand the natural environment without knowing how human intervention affects it – both positively and negatively. As man and nature begin to recognize their interdependence, the study of environment takes on a whole new meaning. Architecture and the Environment encourages students to explore these relationships from a variety of perspectives.

Comfort factors

VISUAL COMFORT

To be able to see well enough in buildings is a fundamental need for occupants to do their work safely and comfortably or live comfortably in a pleasant environment. There should be efficient lighting provided which is not rather bright, nor rather dull. Glare will be caused if there is a big bright source of light and will give occupiers visual discomfort and might cause visual disability.

Efficient light is measured in lumens/mï¿½ or lux and generally described in terms of the illuminance which is the amount of light reaching a surface. A domestic 60W light bulb emits approximately 700 lumens. Different illuminance is required to do different tasks from moving around safely to do restoration work on a painting or using a sewing machine.

Building Regulations

1. “Light fittings including lamp, control gear, housing, reflector, shade, diffuser or other device of controlling the output light should only take lamps with a luminous efficiency greater than 40 lumens per circuit-watt”
2. “Fixed energy efficiency light fittings (one per 25mï¿½ dwelling floor area [excluding garages] and one per four fixed light fittings) should be installed in the most frequented locations in the dwelling.
3. “All areas that involve predominantly desk-based tasks(i.e. such as classrooms, seminar and all conference rooms- including those in schools) shall have a average efficiency of not less than 45 luminaire-lumens/circuit-wall (averaged over the area)”

VENTILATION AND AIR QUALITY

Definition of ventilation in Building Regulations is “the supply and removal of air (by natural and/or mechanical means) to and from a space or spaces in a building”

Additionally ventilation is used for accomplishing adequate air quality and extracting water vapour from wet areas such as bathrooms and kitchens in buildings. Air quality is judged firstly by smell, the symptoms of smoke, pollens or pollution are irritation to eyes, nose or throat.

Fresh air is needed for comfort to supply oxygen for respiration (0.2 litre/s per person). Additionally ventilation is a way of controlling thermal comfort. Approved Document F of Building Regulations emphasises that designers of a building are free to make a choice over the type of ventilation system for a specific building on the condition that the system meets the requirements and standards.

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

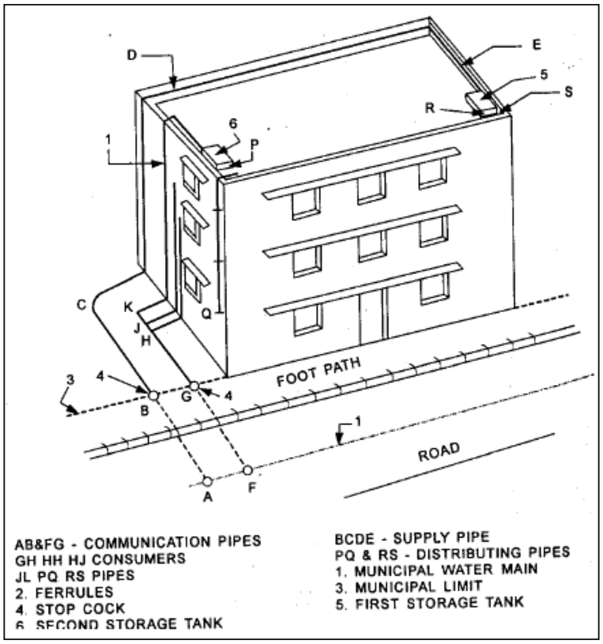
(i) **Inlet pipe:** Water enters the tank through the inlet pipe. A bell mouth is provided at the top of pipe and duct foot bend at bottom connecting horizontal and vertical pipes. A reflux valve is provided to prevent Water from returning into the pipe.

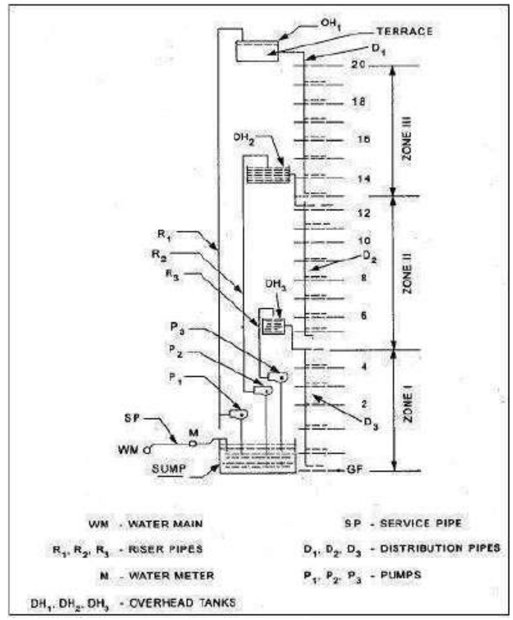
(ii) **Outlet pipe:** The water is drawn from the tank through the outlet pipe.

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

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

General layout of water supply arrangements single story buildings:
The plan of layout of water supply arrangements is as shown in fig.



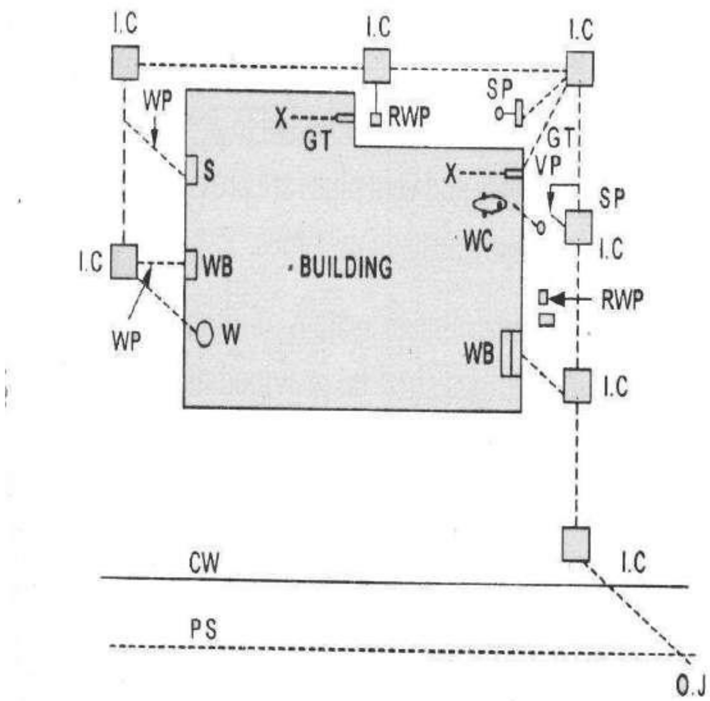


Drainage systems TO BUILDING:
The wastewater coming from Kitchens, Bathrooms, water Closets, Urinals etc. has to be properly drained in order to maintain healthy environment. If the waste water is not drained, it leads to stagnation in and around the building causing nuisance.
Requirements of good drainage 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.

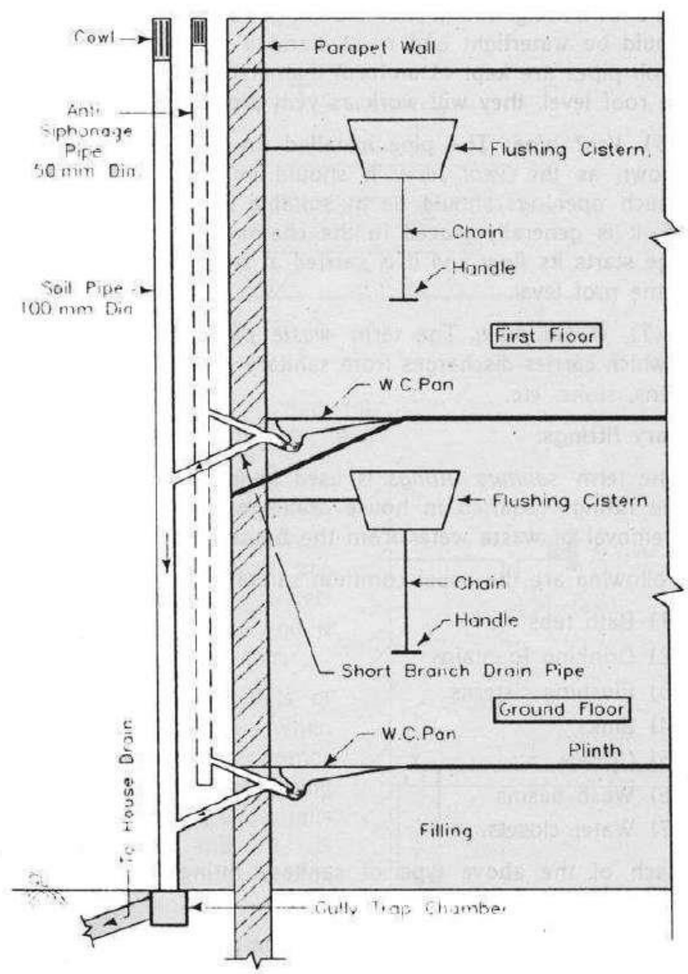
The following points should be considered in planning the layout of drainage connections to the various sanitary fittings

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

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

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.

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

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)

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.

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:

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.

- 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.

Unit-IV

Principles of architectural design – Definition of architecture, factors influencing architectural development, characteristics feature of style, historic examples, and creative principles. Principles of architectural composition – Unity, balance, proportion, scale, rhythm, harmony, Accentuation and contrast. Organizing principles in architecture-Symmetry, hierarchy, axis linear, concentric, radial, and asymmetric grouping, primary and secondary masses, Role of color, texture, shapes/forms in architecture. Architectural space and mass, visual and emotional effects of geometric forms, space activity and tolerance space. Forms related to materials and structural systems. Elements of architecture: Functions – Pragmatic utility, circulatory function, symbolic function, physiological function. Structure– Physical structure, Perceptual structures. Space in architecture –Positive and negative space. Aesthetics: Visual perception. Protective: Protection from climate and other elements, architecture a part of the environment. Comfort factors.

Definition of architecture

Architecture is the process and the product of planning, designing, and constructing buildings and other physical structures. Architectural works, in the material form of buildings, are often perceived as cultural symbols and as works of art. Historical civilizations are often identified with their surviving architectural achievements.

"Architecture" can mean:

- A general term to describe buildings and other physical structures.
- The art and science of designing buildings and (some) no building structures.
- The style of design and method of construction of buildings and other physical structures.
- A unifying or coherent form or structure
- Knowledge of art, science, technology, and humanity.
- The design activity of the architect, from the macro-level (urban design, landscape architecture) to the micro-level (construction details and furniture). The practice of the architect, where architecture means offering or rendering professional services in connection with the design and construction of buildings, or built environments.

Factors influencing architectural development

FACTORS THAT AFFECT DESIGN

Every project situation is different. Each presents a different set of requirements and limitations. Each presents a unique set of cultural, environmental, technological, and aesthetic contexts to be considered. Each presents its own set of challenges and opportunities. Design brings to the surface the major considerations inherent in a situation. It is a process that is both problem- seeking and problem-solving. While every project has a unique combination of design influences, some of the more important ones are discussed here.

Client

Some clients have a clear idea of a program, budget, and other project objectives, including the final appearance of the building. Others look to their architect to help them define the project objectives and to design a building that meets those objectives. In both cases the effectiveness of the relationship between client and architect is a major factor in making design decisions throughout the project.

Program

All clients have a series of aspirations, requirements, and limitations to be met in design. The program provides a place for identifying and delineating these factors and any number of related considerations. The program may be short or long, general or specific, descriptive of needs, or suggestive of solutions.

Community Concerns

Clients and their architects may need to adjust their designs to satisfy community groups, neighbors, and public officials. These design adjustments are often ad hoc efforts to meet objections or to gain support rather than direct responses to codified requirements.

Codes and Regulations

Regulatory constraints on design have increased steadily. Beginning with simple safety requirements and minimal land-use and light-and-air zoning, building codes and regulations have grown into a major force in design that regulates every aspect of design and construction.

Context and Climate

Contextual factors include the nature of the surrounding fabric of natural and built elements. Existing patterns and characteristics of this fabric can provide clues or starting points for approaching site development as well as the building design, influencing its configuration and use of materials, colors, and textures. Climatic factors include the nature of regional microclimates defined by solar radiation, temperatures, humidity, wind, and precipitation.

Site

These factors include site size; configuration; topography; geotechnical characteristics; ecological features, including vegetation, wildlife habitats, water elements, and drainage; and accessibility to property.

Building Technology

Building configuration, materials, and systems are rarely arbitrarily chosen and are only partially based on aesthetic criteria. For example, floor-to-floor height required to accommodate structural, mechanical, lighting and ceiling systems in a cost-effective manner varies significantly from an apartment house to an office building to a research facility. Similarly, office fenestration may be based on one module and housing on another module. In still other cases, these dimensions may be dictated largely by mechanical systems or even by the knowledge and preferences of the local construction industry.

Sustainability

In its broadest scope, sustainability refers to the ability of a society, ecosystem, or any such ongoing system to continue functioning into the future, without being forced into decline through exhaustion or overloading of the key resources on which that system depends. For architecture, this means design that delivers buildings and communities with lower environmental impacts while enhancing health, productivity, community and quality of life.

Cost

In most cases, there is a limit to the funds available for construction. Once defined, this limit has a major influence on subsequent design decisions, from building size and configuration to material selection and detailing. Although most budgets are fixed, (often by the amount of financing available) others may be flexible. For example, some owners are willing to increase initial budgets to achieve overall life-cycle cost savings.

Schedule

The demands and constraints set by the project schedule may influence how specific issues are explored and considered. For example, an alternative requiring a time-consuming zoning variance may be discarded in favor of one that can keep the project on schedule. Another example may include committing to a final site plan early in the process-before the building footprint on the site plan is fully designed.

Historic examples

Lotus Temple

The temple welcomes worshippers of all faiths The Lotus Temple is a Baha'i House of Worship in New Delhi consisting of 27 structures resembling petals of the lotus flower that open onto a central hall around 40m high. It has nine sides, nine doors, and can accommodate 2,500 people. It's surface is made of white marble from Mount Pantelakos in Greece, the same marble used to build the Parthenon. Since its completion in 1986 it has become one of the most visited buildings in the world, attracting over 100 million people.

Cologne Cathedral

Germany's most-visited landmark Cologne Cathedral is a High Gothic five-aisled basilica, the construction of which began in 1248 and stopped in 1473, before the building was complete. Work did not resume until the 1800s, and it was finally finished in 1880. Later work follows the original medieval plan faithfully.
It is renowned as a Gothic masterpiece and houses many works of art as well as the tombs of 12 archbishops.

Dome of the Rock, Jerusalem

The Dome of the Rock is a masterpiece of Islamic architecture A masterpiece of Islamic architecture, the Dome of the Rock is a 7th century building, located in Jerusalem. Built by Caliph Abd al-Malik between 687 and 691, the octagonal plan and the rotunda dome of wood are of Byzantine design. The Persian tiles on the exterior and the marble slabs that decorate the interior were added by Suleiman I in 1561.
The oldest extant Islamic monument, the Dome of the Rock has served as a model for architecture and other artistic endeavors for over a millennium.

La Pedrera, Barcelona

Gaudi's La Pedrera is one of the most imaginative houses in the history of architecture Nested among the urban streets of Barcelona are some unusual and beautiful buildings by infamous architect Antoni Gaudi. His unique approach to the Art Nouveau movement generated some of the most creative buildings the world has ever seen. And La Pedrera is no exception.

One of the most imaginative houses in the history of architecture, this is more sculpture than building. The façade is a varied and harmonious mass of undulating stone that, along with its forged iron balconies, explores the irregularities of the natural world. The United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized this building as World Heritage in 1984.

One World Trade Center, New York

The One World Trade Center is the tallest skyscraper in the Western Hemisphere. One World Trade Center the latest addition to New York's skyline, the One World Trade Center, is the tallest skyscraper in the Western Hemisphere. Construction began in April 2006 and the final component of the building's spire installed five years later in 2013, making it the fourth tallest skyscraper in the world.

The One World Trade Center's design is no coincidence, standing at a symbolic height of 1,776 feet (541m) in a direct nod to the year of the US Declaration of Independence.

Designed by David M Childs of Skidmore, Owings & Merrill, the 104-story glass tower raises from a cube base before transforming from the 20th floor into eight sleek isosceles triangles. Stood adjacent to the city's beautiful 9/11 memorial, the One World Trade Center is a shining beacon for the city.

St Paul's Cathedral, London

British architect Sir Christopher Wren took 10 years to finalize his designs for St Paul's London's most iconic building, St Paul's Cathedral, was designed by English architect Sir Christopher Wren. Sitting at the top of Ludgate Hill, the highest point in the City of London, its famous dome is one of the world's largest, measuring nearly 112 meters high.

The original church on the site was founded in the year 604AD. Work on the present English Baroque church began in the 17th Century by Christopher Wren as part of a major rebuilding program after the Great Fire of London. Wren started working on St Paul's in 1668, his designs for the cathedral taking a decade to complete and the actual construction taking a further 40 years. St Paul's has played an integral part of London life ever since – as a domineering element in the city's skyline, as a center for tourism and religious worship, and most recently as a focal point for anticapitalistic protests.

Petronas Towers, Kuala Lumpur

The Petronas Towers are an iconic landmark in Malaysia's capital city Kuala Lumpur Standing at 170 meters above ground; the Petronas Towers are twin skyscrapers in Kuala Lumpur, Malaysia. The buildings, which held the titled of tallest in the world between 1998-2004, are an iconic landmark of the capital city.

The distinctive postmodern style was created by architects Cesar Pelli and Achmad Murdijat, engineer Deejay Cerico and designer Dominic Saibo under the consultancy of JC Guinto.

The White House, Washington

The White House, designed by Irish architect James Hoban, took eight years to construct. Image © Matt Wade Irish architect James Hoban was the man behind the design of the White House. In 1792 Hoban submitted a plan for the presidential mansion and subsequently got the commission to build the White House. Constructed began in 1793 through to completion in 1801. The mansion, which has been home to every US leader since the country's second president John Adams, is made from white-painted Aqua sandstone.

Leaning Tower of Pisa

Due to restoration work carried out in 2001, the tower currently leans at just under 4 degrees. It is estimated that it will collapse in the next 75-100 years. Image

The Leaning Tower of Pisa is one of the most remarkable architectural structures in Europe. Most famous for its tilt, the tower began to lean during construction after soft ground on one side was unable to properly support the structure's weight.

Building work on the tower began in 1173 and went on for over a whopping 300 years. There has been much controversy surrounding the true identity of the architect behind the tower – the design originally attributed to artist Bonnano Pisano but studies have also implicated architect.

The Kaaba, Mecca

The Kaaba is a most sacred space in Islam the Kaaba, meaning cube in Arabic, is a square building located in Mecca, Saudi Arabia. A most sacred place in Islam, the Kaaba is elegantly draped in a silk and cotton veil. Every year millions of Muslims travel to the Kabba for the hajj, an annual Islamic pilgrimage to Mecca.

The small square building is about 60 feet high and it's walls a meter wide, with its total size occupying roughly 627 square feet.

Creative principles

Balance
Balance is the equal distribution of visual weight in a design. Visual balance occurs around a vertical axis; our eyes require the visual weight to be equal on the two sides of the axis. We are bilateral creatures and our sense of balance is innate. When elements are not balanced around a vertical axis, the effect is disturbing and makes us uncomfortable.

Proportion
Rhythm:

Continuity, recurrence or organized movement in space & time. Sequence is the experience of the rhythm. One space may have several different rhythms

Harmony:
The pleasing agreement of parts or combination of parts in a composition. Harmony involves the selection design of elements that share a common trait, however, Harmony becomes monotony without Variety. Common traits orientation colors or values shape/size materials variety: the extent of the differences in design elements -- visual interest is enhanced by introducing dissimilar elements and spatial arrangements.

Proportion is a central principle of architectural theory and an important connection between mathematics and art. It is the visual effect of the relationships of the various objects and spaces that make up a structure to one another and to the whole. These relationships are often governed by multiples of a standard unit of length known as a "module".[1]

Accentuation and contrast

- Mass composition with harmonious unity should create interest in the design so as to catch the attention of the observer.
- Monotony may reduce interest.
- Contrast reduces monotony.
- A well- conceived contrast of form, size, tone and direction may result in serious harm to unity. Such harms should be minimized.
- Contrast may be achieved in mass, in space, in mass and space, in surfaces, in color and with light.

Principles of Architecture: Accentuation and Rhythm

- After viewing any space (internally and externally) a person always has a special feeling about a special element.
- This feeling is because of the impression, emphasis, rigidity, firmness, function, decisively of the element.
- This emphasis of the element is termed as accentuation.
- Any repetitive occurrence of a particular pattern is called

Hierarchy

There are several ordering principles used by architects and art historians, but today we're only going to be dealing with one specific principle: hierarchy. Hierarchy describes components of a structure by how noticeable they are. The more obviously noticeable a component is, the more important it is to the architect and to the structure's overall aesthetic. Basically, hierarchy is about understanding how and why some parts carry more visual weight than others, and using that to create balanced (or unbalanced) structures, depending on your overall plans.

Axis: An axis is a central line that helps to organize a design. Often there is an axis at the center of a building or over a doorway. When architects use an axis or focal point in their design it acts like a straight arrow on a sign, pointing you in the right direction.

Symmetry: Symmetry refers to the geometry of a building and occurs if the building is the same on either side of an axis. There are many types of symmetry but the three that are most commonly used in architecture are lateral (the two sides are mirror images of each other), and can be vertical (up and down axis) or horizontal (across axis)

Radial

Radial structure, or graded centrality, is a primary feature of a prototype category. It is a center-periphery taxonomy with the abstract or schematic prototype placed at the center. Those instances of category C that display the highest degree of C-ness are placed towards the center, and are more prototypical instances of category C, while those that display a low degree of C-ness are placed towards the periphery, and are less prototypical instances of category C (and are often also extensions of the category).

Concentric
A structure in which approximately parallel layers of a mineral are arranged around a common center.

Asymmetric grouping
Asymmetry is the absence of, or a violation of, symmetry (the property of an object being invariant to a transformation, such as reflection). Symmetry is an important property of both physical and abstract systems and it may be displayed in precise terms or in more aesthetic terms. The absence of or violation of symmetry that are either expected or desired can have important consequences for a system.

Radial
The building's main advantage is the fact that the rooms can be simultaneously and flexibly used for different art productions and events by Radial system GmbH as well as by other users. The machine hall and boiler room of the former pumping station were transformed into a main hall of 600 square meters and a smaller hall of 400 square meters. The new addition provided the building with a foyer for visitors and artists, as well as wardrobes, office space and three studios facing south onto the Spree river: Studio A with 400 square meters, and Studios B and C with 200 square meters of space each. Also, there is a two story cube with a glass facade facing southwest, a 400 square meter covered deck and a large terrace by the banks of the Spree River with a boat landing. The former work quarter on the premises of RADIALSYSTEM. V. has been turned into a guest-house. All of this makes RADIALSYSTEM. V. an extremely attractive place during the entire year. RADIALSYSTEM. V. is a prime example of the successful metamorphosis of an industrial age building, allowing it to both tell and create history at the same time.

Primary and secondary masses
Primary vs Secondary Sources

When evaluating the quality of the information you are using, it is useful to identify if you are using a **Primary, Secondary, or Tertiary source**. By doing so, you will be able recognize if the author is reporting on his/her own first hand experiences, or relying on the views of others.

Source Type	Examples
Primary A primary source is a first person account by someone who experienced or witnessed an event. This original document has not been previously published or interpreted by anyone else.	• First person account of an event • First publication of a scientific study • Speech or lecture • Original artwork • Novel (fiction) or film • Handwritten manuscript • Letters between two people • A diary • Historical documents, e.g. Bill of Rights
Secondary A secondary source is one step removed from the primary original source. The author is reexamining, interpreting and forming conclusions based on the information that is conveyed in the primary source.	• Journal article reporting on a scientific study • Newspaper and Magazine articles • Review of a music CD or art show • Critique of a work of fiction or film

	• Biography
Tertiary A tertiary source is further removed from primary source. It leads the researcher to a secondary source, rather than to the primary source.	• Indexes and Bibliography • Encyclopedias and Dictionaries • Library catalog • Most textbooks • Guidebooks

Role of colour

Just as the visual artist has a palette of colors to work with when creating a work of art, the musical composer's palette consists of tone colors, also called timbres (TAM-bers). The timbre is defined by the type of waveform created by a particular instrument and the harmonics present in that sound. The basic waveform or timbre is often considered to be the sine wave, whose graph of pitch vs. time equals that of y=sin x. The description of a timbre as simple-sounding as that of a clarinet is actually enormously complex. Because of this, synthesized sounds are often rather different than acoustic sounds they attempt to emulate. Recent synthesizers use sampling, a method of recording real-life sounds and using them as a basis for synthesis. This allows modern synthesizers to create more authentic sounds.

Shape

Space exists in music as silence. In a work for a large group, the composer may instruct certain instruments to not play during specific passages to create different timbres of sound. Complete silence is often used for varying effects; In Mahler's third symphony the composer instructed the orchestra to maintain a silence of at least ten minutes between two movements to create a perceptual separation. John Cage wrote a piece called _4'33"_ which involves a pianist to sit silently at the piano for more than four and a half minutes. (It should be noted, however, that Cage was not actually writing complete silence; he intended that the music consist of the background noises of the performing area.)

Texture

The musical counterpart of texture is harmony. Harmony is the sounding of more than one note at an instant of time. The harmonic series, which is the set of pitches created by continuously dividing a vibrating string in half, is the basis for harmony in all cultures. The concepts of consonance and dissonance are based on the perception of different harmonies and are grounded in the harmonic series.

Architectural space and mass

Form and Shape occur on many different levels in music. At the most basic level, each note has a shape, commonly called an envelope. The envelope is usually divided into four parts:

- Attack, which is the speed at which the volume increases from silence to full volume ("tah" has a short attack; "lah" has a long attack);
- Decay, which is the speed at which the volume decreases from the initial burst of sound to the sustaining volume;
- Sustain, which is the volume level at which the sound settles after the initial attack; and
- Release, which is the speed at which the volume discourses from the sustaining volume to silence.

The envelope is often considered to be part of the timbre of a particular sound. Much like tone color, envelopes can be extremely complex; many sounds actually consist of several envelopes sounding at once or in succession.

Another, more obvious instance of form and shape in music is the form of a musical piece as a whole. Some of the more popular forms in western history include binary form (AABB), sonata form (ABCAB'), rondo form (ABACADA), and modern song form (ABABCBB). Form can exist on larger levels, such as the overall form of multi movement works, operas or cyclic works. This aspect of form, however, might be better listed as a Principle of Design.

Visual and emotional effects of geometric forms

According to the literature, simple shapes induce emotional responses. Current evaluations suggest that humans consider angular shapes as “bad” and curvilinear forms as “good,” but no behavioral data are available to support this hypothesis. Atypical development, such as autism spectrum disorder (ASD), could modify humans’ perception of visual stimuli and thereby their emotional effect. This study assessed the effects of simple stimuli (i.e., jagged edges shape, disk, star, spiral, eye-like shape, and head character) on the emotional responses of different groups of humans. First, we assessed the effects of a looming movement on neurotypical adults’ emotional responses. Second, we assessed the effects of atypical development on emotional responses by comparing the reactions of neurotypical children and of children with ASD. We used different methodological approaches: self-evaluation through questionnaires and direct observation of participants’ behavior. We found that (1) neurotypical adults tended to perceive looming stimuli negatively as they associated more negative feelings with them although few behavioral responses could be evidenced and (2) the emotional responses of neurotypical children and of children with ASD differed significantly. Neurotypical children perceived the spiral stimulus positively, i.e., a curvilinear shape, whereas children with ASD perceived the jagged edges stimulus positively, i.e., an angular shape. Although neurotypical children and children with ASD presented some behavioral responses in common, children with ASD smiled and vocalized more than did neurotypical children during stimuli presentations. We discuss our results in relation to the literature on humans’ perception of simple shapes and we stress the importance of studying behavioral components for visual cognition research.

Space architecture, in its simplest definition, is the theory and practice of designing and building inhabited environments in outer space.

The architectural approach to spacecraft design addresses the total built environment. It is mainly based on the field of engineering (especially aerospace engineering), but also involves diverse disciplines such as physiology, psychology, and sociology. Like architecture on Earth, the attempt is to go beyond the component elements and systems and gain a broad understanding of the issues that affect design success.[2] Much space architecture work has been in designing concepts for orbital space stations and lunar and Martian exploration ships and surface bases for the world's space agencies, chiefly NASA.

The practice of involving architects in the space program grew out of the Space Race, although its origins can be seen much earlier. The need for their involvement stemmed from the push to extend space mission durations and address the needs of astronauts including but beyond minimum survival needs. Space architecture is currently represented in several institutions. The Sasakawa International Center for Space Architecture (SICSA) is an academic organization with the University of Houston that offers a Master of Science in Space Architecture. SICSA also works design contracts with corporations and space agencies. In Europe, International Space University is deeply involved in space architecture research. The International Conference on Environmental Systems meets annually to present sessions on human spaceflight and space human factors. Within the American Institute of Aeronautics and Astronautics, the Space Architecture Technical Committee has been formed. Despite the historical pattern of large government-led space projects and university-level conceptual design, the advent of space tourism threatens to shift the outlook for space architecture work.

Forms related to materials and structural systems

Columns

Columns are elements that carry only axial force (compression) or both axial force and bending (which is technically called a beam-column but practically, just a column). The design of a column must check the axial capacity of the element, and the buckling capacity.

The buckling capacity is the capacity of the element to withstand the propensity to buckle. Its capacity depends upon its geometry, material, and the effective length of the column, which depends upon the restraint conditions at the top and bottom of the column. The effective length is where the real length of the column is and K is the factor dependent on the restraint conditions.

The capacity of a column to carry axial load depends on the degree of bending it is subjected to, and vice versa. This is represented on an interaction chart and is a complex non-linear relationship.

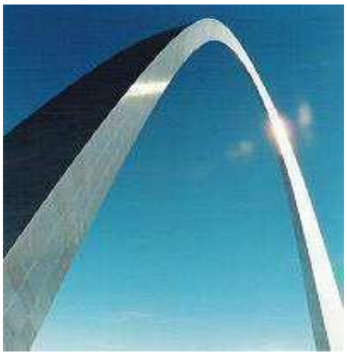
Beams

A beam may be defined as an element in which one dimension is much greater than the other two and the applied loads are usually normal to the main axis of the element. Beams and columns are called line elements and are often represented by simple lines in structural modeling.

- cantilevered (supported at one end only with a fixed connection)
- simply supported (fixed against vertical translation at each end and horizontal translation at one end only, and able to rotate at the supports)
- fixed (supported in all directions for translation and rotation at each end)
- continuous (supported by three or more supports)
- a combination of the above (ex. supported at one end and in the middle)

Beams are elements which carry pure bending only. Bending causes one part of the section of a beam (divided along its length) to go into compression and the other part into tension. The compression part must be designed to resist buckling and crushing, while the tension part must be able to adequately resist the tension.

Trusses



A truss is a structure comprising members and connection points or nodes. When members are connected at nodes and forces are applied at nodes members can act in tension or in compression. Members acting in compression are referred to as compression members or struts while members acting in tension are referred to as tension members or ties. Most trusses use gusset plates to connect intersecting elements. Gusset plates are relatively flexible and unable to transfer bending moments. The connection is usually arranged so that the lines of force in the members are coincident at the joint thus allowing the truss members to act in pure tension or compression.

Trusses are usually utilized in large-span structures, where it would be uneconomical to use solid beams.

Plates

Plates carry bending in two directions. A concrete flat slab is an example of a plate. Plates are understood by using continuum mechanics, but due to the complexity involved they are most often designed using a codified empirical approach, or computer analysis.

They can also be designed with yield line theory, where an assumed collapse mechanism is analyzed to give an upper bound on the collapse load (see Plasticity). This technique is used in practice [8] but because the method provides an upper-bound, i.e. an unsafe prediction of the collapse load, for poorly conceived collapse mechanisms great care is needed to ensure that the assumed collapse mechanism is realistic.[9]

Shells

Shells derive their strength from their form, and carry forces in compression in two directions. A dome is an example of a shell. They can be designed by making a hanging-chain model, which will act as a catenary in pure tension, and inverting the form to achieve pure compression.

Arches

Arches carry forces in compression in one direction only, which is why it is appropriate to build arches out of masonry. They are designed by ensuring that the line of thrust of the force remains within the depth of the arch. It is mainly used to increase the bountifulness of any structure.

Catenaries

Catenaries derive their strength from their form, and carry transverse forces in pure tension by deflecting (just as a tightrope will sag when someone walks on it). They are almost always cable or fabric structures. A fabric structure acts as a catenary in two directions.

Elements of architecture: Functions – Pragmatic utility

The Elements

These elements are the bare essentials and hold the greatest importance in a work. There are 6 main elements and form, space are some of them. The other 5 more elements include dot, line, shape, texture, and color. All works should incorporate these elements in the design because it defines the creation on the platform of art and functionality it stands on.

Dot

A dot is a mark that is shows the beginning of a work or the end of it. It is the very basic element whereby an art work or a design starts. Nothing will be done without the dots. It's the basic. One dot marks a point where people will look and concentrate at as it directs attentions. Dots are used to amplify perception and it does not mean one dot, a dot in architecture can mean a center or a mole or a concentration of forms or objects near or close together. Dots that are aligned together create a line. Dots are use to create feel or texture to create form, space and texture. Dots are used to create tones and more. One dot is a point, a number of dots create different elements that are important to showcase a design. A dot does not mean that it is rounded, it dot can have any shape imaginable. A dot just means a point or a mark and that mark could be a circle, triangular, square or uneven shapes. The main purpose of the dot is there regardless of its shape.

Line

A line is a combination of a series of dots that are continuous, with an exact distance in between each dot. They are a number of lines that are all around us, they vary from size of its thickness to the smoothness of the line: lines can be jagged, twisted, and bold or anything. Line can be the outer layer of a form. It defines a shape and also space. Lines creates shapes, Lines could also show texture, lines creates patterns, Lines create color tones, lines create texture and space, line creates form and texture, line creates form and patterns and most importantly lines creates form and space. By using the right lines in a work, you are able to create something that has all of the elements which include the above: form, texture, tone, pattern, space and movement.

Shape

Shape is the creation when the end of a line meets the start of that line itself. Shape can be just a flat plane that is surrounded by outer line and does not hold any mass. Shape is perceived as an idea of the form or how it looks. Shape is composed in positive and negative shapes. Positive shapes mean the shape of the object on the area it is located. Negative shapes are the shape of the area the object is on. Normally to emphasize on the object or area, they are usually darken to show concentration.

Form

From the evolution of dot, to lines, and to shape; it evolved from 1 dimension (dot &line) to 2 dimension (shape) and form is the 3 dimensional combination of the previous products. Form has an area, height, mass and more than one surface. The outline is a forms structure and form will have a different perspective from different point of view, front, left, right, rear, top and bottom. In terms of presentation of form, it is done by using a few elements such as lines, renderings, and texture and tone value.

Texture

Normally we define texture as feel of the surface of an object. Texture is everywhere from every material and object whether it was man-made or natural. Texture give a sense of individuality on the material and using the right material on a design will help emphasize and create a feel that is called home or anything that the space is design for. Texture tells a whole lot more than just feel, it tells emotions and thoughts. Rough edges tell of anger and masculinity, and smooth surfaces are the opposite.

Color

Color is the most important element in the creation of a work. Color has the power to influence and brings out our feelings. Take for example, bright colors creates a sense of joy and happiness. Dark and gloomy colors create a sense of sadness and dread.

Circulatory function

In architecture, **circulation** refers to the way people move through and interact with a building.[1] In public buildings, circulation is of high importance; Structures such as elevators, escalators, and staircases are often referred to as circulation elements, as they are positioned and designed to optimize the flow of people through a building, sometimes through the use of a core.

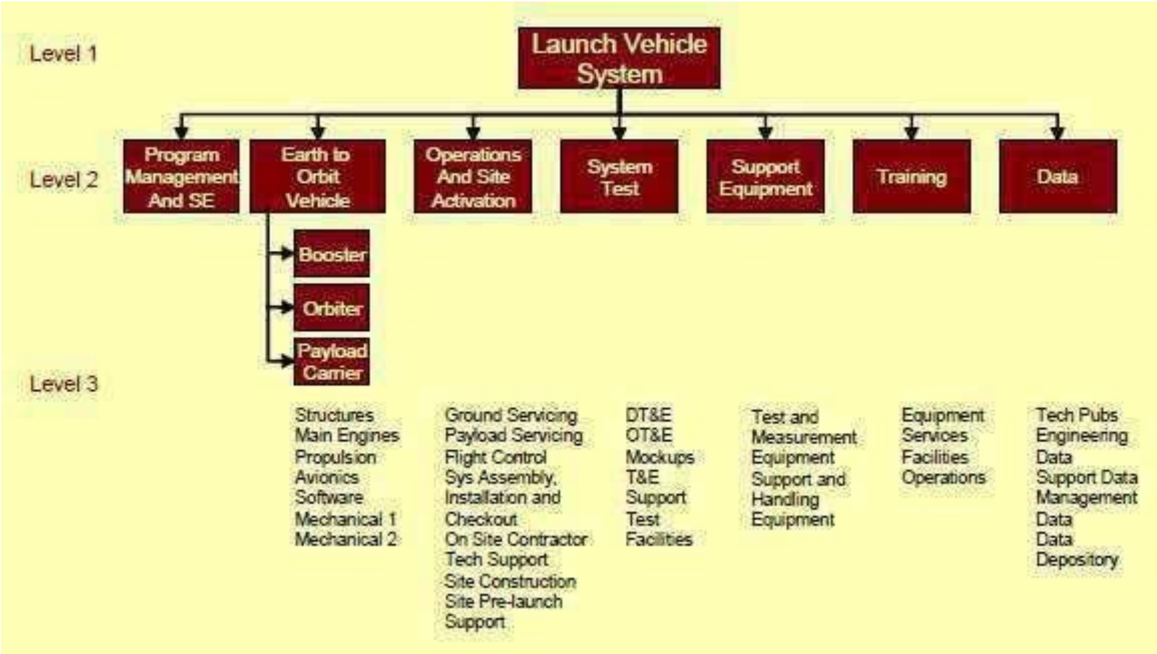
Symbols of function

Society requires that architecture not only communicate the aspirations of its institutions but also fulfill their practical needs. Differences in expression, apart from differences in planning, distinguish the forms of architectural types (the house from the church, etc.), the kinds of use (the Catholic from the Protestant church), and the traditions and customs of users (the English from the Swiss Protestant church). When architectural forms become the vehicles of content—in plan, elevation, and decoration—they are symbolic. Their symbolism can be understood consciously or unconsciously, by association (*e.g.,* spire = church) to a building one has seen before and by the fact that it suggests certain universal experiences (*e.g.,* vertical forms "rise"; low roofs "envelop"). One comprehends the meaning of symbols that are new, as well as those that are known, by association, because the laws of statics restrain builders from putting them into forms so completely unfamiliar that they do not suggest some tradition, just as the structure of language permits endless new meanings but retains a fairly constant vocabulary. The meaning of architectural symbols—or of words—may even change, but the process must be both logical and gradual, for, if the change is irrational, the purpose—communication—is lost.

Physiological function

Physical structure

The physical architecture is the physical layout of a system and its components in a schema. It refers to some representation of the structure or organization of the physical elements of the system. The physical architecture should be part of the Allocated and Product.



The development of the physical architecture consists of one or more logical models or views of the physical solution. The logical models or views may consist of conceptual design drawings, schematics, and block diagrams that define the systems form and the arrangement of the system components and associated interfaces. The development of a physical architecture is an iterative and recursive process and will evolve together with the requirements and functional architecture. Development of the physical architecture is complete when the system has been decomposed down to lowest system element or configuration item level, and it is critical that this process identify the design drivers as early as possible. Therefore, it is imperative that the driving requirements be identified and the combined processes—Stakeholder Requirements Definition, Requirements Analysis, and Architecture Design—will provide key insights to risk early in the development life cycle, allowing for mitigating strategies. [1]

Key activities performed when developing a physical architecture and design includes:

- Analysis and synthesis of the physical architecture and the appropriate allocation,
- Analysis of the constraint requirements,
- Identify and define physical interfaces and components, and
- Identify and define critical attributes of the physical components, including design budgets (e.g., weight, reliability) and open system principles.

Perceptual structures

The implicit nature of our daily surroundings often impedes individual perception. The shortage of learnt parameters, units of value and knowledge around spatial relationships and form making creates the basis for uncertainty in times of change and in urban decision-making processes. The creeping privatization of public space, the loss of common ground, issues of territory and privacy as well as the question of who determines and designs the physical and virtual realms increasingly escape the individual as well as the collective consciousness.

Space in architecture –Positive and negative space

One of the simplest yet least applied concepts in architecture is that of positive versus negative space. However esoteric it may sound, its applications to home and landscape design are immediate and tangible. The basic concept is simple. Imagine a rolled-out sheet of cookie dough. Think of positive space as being

the cookies cut out from the dough, and negative space as the pointy scraps left behind.
In planning, just as in cookie cutting, the name of the game is to minimize the sharp-angled or unusable scraps of negative space that are left over. Alas, unlike baking, you can't just gather them up and knead them into more dough – you have to figure out what to do with them ahead of time. The desirability of positive space is rooted in the fact that nature's fundamental closed shape is the circle, or at least some approximation thereof. And regardless of how far man removes himself from his primitive beginnings, circular shapes remain the most psychologically comforting for human habitation – a fact borne out by the widespread persistence of circular dwellings, from the mud huts to yurts to igloos, despite the fact that they are not necessarily the simplest shapes to construct.
We in the industrialized nations, however, live in a rectilinear world that's chock full of negative space. Outdoors, common examples would include those useless slivers of side yard that zoning ordinances insist on having between houses – the house, in this case, being the "cookie". Inside, negative could include that dust-catching wedge of space under a stair, or that inaccessible corner of the living room that always seems to gather dust bunnies.
There are a few simple ways to avoid negative space in architecture:
• Avoid shapes having acute angles, both in plan and elevation. Modern architects were (some still are) smitten with acute angles precisely because they're rare in traditional architecture. But while razor-sharp angles make for cheap drama, they don't make for comfortable living – fact vernacular builders have recognized for centuries.
• Strive for areas with a circular sense of enclosure. The closer a room arrangement approaches a circular shape, the more comfortable it'll be. This doesn't mean the room itself should be rounded – just that the arrangement of the objects within it should be reasonably equidistant from a central focal point.
• Apply these concepts to exterior design as well. Take a typical rectangular plot of land with an ell-shaped house in the middle: the structure's presence necessarily subdivides the outdoor area into smaller rectangular pieces, many of them awkwardly proportioned.
What to do with these negative leftovers?
The best solution is to break down awkward negative spaces into a series of organically-shaped positive spaces – as many as are useful – and fill the leftover negative space with planting. Note that size doesn't determine whether the space is positive or negative; even a triangular scrap of land a few yards on a side could be transformed into positive space by adding, say, a garden bench comfortably surrounded by a cloak of plants.

Aesthetics: Visual perception
Visual perception is human's main source of information. Therefore understanding and modeling human interaction with environment, inevitably involves this subject. Developing models of visual perception is relevant to the diverse fields where human interaction with environment is concerned, such as cybernetics, robotics, medicine, architecture, and industrial design, making the subject an important one. Perception has been extensively treated in the literature, for instance in philosophy and psychology. Descriptions of the phenomenon in these fields are generally qualitative or statistical in nature. Despite their validity, descriptions of the basic nature of perception are lacking in precision. The same issue also applies to other areas dealing with perception, such as psychophysics and image processing [3-8], where the perception concept referred to is generally expressed not mathematically but linguistically. For instance, in the psychophysics and cognition works, brain processing in human visual system is explained via neurobiological terms rather than mathematical ones. Yet, establishing a model of human perception implies that the phenomenon should be treated in computational form for minimal ambiguity. Although image processing studies are a matter of computation, and they traditionally do make reference to biological vision in order to justify or have inspiration in the development of machine vision algorithms, the algorithms resemble to human vision only in a restricted sense. Generally an image processing algorithm singles-out a component of perception process occurring in human visual system. Examples are the ample edge detection studies in the literature, and works on recovering three-dimensional object information from two-dimensional image data, e.g. However, due to the specific nature of the image processing applications, there is no need on that the computations reflect some general characteristics of human

vision that are due to the totality of interrelated brain processes. One of the most observable of such characteristics is the uncertainty of remembering visual information.

Protection from climate and other elements

There are other factors too, but the above predominate. These are also inter related and are to be properly coordinated in a successful design. However, in this paper it is intended to study the effect of climate on architectural expression of buildings.

As we know, the climatic conditions have almost remained the same throughout the ages, but the expression in architecture has varied due to various factors. These are mainly the building materials used, the method of construction adopted, and the economic and social conditions of the day. Considerable changes have taken place owing to the present-day technological developments, and hence the same old climatic conditions are being dealt with in the present-day, by different means and in different manner.

In these days of geodesic dome, shell roof and pre stressed concrete, very unusual and new forms have come into being. The new structural forms determine the design of buildings and the same are to be provided with suitable climatic protection.

Just as different buildings can be distinguished by their expression of purpose, like a school, office or a residence, the external appearance and the planning should also express the climate for which it is built. The effect of climate will determine the general planning and also the external treatment. Though all the sides of a building should have harmonious façade, the different faces may need a particular treatment according to its orientation.

Natural light and fresh air is desirable in buildings. In temperate climates where air-conditioning is not needed, free flow of natural air is sought for. The size and shape of windows will depend upon the amount of light and air desired to be admitted.

From time immemorial, different ways and means have been adopted to provide protection against sun. Awnings which form typical features of our tropical bazars, projected roof overhanging's which provide deep shadows, and well projected cornices and chhajjas have been freely used. Tropical countries in other parts of the world have similar methods. Such methods to suit the present-day conditions can be well adopted.

CLIMATIC REGIONS

Different climatic regions of India will have its own type of building. To suit the climatic and other conditions. The main regions are Delhi and Northern India Region, Central India Region, Bombay and Western Region, Madras and Southern Region, Calcutta and Eastern Region. Assam Region and other Hill Regions. It is not possible to go into detail for all types of problems in each of the regions in this paper and, therefore, only important features of some of the regions have been dealt with.

Architecture a part of the environment

Architecture and Environmental Studies are natural companions. It is impossible to design good buildings without understanding their relationship to natural systems. It is also impossible to understand the natural environment without knowing how human intervention affects it – both positively and negatively. As man and nature begin to recognize their interdependence, the study of environment takes on a whole new meaning. Architecture and the Environment encourages students to explore these relationships from a variety of perspectives.

Comfort factors

VISUAL COMFORT

To be able to see well enough in buildings is a fundamental need for occupants to do their work safely and comfortably or live comfortably in a pleasant environment. There should be efficient lighting provided

which is not rather bright, nor rather dull. Glare will be caused if there is a big bright source of light and will give occupiers visual discomfort and might cause visual disability.
Efficient light is measured in lumens/mï¿½ or lux and generally described in terms of the illuminance which is the amount of light reaching a surface. A domestic 60W light bulb emits approximately 700 lumens. Different illuminance is required to do different tasks from moving around safely to do restoration work on a painting or using a sewing machine.

Building Regulations

1. “Light fittings including lamp, control gear, housing, reflector, shade, diffuser or other device of controlling the output light should only take lamps with a luminous efficiency greater than 40 lumens per circuit-watt”
2. “Fixed energy efficiency light fittings (one per 25mï¿½ dwelling floor area [excluding garages] and one per four fixed light fittings) should be installed in the most frequented locations in the dwelling.
3. “All areas that involve predominantly desk-based tasks(i.e. such as classrooms, seminar and all conference rooms- including those in schools) shall have a average efficiency of not less than 45 luminaire-lumens/circuit-wall (averaged over the area)”

VENTILATION AND AIR QUALITY

Definition of ventilation in Building Regulations is “the supply and removal of air (by natural and/or mechanical means) to and from a space or spaces in a building”
Additionally ventilation is used for accomplishing adequate air quality and extracting water vapour from wet areas such as bathrooms and kitchens in buildings. Air quality is judged firstly by smell, the symptoms of smoke, pollens or pollution are irritation to eyes, nose or throat.

Fresh air is needed for comfort to supply oxygen for respiration (0.2 litre/s per person). Additionally ventilation is a way of controlling thermal comfort. Approved Document F of Building Regulations emphasises that designers of a building are free to make a choice over the type of ventilation system for a specific building on the condition that the system meets the requirements and standards.

Unit: - V

Perspective Drawing and Town Planning- Elements of perspective drawing involving simple problems, one point and two point perspectives, energy efficient buildings. Concepts of master plan, structure plan, detailed town planning scheme and action plan, estimating future needs - planning standards for different land use, allocation for commerce, industries, public amenities, open areas etc., planning standards for density distributions, density zones, planning standards for traffic network, standard of roads and paths, provision for urban growth, growth models, plan implementation, town planning legislation and municipal acts, panning of control development schemes, urban financing, land acquisition, slum clearance schemes, pollution control aspects

Elements of perspective drawing involving simple problems

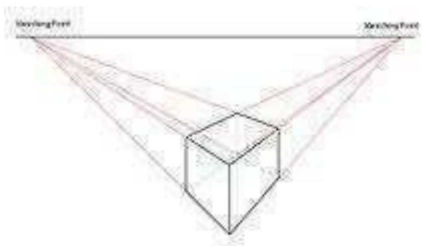
PERSPECTIVE DRAWING is a technique used to represent three-dimensional images on a two-dimensional picture plane. In our series of lessons on perspective drawing we explain the various methods of constructing an image with perspective and show how these are used by artists and illustrators.

One-point perspective

A drawing has one-point perspective when it contains only one vanishing point on the horizon line. This type of perspective is typically used for images of roads, railway tracks, hallways, or buildings viewed so that the front is directly facing the viewer. Any objects that are made up of lines either directly parallel with the viewer's line of sight or directly perpendicular (the railroad slats) can be represented with one-point perspective. These parallel lines converge at the vanishing point.

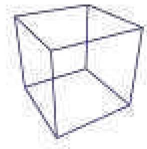
Two-point perspective

A drawing has two-point perspective when it contains two vanishing points on the horizon line. In an illustration, these vanishing points can be placed arbitrarily along the horizon. Two-point perspective can be used to draw the same objects as one-point perspective, rotated: looking at the corner of a house, or at two forked roads shrinking into the distance, for example. One point represents one set of parallel lines, the other point represents the other. Seen from the corner, one wall of a house would recede towards one vanishing point while the other wall recedes towards the opposite vanishing point.



Three-point perspective

Three-point perspective is often used for buildings seen from above (or below). In addition to the two vanishing points from before, one for each wall, there is now one for how the vertical lines of the walls recede. For an object seen from above, this third vanishing point is below the ground. For an object seen from below, as when the viewer looks up at a tall building, the third vanishing point is high in space.



Four-point perspective

Four-point perspective, also called infinite-point perspective, is the curvilinear (see curvilinear perspective) variant of two-point perspective. A four-point perspective image can represent a 360° panorama, and even beyond 360° to depict impossible scenes. This perspective can be used with either a horizontal or a vertical horizon line: in the latter configuration it can depict both a worm's-eye and bird's-eye view of a scene at the same time.

Energy efficient buildings

1. the energy needed to fulfill the user's requirements for heating, lighting, cooling etc., according to levels that are specified for the purposes of the calculation
2. The "natural" energy gains – passive solar, ventilation cooling, daylight, etc. together with internal gains (occupants, lighting, electrical equipment, etc.)
3. the building's net energy use, obtained from and along with the characteristics of the building itself
4. the delivered energy, represented separately for each energy carrier, inclusive of auxiliary energy, used by heating, cooling, ventilation, hot water and lighting systems, taking into account renewable energy sources and cogeneration. This may be expressed in energy units or in units of the energy ware (kg, m^3, kWh, etc.)
5. renewable energy produced on the building premises
6. generated energy, produced on the premises and exported to the market; this can include part of
7. represents the primary energy usage or the CO_2 emissions associated with the building
8. represents the primary energy or emissions associated with on-site generation that is used on-site and so is not subtracted from
9. represents the primary energy or CO_2 savings associated with exported energy, which is subtracted from

Concepts of master plan

A master plan is an overarching planning document and spatial layout which is used to structure land use and development. 'Master plan' is an all-encompassing term. Its scope can range from 10 year implementation at the regional scale, to an illustrative plan of small scale groups of buildings. There is no formal process for master planning and every design team will have their own individual approach. In order to demonstrate the opportunities for maximizing the benefits of combining Suds with the design vision, a typical master planning process has been developed, and it is shown here. Stages A – B form the preparation stages of the process, where the brief for the master plan is developed and the baseline analysis is conducted. Stages C – E step through the design process, moving from strategic land use arrangements to a concept design of streets and buildings. Broadly speaking, there are three key land use components to consider in the master planning process as design moves towards more detailed proposals

Concepts of structure plan

Structure Planning is a type of spatial planning and is part of urban planning practice in the United Kingdom and Western Australia. A structure plan in any jurisdiction will usually consist of a written component, supported by maps, photographs, sketches, tables and diagrams and a 'plan' component consisting of one or more plans illustrating land use and infrastructure proposals for the area being planned.

Detailed town planning scheme and action plan

DETAILED PLANNING SCHEMES Currently, there are many approved detailed planning schemes, some of which have been implemented but there are many more planning schemes which have not been adopted for implementation. Consequently spatial growth proceeds unguided with conspicuous negative implications to people and the urban environment. This situation is a result of the following reasons, among others:

- Inadequate involvement of stakeholders in plan making
- Disregard of land rights and other interests in land during plan preparation
- Planning schemes are not displayed in affected localities
- Lack of awareness about existence of a planning scheme
- Schemes are not prepared in a form that display the expected spatial outlook (image)
- Schemes are not accompanied by infrastructure investment plans and budgets
- Lack of resources for settlement of third party interests to secure public land and carry out cadastral survey
- Poor coordination among developers and utility agencies
- Poor enforcement of development control measures there are however potentials that could be harnessed to redress the situation such as the high demand for building land and the existence of resources among potential developers. The aim and objectives of these guidelines are thus to facilitate preparation and implementation of detailed planning schemes for new areas which will create conducive environment for human habitation and contribute to sustainable development.

Planning standards for different land use

Various types of planning have emerged over the course of the 20th century. Below are the six main typologies of planning, as defined by David Walters in his book, *Designing Communities* (2007):

- *Traditional or comprehensive planning*: Common in the US after World War II, characterized by politically neutral experts with a rational view of the new urban development. Focused on producing clear statements about the form and content of new development.
- *Systems planning*: 1950s–1970s, resulting from the failure of comprehensive planning to deal with the unforeseen growth of post-World War II America. More analytical view of the planning area as a set of complex processes, less interested in a physical plan.
- *Democratic planning*: 1960s. Result of societal loosening of class and race barriers. Gave more citizens a voice in planning for future of community.
- *Advocacy and equity planning*: 1960s & 70s. Strands of democratic planning that sought specifically to address social issues of inequality and injustice in community planning.

- *Strategic planning*: 1960s-present. Recognizes small-scale objectives and pragmatic real-world constraints.
- *Environmental planning*: 1960s-present. Developed as many of the ecological and social implications of global development were first widely understood.
- Tenure responsive planning: 2015-onwards. It recognizes that land use planning should be collaborative but with the purpose of tenure security improvement. This is a hybrid approach whereby traditional, advocacy, democratic and bottom-up efforts are merged in such a way that they focus towards tenure security outcomes.

Today, successful planning involves a balanced mix of analysis of the existing conditions and constraints; extensive public engagement; practical planning and design; and financially and politically feasible strategies for implementation.

Current processes include a combination of strategic and environmental planning. It is becoming more widely understood that any sector of land has a certain capacity for supporting human, animal, and vegetative life in harmony, and that upsetting this balance has dire consequences on the environment. Planners and citizens often take on an advocacy role during the planning process in an attempt to influence public policy. Due to a host of political and economic factors, governments are slow to adopt land use policies that are congruent with scientific data supporting more environmentally sensitive regulations.

Since the 1990s, the activist/environmentalist approach to planning has grown into the Smart Growth movement, characterized by the focus on more sustainable and less environmentally damaging forms of development.

Estimating future needs

- Mortality forecasting models assuming well-established cohort patterns, for instance for the 1930s ‘golden generations’, are oversimplified and considerably less firm than often claimed. The assumption that improvement in mortality will slow down may require re-consideration
- Policies on long-term care have influenced alternative living arrangements for older people, even though the trend towards residential independence continues
- Demand for informal care by disabled older people from their adult children is projected to rise faster than supply over the next 20 years, with a ‘tipping point’ reached after 2017
- The numbers of disabled older people will increase sharply, but the average number of years people live with disability will not alter
- Halving dementia-related disability could reduce the size of the disabled older population by 10 per cent. A shorter period of disability at the oldest ages seems attainable, but only through halving the prevalence of major diseases which would require major advances in preventive and treatment strategies
- Changing demographics will affect family relationships and availability of kin, and lead to patterns of more complex relationships involving step-children, half siblings and former partners
- Despite high mortality rates, 36 per cent of women and 26 per cent of men in institutional care in 2001 were still alive three years later - a finding relevant to both families and service providers planning financing of care.

Allocation for commerce

E-commerce has become one of the fastest-growing industries in the past few years. As per the stats, 60% of buyers plan to spend more money via online shopping. There is no doubt that developing an e-commerce website is the latest trend for online businesses. In this blog, we will analyze the 6 key factors to the success of an online store.

1. Platform and Theme

Choosing an appropriate platform is the first and foremost step you need to do to build a sales-driven e-commerce site. There are various platforms to choose from: WordPress, Magneto, Shopify, Joomla, Drupal, Zen Cart, Open Cart, ecommerce, etc.

WordPress is considered to be one of the best platforms for e-commerce websites. Nowadays, WordPress is not only used for blogging; it is also used for news magazine, portfolio and e-commerce purposes. Its popularity can be shown by the fact that there are over 140 million installations of WordPress. One-sixth of all sites, in the top million sites by traffic, are powered by WordPress. WordPress easily integrates e-commerce themes and plugins to customize the appearance of the frontend and functionality in the backend, and therefore maximize e-commerce functionalities.

Allocation for industries

The free allocation for each installation is calculated using benchmarks developed for each product, as far as possible. The current 54 benchmarks (52 product and 2 so-called fallback approaches based on heat and fuel) were elaborated based on extensive technical work.

Generally speaking, a product benchmark is based on the average greenhouse gas emissions of the best performing 10% of the installations producing that product in the EU.

The benchmarks are based on the principle of 'one product = one benchmark'. This means that the methodology does not vary according to the technology or fuel used, the size of an installation, or geographical location.

Installations that meet the benchmarks, and are therefore some of the most efficient in the EU, will in principle receive all the allowances they need to cover their emissions.

Installations that do not reach the benchmarks will receive fewer allowances than they need. They will have to

- reduce their emissions,
- buy additional allowances or credits to cover their emissions, or
- Combine these two options.

Allocation for public amenities

Storm water: Signify cant sections of the Downtown CRA were developed prior to the new storm water control requirements adopted by the City. Therefore, a large amount of the storm water in the Downtown runs directly into Lake Dora without any retention. The City has adopted Land Development Regulations that comply with both Lake County and St. John's River Water Management District storm water regulations. The City is currently preparing Storm water Master Plan Update encompassing all lands within the City limits, including the redevelopment area. In order to attract private sector investment into Downtown while at the same time ensuring that the storm water runoff is addressed at a regional level, the Plan recommends that the City/ CRA should work with the St. Johns Water Management District to provide for a master storm water permit for the entire Downtown redevelopment area. The area-wide master storm water permit would streamline the process and eliminate the need for individual property owners to obtain permits from the various permitting entities.

Water, Sewer and Wastewater Systems: The City of Tavares anticipates the need to treat 2.698 million gallons per day (MGD) of wastewater in its service area within 10 years. The City is currently working on a long-range Master Plan to determine build-out, as well as coordinate the population projections of the Comprehensive Plan with those currently under study by Lake County for use in the Metropolitan Planning Organization traffic c studies. Although the existing wastewater treatment facilities is considered adequate to meet the current demands, the Plan recommends that the City should conduct a detailed study to expand existing pumping station capacities to accommodate the projected increase in densities recommended in this Plan. Since the City's fi rest wastewater treatment system was constructed in 1971, there are many structures that still are not connected to the City's treatment plant. When the treatment plant was made operational, all structures with waste disposal facilities were to connect to the plant. During the period of connection, some of the structures were not connected because of problems with getting the sewage to the sewer lines or because individual property owners did not comply with the requirement to connect all sewage disposal facilities to the sewer lines. The Plan recommends that the City continue with its efforts to eliminate all septic systems within the City limits.

Allocation for open space

These guidelines constitute a companion document to the UMBC Policy on Space Allocation and both documents should be consulted when making office space allocation and reallocation decisions.

Principles

- All faculty and staff will be provided with a suitable working environment for the type of work they perform.
- Office space will be provided to units to support adequately their core missions and functional needs.
- Office space, like all space, is a University property that will be allocated to a given unit, as available, in a manner that best advances University priorities. No unit "owns" the space that has been allocated to it.
- Office space allocations are made to units, not to individuals.
- Office space, like all University space resources, should be deployed in the most efficient and effective manner to best serve programmatic and strategic goals.
- Each unit should manage its office space needs within the space that has been allocated to the unit at any given time.
- Existing office space should be used to maximum functionality and efficiency.
- Shared office and open office arrangements are encouraged whenever possible to efficiently use the campus' limited space.
- Conference rooms and office service spaces are encouraged to be shared among one or more units whenever possible to maximize space utilization.
- Office space that has been allocated to a unit can be reassigned to another unit in response to University needs and priorities.
- Responsibility for assignment and reassignment of office space will generally follow divisional hierarchy.

The ability to allocate and reallocate office space within a given division resides ultimately with the corresponding division Vice President/Dean or his/her designee. Unit heads (chairs, directors) have the responsibility to address office space needs within their respective units.

• Office space vacated due to a substantial reduction in program size, reduction in workforce, or program elimination resulting in office space being unoccupied (refer to next section for further guidance) reverts back to the university space pool. The Provost is responsible for ensuring that a process for reassignment of vacant space is established.

• Office space vacated due to a unit's relocation to another building, floor, or suite reverts back to the university space pool. The Provost is responsible for ensuring that a process for reassignment of the vacant space is established. Guidelines for Allocation of Office Space

• In general, the office space allocation priorities are as follows:

(1) Tenured, tenure-track, full time non-tenure track and research faculty and unit full-time staff requiring a high level of privacy for working on confidential matters or meeting with students, staff and others;

(2) Active adjunct, visiting and part-time faculty, and unit part-time staff; and

(3) Postdoctoral fellows, graduate students supported through teaching or research assistantships, active emeritus/retired faculty.

• Offices may be private, shared, open, or in cubicles as appropriate and available.

• The accompanying table outlines the recommended office sizes and types for specific employee categories. For current offices, the types and sizes will necessarily vary from these recommendations due to existing building configurations and availability of appropriate spaces. For new buildings, these recommendations will serve as the standard for programming new space.

• Offices will be assigned based on need, availability, and suitability for the intended use.

• Assignment of multiple offices for faculty and staff is not allowed unless there is a true demonstrated need. Under such circumstances, a faculty or staff member may be assigned a secondary office (ideally in a shared arrangement), provided it is not located in the same building as the primary office. All decisions related to multiple offices will be made on a case-by-case basis and require the approval of the appropriate Vice President/Dean in consultation with the Provost.

• Post-doctoral scholars, graduate students and part-time faculty and staff should be assigned office space in a shared office arrangement.

• Each unit should ensure that all offices are occupied. When offices are left unoccupied for significant periods of time, such as during sabbaticals or other leaves, units should use these spaces to alleviate pressing space needs. If an office space remains under-utilized for a period longer than one year, the unit may be required to provide a justification for maintaining use of the space.

• Emeritus/retired faculty and staff may be provided shared offices, if space is available within a unit, as long as they remain engaged in unit activities. These shared offices are intended to allow an individual to maintain contact with their unit, discipline and colleagues. An emeritus/retired faculty or staff member actively engaged in teaching or research may retain a private office at the discretion of the unit, if space is available.

• When possible, if units desire to consolidate their space assignments for reasons of academic interaction and administrative efficiency, contiguous spaces will be provided. However, close proximity cannot be guaranteed depending upon the space and financial resources available at any given time.

• Periodic evaluation of office space allocation should be made by the unit head to insure that all office space is being used to maximum functionality and efficiency.

• Official space inventory reports recording all office space allocations will be maintained by Facilities Management.
• To support an accurate and complete record of space allocations, units will verify to Facilities Management on an annual basis its office space allocation and names of personnel assigned to occupy specific rooms.
• The Provost's Office will periodically request Facilities Management to evaluate and analyze the adequacy of a unit's office space allocation based upon criteria such as the number and types of personnel, the location, functional layout, and changes in programmatic needs. • Office space may not be assigned to non-campus organizations without prior approval from the appropriate division head and the Office of the Provost.

Objectives and Functions of Residential Density Guidelines

1. Residential density is a quantitative measure of the intensity with which land is occupied by either development or population. Control of residential density is a fundamental component of effective land use planning, as the relative distribution of population has major implications for the provision of public facilities, such as transport, utilities and social infrastructure.
2. In order to boost the short- to medium- term land supply for housing use, there is a need to make efficient use of the scarce land resources, in particular land more immediately available for development within a shorter timeframe, by maximizing the residential density to the extent permitted by planning terms in order to augment the supply of land in Hong Kong and living space of Hong Kong people.
3. In the 2014 Policy Address, the Government announced that, except for the north of Hong Kong Island and Kowloon Peninsula which are more densely populated, the maximum domestic plot ratios that can be allowed for housing sites located in the other Density Zones of the Main Urban Areas and New Towns would be raised generally by about 20% as appropriate. In accordance with the established practice, the Government will duly consider factors such as traffic and infrastructural capacity, local characteristics, existing development intensity and various possible impacts of the proposed development in the area concerned. The 2015 Policy Address also mentions that the Government will increase development intensity as appropriate in order to optimize land use.
4. The maximum plot ratios in the relevant Density Zones should not be considered as an automatic and across-the-board specification, but a general guidance for the maximum plot ratio to be considered or tested for individual sites for residential development in the planning process where there is scope to allow such an increase in terms of infrastructure capacity and planning considerations, that is, where planning terms permit.
5. **The main objectives of density policy are**:

   (a) to promote an acceptable standard of environment and amenity for the occupants of residential areas;
   (b) to ensure an appropriate balance between the residential population of an area and the capacity of the existing or planned facilities and infrastructure required to service it;
   (c) to maintain an efficient intensity of land use and make the optimal use of land resources

in the context of competing demands on a limited supply of developable land;

(d) to maintain safe levels of development and population in areas where there may be potential risks due to adverse geotechnical conditions, neighboring hazardous installations, etc.;

(e) to provide for a variety of urban form for urban design reasons and to satisfy the demands of different market sectors; and

(f) particularly in rural and/or heritage and nature conservation areas, to ensure development is of an appropriate scale in relation to its setting

Density zones

Zoning is the process of dividing land in a municipality into zones (e.g. residential, industrial) in which certain land uses are permitted or prohibited.[1] The type of zone determines whether planning permission for a given development is granted. Zoning may specify a variety of outright and conditional uses of land. It may also indicate the size and dimensions of land area as well as the form and scale of buildings. These guidelines are set in order to guide urban growth and development.

The theoretical and practical application of zoning can be divided into categories. Countries around the world utilize different types of zoning.

Types of Zone

Land Use Zoning

Basically, urban zones fall into one of five major categories: residential, mixed residential-commercial, commercial, industrial and spatial (e. g. power plants, sports complexes, airports, shopping malls etc.). Each category can have a number of sub-categories, for example, within the commercial category there may be separate zones for small-retail, large retail, office use, lodging and others, while industrial may be subdivided into heavy manufacturing, light assembly and warehouse uses. In Germany, each category has a designated limit for noise emissions (not part of the building code, but federal emissions code).

In the United States or Canada, for example, residential zones can have the following sub-categories:

1. Residential occupancies containing sleeping units where the occupants are primarily transient in nature, including: boarding houses, hotels, motels
2. Residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including: apartment houses, boarding houses, convents, dormitories.
3. Residential occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-4 or I, including: buildings that do not contain more than two dwelling units, adult care facilities for five or fewer persons for less than 24 hours.
4. Residential occupancies where the buildings are arranged for occupancy as residential care/assisted living facilities including more than five but not more than 16 occupants.

Planning standards for traffic network

There are two principle areas of road planning, via, residential and arterial, the latter being the major distribution system to the local street network. This Chapter primarily provides guidelines for road planning in residential neighborhoods, whilst the reference documents and Planning and Land Management (PALM) should be consulted for planning of the rural and urban arterial road systems. A fundamental requirement of the planning process is for designers and planners to determine networks that respond to the following inputs:

- Environment.
- Environmental sustainability
- Demography and demographic trends.
- Neighborhood identity.
- Integration of movement modes.
- Recreational / community needs.
- Strategic residential planning.
- Public transport issues.
- Pedestrian and cyclist requirements, including access for disabled persons.
- Whole of life costs. The road transport network should:
- Reflect a broad based (e.g. metropolitan / district level) land use / transportation strategy.
- Translate that strategy into a series of movement routes and elements that perform desired functions, such as those listed above.

The spectrum of movement elements range from high level roads (high volumes, high speeds, and no travel constraints) to low level streets and places (low volumes, low speeds, shared spaces, human scale and interconnectivity). It is not the intent of this document to provide design and planning advice for town planning other than that which is necessary for practitioners to understand the role of road networks in the overall transport system. In this context the Integrated Land Use and Transport planning in the ACT discussion paper (PALM, 1999) outlines directions for accessibility. A key Guiding Principle of Accessibility is that movement around the city by walking, cycling, public transport and driving should be easy and accessible. Priority should be given to the needs of transport modes in the following order of precedence:

- Walking
- Cycling
- Public Transport
- Commercial Vehicles
- Private cars

Standard of roads and paths

(1) The purpose of this chapter of the policy is to support the provisions of the Reconfiguration Code and the Infrastructure Works Code for the design of roads and paths under the planning scheme.

(2) In supporting these codes this chapter augments the provisions of the following -

(a) *Queensland Streets;*

(b) *Queensland Urban Drainage Manual* (QUDM);

(c) *AUSTROADS Parts 13 and 14*;

(d) Department of Main Roads design manuals.

Applicability

This chapter applies to all applications under the planning scheme for construction of new roads and paths, or alterations to the design of existing roads or paths within the planning scheme area.

Road Function, Width and Movement Network Design

General

(1) The local government's approved specifications for road construction works conforms to *AUS-SPEC # 1 - Construction*, except as amended in this policy.

(2) The use of the word road in this chapter may also include streets but not vice versa.

Streets

(1) Streets are designed in accordance with the requirements of *Queensland Streets* except as specifically described in relation to conditions of reconfiguration approval for developments, or as specified in this chapter of the policy.

(2) *Queensland Streets* is the principal document for the design of reconfiguration layouts. This chapter of the policy is intended to augment this document and takes precedence.

Roads

(1) Where conflict exists, this chapter of the policy takes precedence.

(2) Roads are designed in accordance with the requirements of -

- (a) *Queensland Streets*;
- (b) *Queensland Transport Design Manuals*;
- (c) *AUSTROADS*;
- (d) This chapter of the policy.

(3) Industrial uses, commercial uses and park residential roads are designed based on -

- (a) *Queensland Streets*;
- (b) This chapter of the policy;
- (c) *AUSTROADS*;
- (d) Department of Main Roads design criteria.

(4) Park residential streets are those streets serving areas zoned Park Residential in the planning scheme. Commercial streets are those streets servicing commercial activity in the planning scheme.

Provision for urban growth

In the next 40 y, the number of urban dwellers in the developing world is forecast to grow by nearly 3 billion

(1). While this urban demographic transformation is unfolding, climate change is expected to affect the global hydrologic cycle. Anthropogenic emissions of greenhouse gases will likely raise average global temperatures, with temperature changes expected to be greater near the poles than the equator. Climate change will also likely alter precipitation patterns, with some areas becoming wetter and others becoming drier

(2). for some regions, climate and demographic trends will present a fundamental challenge: how will water be provided on a sustainable basis for all those new urbanites?

Freshwater provision to urban residents has three components: water availability (is there enough water nearby?), water quality (how much treatment is needed before it is clean enough to use?), and delivery (are systems in place to bring water to users?)

(3). this article examines only the water availability component, recognizing that for many cities challenges of water quality and delivery are paramount. Throughout this article, "water availability" and "water

shortage" refer solely to the amount of water physically available, not accounting for issues of water quality and delivery. In a sense, our estimates of water shortage are conservative: we assume cities can use all nearby water and map where problems of water shortage are likely to remain.
This article models how population growth and climate change will affect water availability for all cities in developing countries with >100,000 people. These cities had 1.2 billion residents in 2000, 60% of the urban population of developing countries and, according to our demographic projections, will account for 74% of all urban growth globally from 2005 to 2050
Growth model

Smart growth is an urban planning and transportation theory that concentrates growth in compact walkable urban centers to avoid sprawl. It also advocates compact, transit-oriented, walkable, bicycle-friendly land use, including neighborhood schools, complete streets, and mixed-use development with a range of housing choices.[1]The term "smart growth" is particularly used in North America. In Europe and particularly the UK, the terms "compact city", "urban densification"[2] or "urban intensification" have often been used to describe similar concepts, which have influenced government planning policies in the UK, the Netherlands and several other European countries.

Smart growth values long-range, regional considerations of sustainability over a short-term focus. Its sustainable development goals are to achieve a unique sense of community and place; expand the range of transportation, employment, and housing choices; equitably distribute the costs and benefits of development; preserve and enhance natural and cultural resources; and promote public health.

Plan implementation
An implementation plan breaks each strategy into identifiable steps, assigns each step to one or more people and suggests when each step will be completed. For example, if one strategy is to create a membership campaign, one step might be to design a membership brochure. This project might be assigned to a member of the marketing or development staff and might be planned for completion in December of this year.
If there is no effective method to carry out the strategic plan, the strategic plan is likely to collect dust and can lead to planning backlash, the feeling that planning is a waste of time. In an industry where the scarcity of resources is always a key limiting factor, good planning is essential.
However, creating an implementation plan is challenging. It requires the planner to identify each step required to mount a particular strategy. This activity in itself is a good test of the plan. If one does not know how to implement a given strategy, then the strategy is likely not going to be implemented.
Creating an implementation plan does far more than simply test the ability of the organization to make a strategy happen, however.

Plan implementation, town planning legislation and municipal acts
Town planning measures may affect the property interest of many individuals as town planning implies certain amount of control over the individual's rights to use his 'property'. Hence, community has to have adequate legal powers to enable it to enforce necessary regulations and control in the use of land for the general good of the community. '
Property' means a certain thing (like land, building, etc.) that is owned. It may be said that 'property' is an intangible interest created and protected by law and governing relations between the owner and others,

including the community as well. In this sense, the owner has ‘property’ or has ‘property interest’ in his land. His property interest consists of:

1. ‘Right’ to keep others off his land,
2. ‘Powers’ to transfer his land to other, and
3. ‘Privileges to use his land.

The owner’s privileges to use his land are often affected by town planning measures. These measures have to operate within the 129 following two limits, such that the land owner’s privileges and other interests in land or not adversely affected.

1. Planning measures must satisfy the constitutional requirement of procedure established by ‘law’, in that the regulation must be in the public interest, i.e., they must be directly related to public need, safety and morals or welfare.
2. Town planning measures must be in accordance with the provisions of a statute, which provides legal backing to the local government unity to draw its planning powers. The measures must not exceed the substantial planning powers delegated by the Act to the local planning unit and they must be adopted in accordance with the specified procedures. These are important aspects which should be followed strictly as otherwise courts may ‘strike down’ all the planning measures as unconstitutional. If procedures are not followed as set down under the rules and regulations, even the measures undertaken with good intentions may become ‘invalid’ under the law.

Panning of control development schemes

Development control is the process by which authorities manage the extent and nature of growth in local areas. Landowners or leaseholders wishing to develop are typically required to apply to a local authority (depending on the proposal) for permission prior to commencing any development work. Such development control – regulating and managing what is built where, and when – allows authorities to manage land across a large area. It allows authorities to balance competing needs – such as allocating land for farming, while accommodating the growth of cities and towns – and to protect areas with particular values.

Development is mostly controlled by town planning regulations. There are some requirements of national legislation, but most development control is by locally-based zoning and development provisions, in the form of Town Planning Schemes. Schemes set out development provisions specific to land within a designated area. All surveyed land is classified in a ‘zone’, and the schemes set out what types of development are appropriate in each zone, and the standards and guidelines that apply.

Landowners or leaseholders wishing to develop on their land must apply for Development Permission, and proposals for development must comply with the requirements. When an application is made for Development Permission (to subdivide land or to build), the proposal is assessed by technical experts within the authorities against the provisions of the Scheme. Applications are assessed to manage potential impacts on roads and traffic; public health, safety and amenity; natural environments and systems; and people and lifestyles.

Urban financing

As the world continues to rapidly urbanize, investment in good urbanization holds the key to sustainability. Global challenges like combating poverty, reversing rising inequality, and mitigating climate change will be increasingly won or lost in cities. Financing sustainable urbanization is therefore an investment in our present and future. Local government capacity must be expanded to harness private sector participation,

leverage local assets through value capture, and partner with central governments to invest in urbanization.
Since financing for infrastructure is insufficient, the path to long-term finance is to diversify sources. One source is more private participation. This can be through loans from commercial banks, issuing municipal bonds or implementing Private-Public Partnerships. Brazil, China and India are leading the way (Brazil alone was able to implement PPP for over US$300 million from 1990 to 2014) but more is needed, especially in rapidly urbanizing countries.
Land-based financing is an underutilized source of funding. Land values typically increase with urbanization and public investment and this “unearned increment” is socially generated. Ways to share this value include value-based annual land taxes, betterment levies, capital gains taxes, developer exactions, and land readjustment. A transparent and up-to-date fiscal cadaster is essential to utilization of such tools.
Creditworthiness attracts funding and supports good governance. By improving creditworthiness, cities embed the principles of good financial management and transparency. This allows them to develop bankable projects and access credit markets. Creditworthiness allows cities to begin to design and utilize complex financial products such as bonds, pooled financing, and access less costly loans from commercial banks and multilateral development banks.
Though the investment needed to meet unmet and growing needs is huge, quality urbanization can also leverage huge benefits which greatly outweigh costs in the long-term. When investment in cities is guided by good urban development and planning principles, it unlocks the potential for endogenous sources of growth, making sustainable development attainable.
Cities are growing and will continue to expand. Planning in advance of urbanization in conjunction with urban finance for implementation will help cities avoid unplanned and informal growth. Urban extension and infill in efficient patterns can reduce diseconomies of agglomeration and support long-term competitiveness.
The implementation of plans for compact, connected, mixed and integrated cities can be made possible by a three-legged approach that joins planning with legal and financial support. Therefore, finance supports good planning, and good planning supports finance through its economic benefits. By linking finance, planning, economic activity and value capture, a virtuous cycle of investment and growth can be created. Building future cities by linking good urban design, effective financing, and good institutions can create growth, jobs and wealth; it also promises the solution to the challenges of climate change and social inequity. Well-planned urban finance and investment can unleash a broader base of economic activities, allowing a wider range of participation in the urban economy and stimulating bottom-up prosperity.

Land acquisition

Land acquisition in India refers to the process by which the union or a state government in India acquires private land for the purpose of industrialization, development of infrastructural facilities or urbanization of the private land, and provides compensation to the affected land owners and their rehabilitation and resettlement.[1]

Land acquisition in India is governed by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR) and which came into force from 1 January 2014. Till 2013, land acquisition in India was governed by Land Acquisition Act of 1894. On 31 December 2014, the President of India promulgated an ordinance with an official mandate to "meet the twin objectives of farmer welfare; along with expeditiously meeting the strategic and developmental needs of the country". An amendment bill was then introduced in Parliament to endorse the Ordinance. Lok Sabha passed the bill but the same is still lying for passage by the Rajya Sabha. On 30 May 2015, President of India promulgated the amendment ordinance for third time. Union Government of India has also made and notified the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Social Impact Assessment and Consent) Rules, 2014 under the Act to regulate the procedure. The land acquisition in Jammu and Kashmir is governed by the Jammu and Kashmir Land Acquisition Act 1934.

Slum clearance schemes

Slum clearance, **slum eviction** or **slum removal** is an urban renewal strategy used to transform low income settlements with poor reputation into another type of development or housing. The clearance of the slum destroys low income homes as well as illegal squatting sites, displacing inhabitants into different housing areas with the intent of breaking up continuous zones of poverty.

This has long been a strategy for redeveloping urban communities; for example slum clearance plans were required in the United Kingdom in the Housing and Slum Clearance Act 1930. Similarly the Housing Act of 1937 encouraged similar strategies in the United States. Frequently, but not always these programs were paired with public housing or other assistance programs for the displaced communities.

Critics argue that slum removal by force tends to ignore the social problems that cause slums. Poor families, often including children and working adults, need a place to live when adequate low income housing is not providing otherwise. Moreover, slums are frequently sites of informal economies that provide jobs, services, and livelihoods not otherwise available in the community. Slum clearance removes the slum, but it does not remove the causes that create and maintain the slum. Similarly, plans to remove slums in a number of non-Western contexts have proven ineffective without sufficient housing and other support for the displaced communities; for example academics describing such strategies as detrimental in Nigeria, where the slum destruction puts further stress on already short housing stock, in some cases create new slums in other parts of the community.[4] Some communities have opted for slum upgrading, as an alternative solution: improving the quality of services and infrastructure to match the community developed in the slum.

Pollution control aspects

The Pollution Control Approach

The environmental consequences of rapid industrialization have resulted in countless incidents of land, air and water resources sites being contaminated with toxic materials and other pollutants, threatening humans and ecosystems with serious health risks. More extensive and intensive use of materials and energy has created cumulative pressures on the quality of local, regional and global ecosystems.

Before there was a concerted effort to restrict the impact of pollution, environmental management extended little beyond laissez-faire tolerance, tempered by disposal of wastes to avoid disruptive local nuisance conceived of in a short-term perspective. The need for remediation was recognized, by exception, in instances where damage was determined to be unacceptable. As the pace of industrial activity intensified and the understanding of cumulative effects grew, a pollution control paradigm became the dominant approach to environmental management.

Two specific concepts served as the basis for the control approach:

· The assimilative capacity concept, which asserts the existence of a specified level of emissions into the environment which does not lead to unacceptable environmental or human health effects

· the principle of control concept, which assumes that environmental damage can be avoided by controlling the manner, time and rate at which pollutants enter the environment

Under the pollution control approach, attempts to protect the environment have especially relied on isolating contaminants from the environment and using end-of-pipe filters and scrubbers. These solutions have tended to focus on media-specific environmental quality objectives or emission limits, and have been primarily directed at point source discharges into specific environmental media (air, water, soil).