



Dr. Vishwanath Karad

**MIT WORLD PEACE
UNIVERSITY** | PUNE

TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

Integrated Build Environment

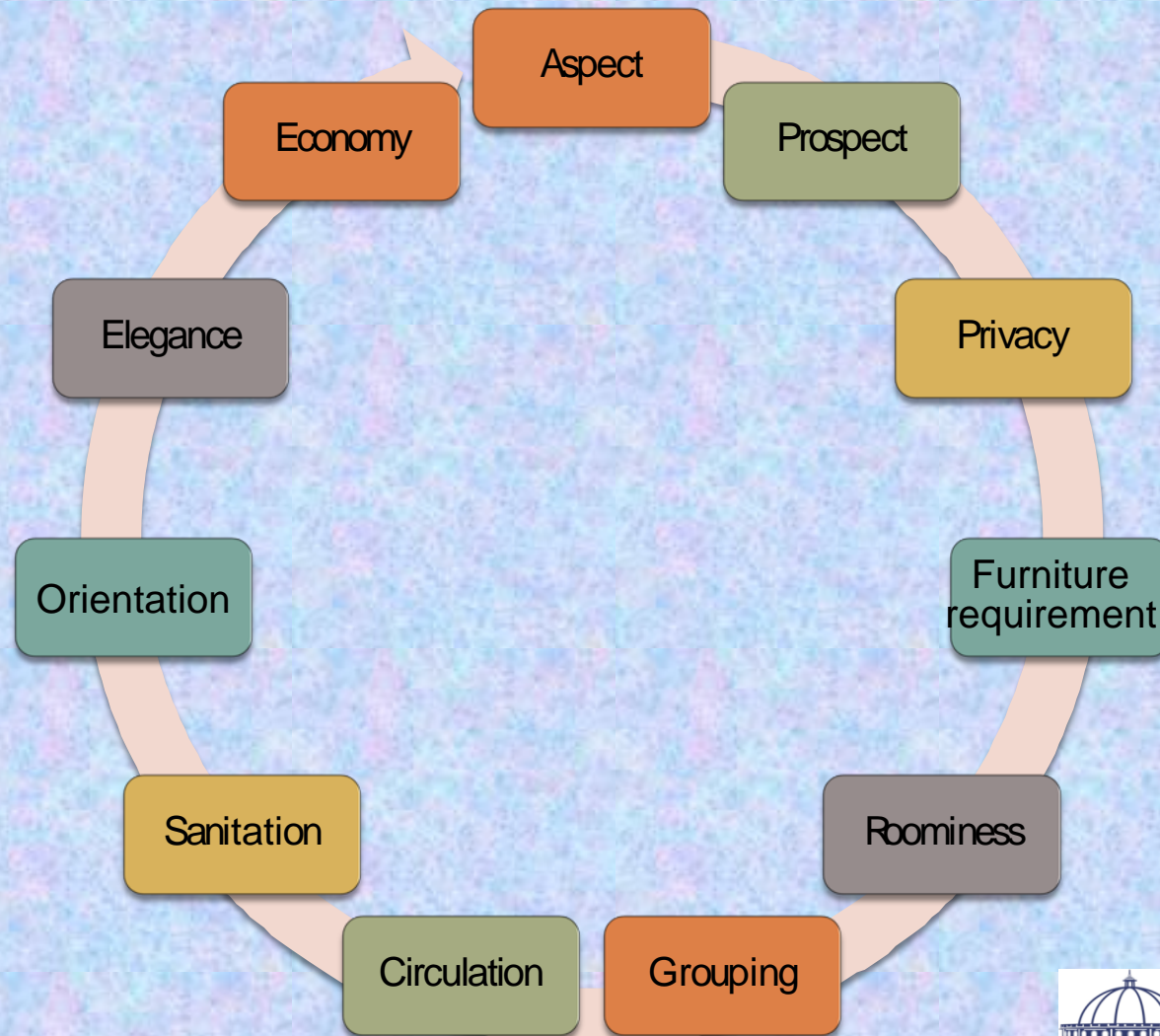
Principles of Planning



Principles of Planning

- **Plan of building:** it is grouping and arrangement of components of building in a systematic manner so as to form a homogeneous body with a comprehensive look out to meet its functional purpose
- **Planning of building depends on:**
 - ⊙ Functional object & requirements
 - ⊙ Component parts, sizes and inter-relationship
 - ⊙ Topography and shape of plot
 - ⊙ Climatic condition
 - ⊙ Location and neighborhood

Principles of Planning (cont.)



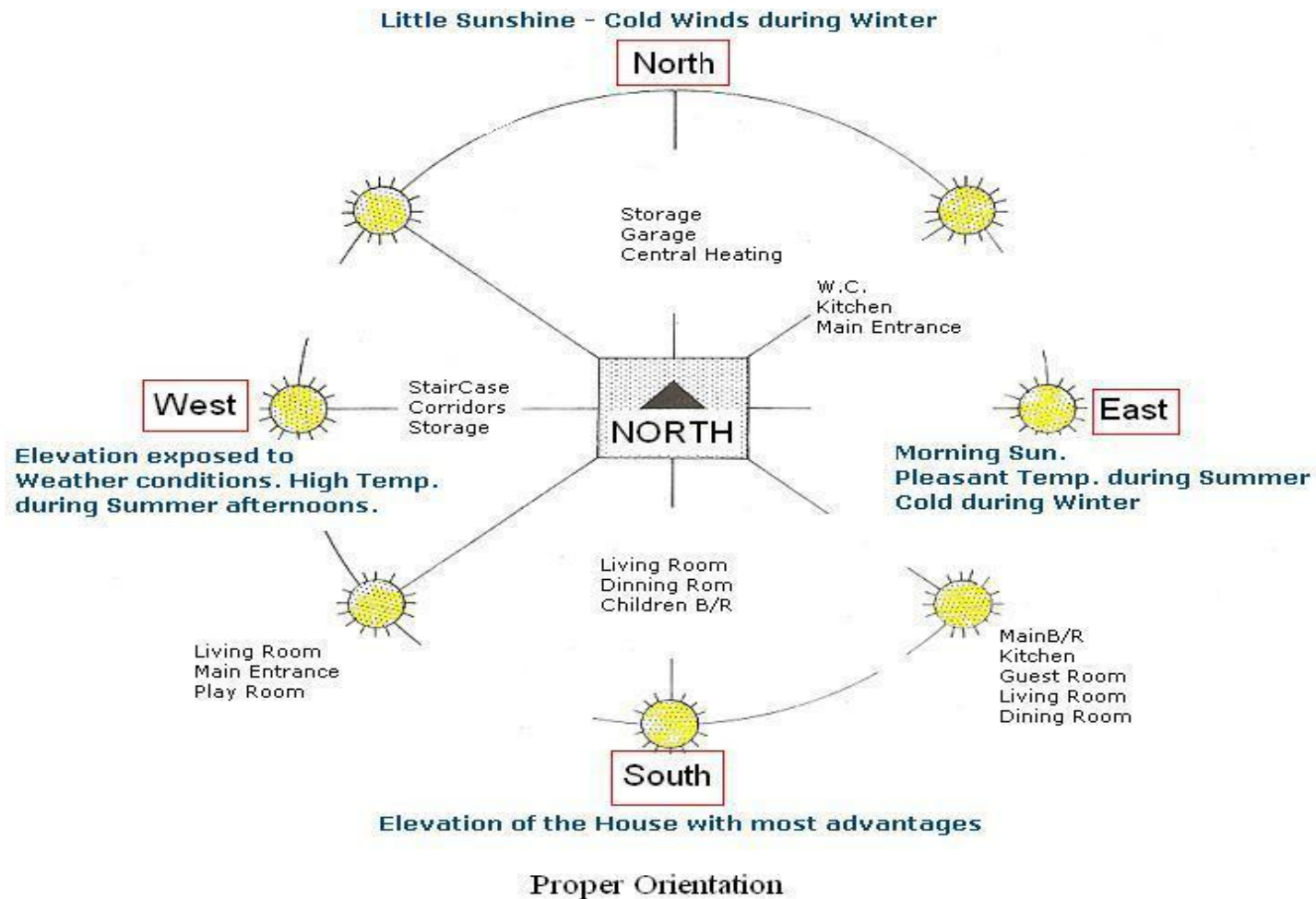
Principles of Planning (cont.)

- **ASPECT:** placement of different rooms of house in accordance with our activities at different hours of day.
- Rooms should get enough sunlight and air, which gives
 - ⊙ Cheerful atmosphere
 - ⊙ Comfort
 - ⊙ Hygienic condition
- A room which receives light & air from particular direction is said to have 'aspect' of that direction.

Principles of Planning (cont.)

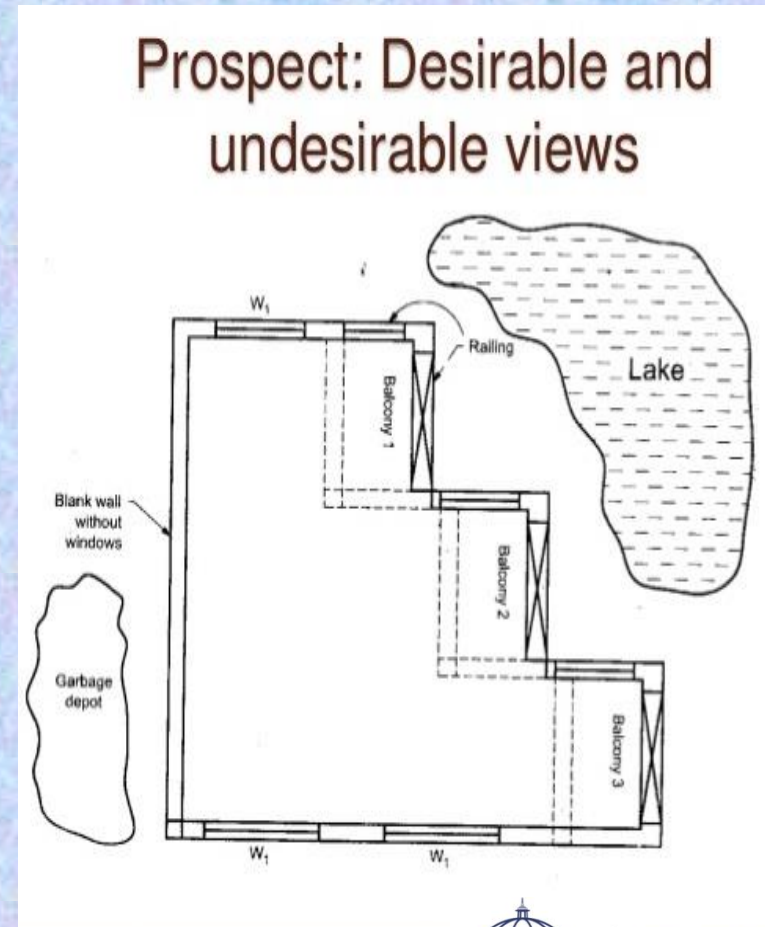
Room	Recommended aspect	Influencing factor
Bed	SW-W-NW	To receive plentiful of breeze in summer
Kitchen	E and rarely NE	To receive morning sun which is germicidal. It purifies air. It should be well illuminated and cool in afternoon.
Dining	SE-S-SW	Proximity of kitchen. It should be cool.
Drawing	SE-S-SW-W	Adequate natural lighting during winter, obviate sun during summer
Reading	N-NW	Light from north being diffused and evenly distributed and cool
Store	NW-N-NE	Dark and cool

Sun Diagram



Principles of Planning (cont.)

- **PROSPECT:** it refers to view as seen of the outside from the windows and doors in external walls
- It is determined by view as desired from certain rooms of house
 - ⊙ View of the garden or a nearby hill
- At the same time, it is naturally intended to conceal some undesirable views



Principles of Planning (cont.)

- **PRIVACY:** privacy can be of
 - ⊙ Sight (bath, w/c)
 - ⊙ Sound (confidential discussion, study room)
 - ⊙ Both sight and sound (bed room)
- It broadly classified in two categories i.e.
 - ⊙ Internal privacy
 - ⊙ External privacy

Principles of Planning (cont.)

- **Internal privacy:** it is privacy within building, it can be achieved by
 - ⊙ Correct positioning of doors and openings of shutters
 - ⊙ Proper grouping of rooms
 - ⊙ Providing buffer area between bed room and other rooms
 - ⊙ Vertical segregation of rooms i.e., by providing drawing, dining, kitchen, toilet at GF and bed and toilet at FF

Principles of Planning (cont.)

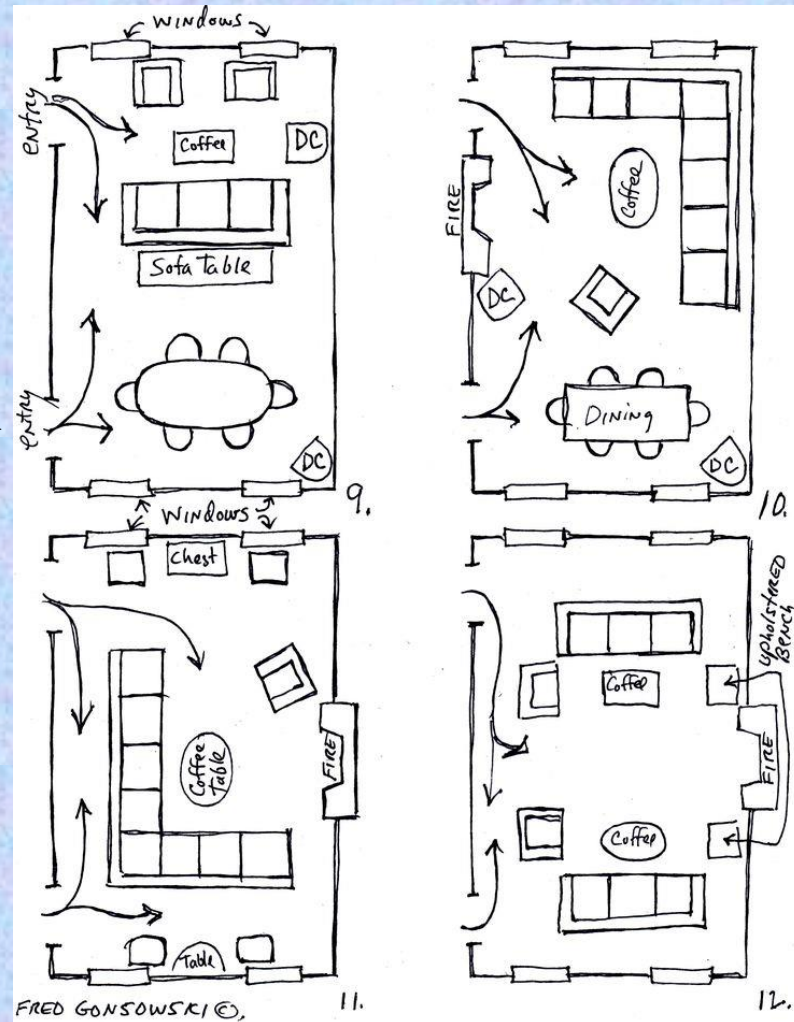
- **External privacy:** it is privacy of whole building with reference to surroundings (buildings and road)
- It can be achieved by
 - ⊙ Compound wall to a height of 1.35 to 1.5 m.
 - ⊙ Planting trees along compound wall (acts as sound & sight barrier)
 - ⊙ Providing screen walls, curtain walls and dwarf wall on verandah

Principles of Planning (cont.)

□ FURNITURE REQUIREMENT:

Planner should know how much space is needed by each function

- Room sizes can be completed on basis of
 - permanent furniture to be used
 - It's dimensions and arrangement
 - Clearance for circulation

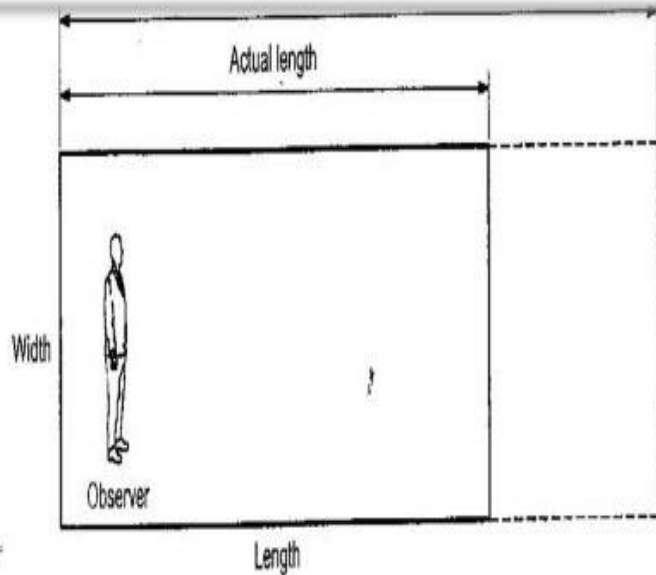


Principles of Planning (cont.)

- ❑ **ROOMINESS:** it is feeling created after a room is well-furnished with all permanent furniture as spacious and well-planned.
 - ⊙ Max use of a room with min possible dimensions
 - ⊙ Rectangular room gives better outlook compare to square room of same floor area.
 - ⊙ Length/breadth ratio of 1.2 to 1.5 is desirable
 - ⊙ When it exceeds 2, it creates tunnel like feeling
 - ⊙ Similarly height also plays imp role
 - ⊙ Room should have all proportional dimensions
 - ⊙ Light colours create effect of more space
 - ⊙ Light and dark colour for different walls of same room will reduce effect of less width and more length

Principles of Planning (cont.)

Roominess : Tunnel Effect



Length > 2 x width - Tunnel effect.

Roominess is greatly influenced by the number and position of doors, windows, lofts and cupboards

Type of curtain can influence roominess

Roominess- head room

Meeting room – ceiling is low- a feeling of close association amongst people

In court or place of worship-ceiling is high- to give a feeling of supremacy



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Principles of Planning (cont.)

- **GROUPING:** it is arrangement of different rooms with reference to their functions, it improves comfort, privacy and convenience and minimises circulation
- Points to be considered
 - Verandah adjacent to drawing room
 - Dining room close to kitchen
 - Bed room, toilet and dressing room grouped together
 - Bath and w/c should be nearer to each other
 - Staircase should be easily accessible from all rooms
 - w/c should be away from dining, psychological feeling of being away from insanitary place

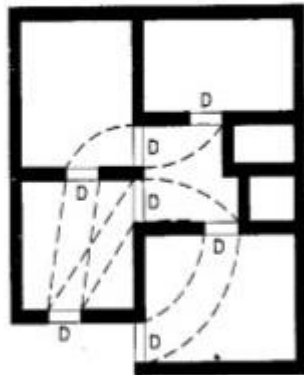
Principles of Planning (cont.)

- **CIRCULATION:** it is access into or out of a room, it is internal movement inside a building
- Circulation area shall be straight, short, bright, lighted both day and night, well ventilated and free from obstructions
- It should not affect privacy nor interfere with utility
- It is of two types
 - ⊙ Horizontal – circulation within same floor
 - ⊙ Vertical – circulation between different floors

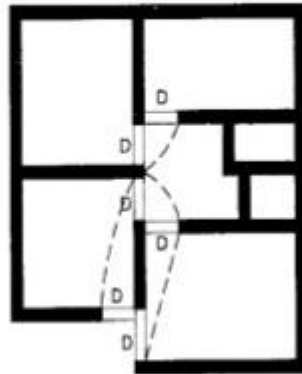
Principles of Planning (cont.)

circulation pattern

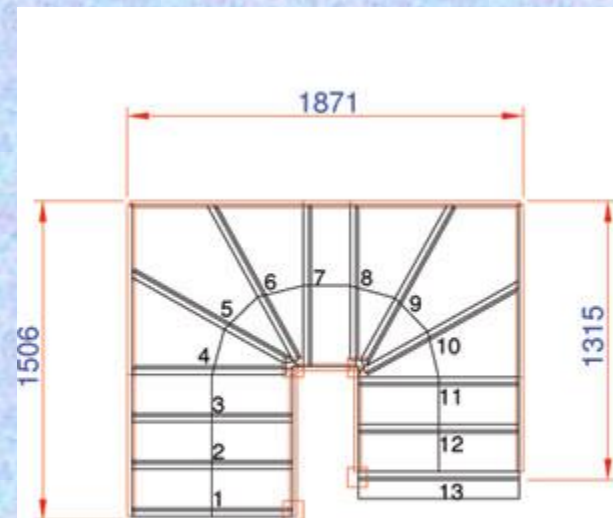
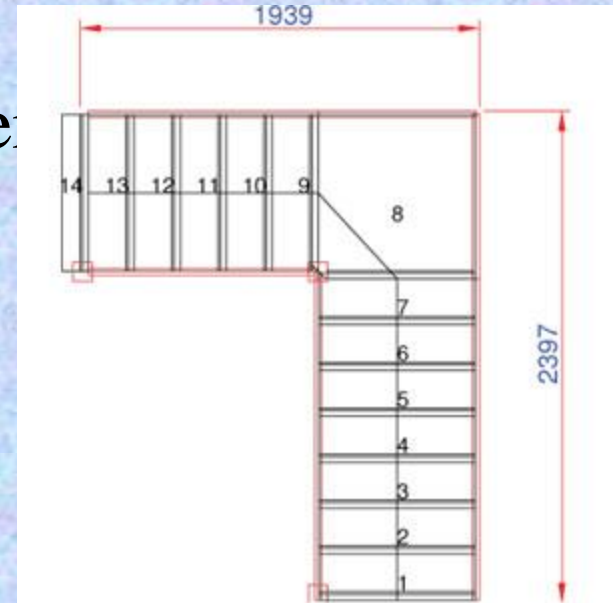
- Horizontal : On the same floor



Wrong placement of doors.
Dotted lines show movements of persons. Thus there is difficulty in placing furniture. It will come in the way. Also large space wasted in circulation

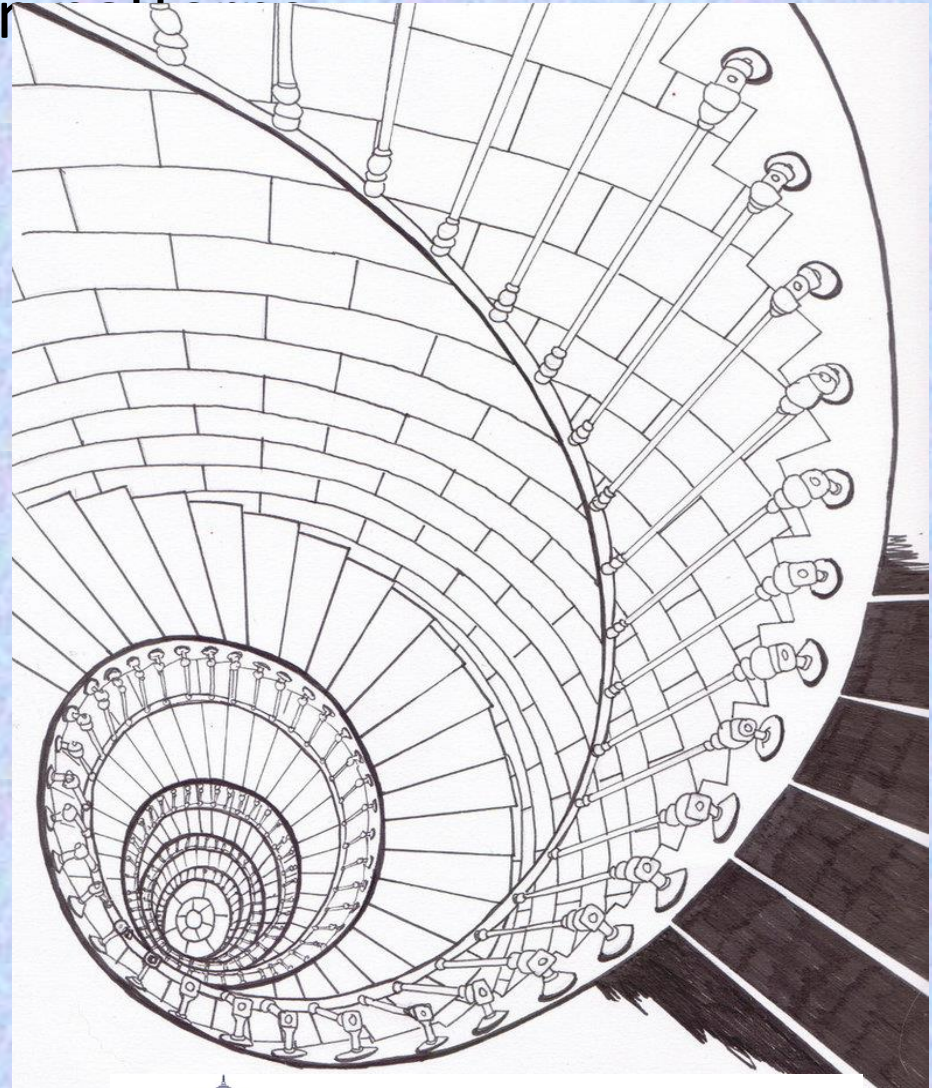


Correct placement of doors.
See the minimum space lost in circulation shown by dotted lines. Also rooms are not divided by circulation.



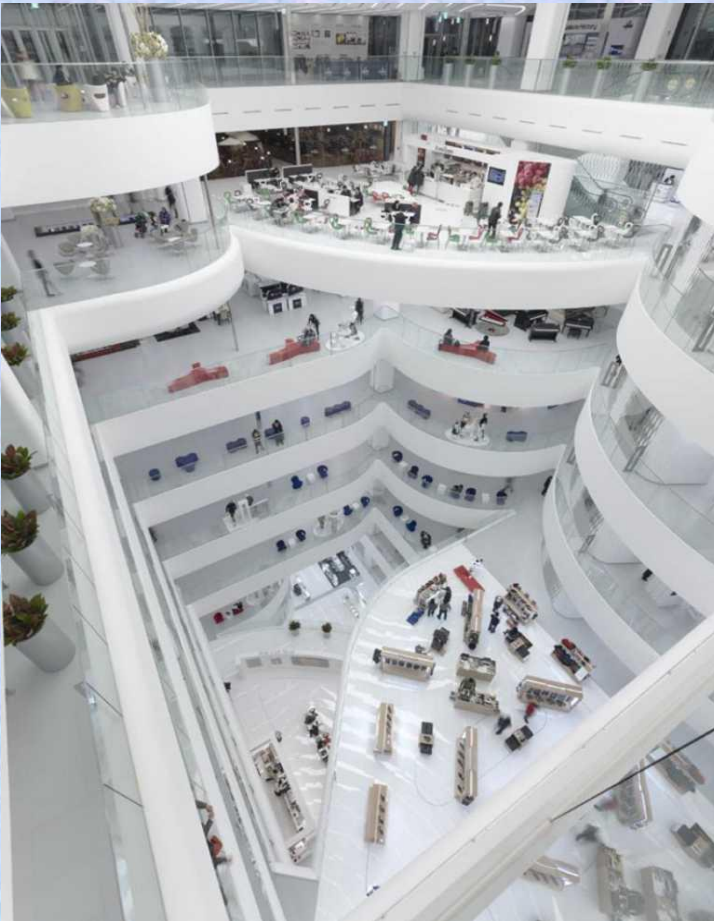
Principles of Planning (cont.)

circulation



Principles of Planning (cont.)

circulation patterns



Principles of Planning (cont.)

- **SANITATION:** it is provision and upkeep of various components of house to keep inmates cheerful and free from disease
- Factors influence sanitation are
 - Lighting
 - Ventilation
 - Cleanliness
- **Lighting:** natural sunlight or artificial
 - Intensity of natural light is affected by pollutants like smoke, dirt, dust, gases and clouds
 - Min window area = $1/7^{\text{th}}$ floor area (hot-humid climate)
 - Min window area = $1/10^{\text{th}}$ floor area (dry climate)

Principles of Planning (cont.)

- **Ventilation:** a system of supplying or removing air by natural or mechanical means to or from any enclosed space to create and maintain comfortable condition
- Orientation of building and location of windows help in providing proper ventilation
- Basic requirements in ventilation
 - Sensation of comfort
 - Reduction in humidity
 - Removal of heat
 - Proper supply of oxygen
 - Reduction of dust



Principles of Planning (cont.)

- There are two methods of ventilation
 - ⊙ **Natural**: suitable for houses and flats, achieved by designing windows and ventilators opposite to each other.
 - ⊙ **Artificial**: necessary if room is to be occupied by more than 50 persons or where space per occupant is less than 3 m³, it is achieved by exhaust system of supply system.

Principles of Planning (cont.)

□ Cleanliness:

⊙ Dust:

- Harbours bacteria
- Creates health problems
- Makes surfaces dull
- Floors shall be smooth, impervious, non-absorbing, uniformly sloping

⊙ Dampness:

- Root cause of infection
- Walls and floors shall be damp-proof
- Kitchen, bath and w/c shall be drained off quickly

Principles of Planning (cont.)

- **ELEGANCE:** is grand appearance of a building, mainly owing to the elevation which in turn depends on plan.

- Depends on
 - ⊙ Elevated site
 - ⊙ Architecture
 - ⊙ Neighbourhood
 - ⊙ Conformity with nature
 - ⊙ Adjoining building and relative placement

Principles of Planning (cont.)

- A better elegance can be obtained by
 - Superior building materials for facing – like paint, glass, timber, polished stones – granite, marble, mosaic etc.
 - Providing projections – like sunshades, balconies, porch etc.
 - Providing bay windows, corner windows etc.

Principles of Planning (cont.)



Elegance



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Principles of Planning (cont.)



Elegance

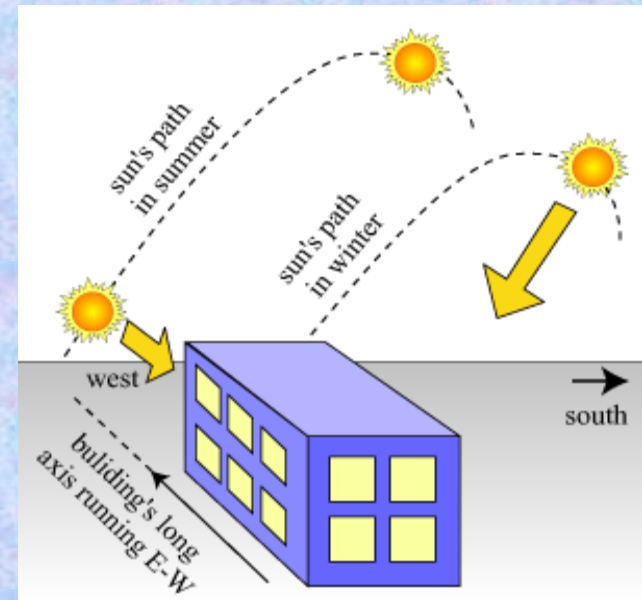
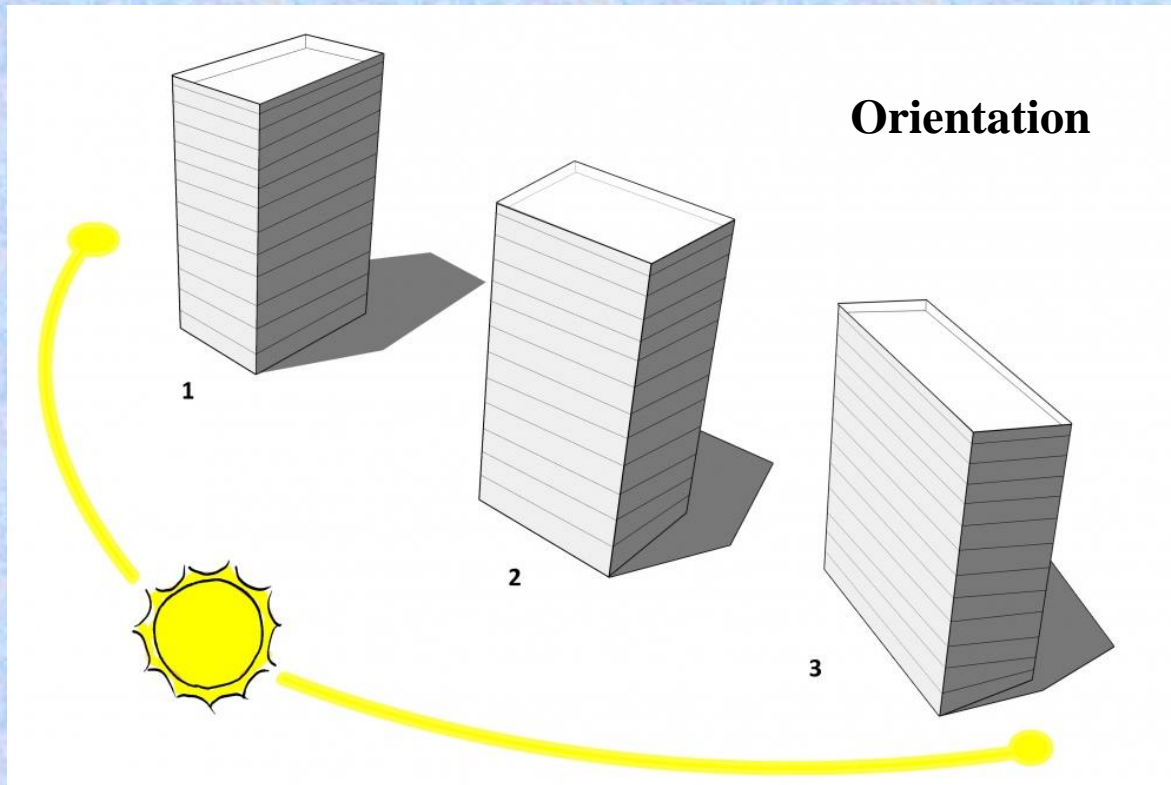


Principles of Planning (cont.)

Orientation

- ❖ Position and direction of building
- ❖ In a school, college or university, orientation preference is given for the class rooms which should not face noisy roads and distracting surroundings. Light and ventilation should be priority
- ❖ For hospitals
 - patient's wards are in use and need to be comfortable position and have privacy too.
 - outdoor patient departments are public oriented, need light and comfort
- ❖ Offices- very densely crowded structures-there should be proper ventilation and prospect for relaxation

Principles of Planning (cont.)



Principles of Planning (cont.)

- **ECONOMY:** building should have min floor area with max utility
- It should not be achieved at the cost of strength
- Only with proper planning and utility of space being maximized (passage being minimized)
- Can be achieved by,
 - ⊙ Simple elevation
 - ⊙ Dispensing of porches, balconies, lobbies
 - ⊙ Reducing storey height
 - ⊙ Reducing no of steps of stairs
 - ⊙ Standardization of sizes of various components and materials

Building Bye Laws

Building Bye-Laws:

Min provisions designed from National Building Code (NBC) by town planning authorities/Urban development authorities/Municipalities, to protect the safety of public with regarding to structural sufficiency, fire hazards and health aspects

Building Bye Laws

Objectives of building bye- laws

- ❖ Disciplined and systematic growth of buildings and towns.
- ❖ Prevent haphazard development
- ❖ Protect safety of public against fire, noise, health hazards and structural failure.
- ❖ Proper utilization of space.
- ❖ Due to it, each building will have proper approaches, light, air and ventilation.
- ❖ Give guideline to architect/engineer in effective planning.
- ❖ To provide health, safety and comfort to people.

Building Bye Laws

□ APPLICABILITY of BYE- LAWS:

- ⊙ New construction:
- ⊙ Additions and alterations to a building
- ⊙ Occupancy of building changed
- ⊙ Development of land
- ⊙ Any part or whole building is demolished

Building Bye Laws

Bye-laws/regulations for different types of building:

- ◉ Line of building frontage
- ◉ Open spaces around residential building
- ◉ Min standard dimensions of building elements
- ◉ Provisions for lighting and ventilation
- ◉ Provisions for safety from fire and explosion
- ◉ Provisions for means of access.
- ◉ Sizes of structural elements
- ◉ Provisions for drainage and sanitation
- ◉ Provisions for safety of works against hazards or accidents
- ◉ Requirements for off-street parking spaces
- ◉ Requirements for greenbelt and landscaping
- ◉ Special requirements for low income group housing



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Building Bye Laws

1. BUILDING FRONTAGE:

- ⊙ it is margin to be left beyond extreme edge of road to front of building line (including excavations for foundation and sunshades/ balcony/ projections of super structures)

- ⊙ i.e. it is the width of clearance of land to be left 'within the private plot' to facilitate
 - Widening of roads in future
 - More site dist at corners
 - Minimizing sound pollution
 - To create a buffer space between public (road) and private (plot) properties



Building Bye Laws

2. Open space requirement

Open space around the building is required to be provided to meet requirements regarding lighting, ventilation, future expansion and approach

Open space for front, rear and side yards depend upon height of building and can be calculated by the formula.

W = Width of open space around the building in m.

$$W = 3 + (h/10)/3$$

h = ht. of the building in m. < 25m.

Open space = 3 m. When $h < 10\text{m}$.

But in no case less than 1.8m.



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Building Bye Laws

OPEN SPACES

- Residential buildings: (up-to 10m height)

- **Front open space**

(Road) Width of street fronting the plot (m)	Front open space minimum (m)
Upto 7.5*	1.5*
7.5 to 18	3.0
18 to 30	4.5
Above 30	6.0

Building Bye Laws

■ Rear open space:

- Every residential building shall have rear open space
- Avg width = 3 m, At no place less than 1.8 m
- Can be reduced to

1.5 m for plot width <9m, building ht <7m

■ Side open space:

- Detached bldg: min 3m either side
- Semi-detached: one side open space 3m
- other side open space can be 1.5m
- Row-type: no side open spaces



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Building Bye Laws

3. Set back distance

- It is the distance measured from centre-line of road upto which plinth of building may extend.
- It is provided to facilitate future road widening, parking of vehicles, free circulation of air etc.
- Setback distance is about 1.5 to 1.67 times more for theatres, commercial complexes, factories than residential building.

Type of road	Minimum Setback Distance		Ratio of column 3 to column 2
	Residential	Industrial	
Village road	9 m	15 m	1.67
Major district road	15 m	24 m	1.60
National or state highway	30 m	45 m	1.50

Building Bye Laws

□ MIN STD DIMENSIONS of BLDG ELEMENTS:

- ⊙ Area limitations
- ⊙ Ht of the building
- ⊙ Plinth ht
- ⊙ Requirement of diff types of room
- ⊙ Parapet wall
- ⊙ Boundary wall

⊙ **Area limitation:** it is achieved by satisfying '*floor area ratio (FAR)/FSI*'

■ **FAR/FSI = total covered area of all floors(Built up area) / plot area**

■ For example, if plot size is 15m x 20m, FAR(FSI) is 2.0 then

- max built-up area on such plot is
- $15 \times 20 \times 2 = 600 \text{ sq.m}$

Building Bye Laws

- **Carpet Area** is the area enclosed within the walls, actual area to lay the carpet. This area does not include the thickness of the inner walls. It is the actual used area of an apartment.
- Floor Area is same as Carpet Area.
- *Areas included in Carpet Area*
 - All Rooms – Living Room, Bedrooms, Dining Room, Dressing Room, Other Rooms.
 - Kitchen and Bathrooms
 - Stores and Balconies
- *Areas not included in Carpet Area*
 - External and Internal walls
 - Common Areas

Building Bye Laws

- **Built up Area** is the carpet area plus the thickness of outer walls and the balcony.
- Built Up Area or **Plinth Area** is the total covered area of the apartment or commercial property unit.
- *Areas included in Built Up Area/ Plinth Area*
 - Entire carpet area
 - Internal and External Walls
 - Utility Ducts within walls of the unit



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Building Bye Laws

- **Super Built Up Area** is the built up area plus proportionate area of common areas such as the lobby, lifts shaft, stairs, etc.
- Sometimes it may also include the common areas such, swimming pool, garden, clubhouse, etc.



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Carpet Area, Built Up Area and Super Built Up Area



- Carpet Area
- Super Area
- Built Up Area

AssetYogi.com



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Floor Space Index(F.S.I)/FAR

Floor space index (FSI)/Floor area ratio (FAR) / Floor space ratio (FSR):

It is the ratio of a building's total **floor** area (gross **floor** area) to the size of the piece of land upon which it is built. The terms can also refer to limits imposed on such a ratio.

$$\text{FSI} = \frac{\text{Floor space covered in all floors}}{\text{Area of the plot}}$$

Floor Space Index(F.S.I)

FSI regulates by Directorate of Town and Country Planning (**DTCP**) department.

They will regulate the FSI value based on city zone, type of building and other amenities. Construction companies or builders can only build up to the FSI imposed by the government.

$$\text{FSI} \times \text{Plot Area} = \text{Built-up Area}$$



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Problem on F.S.I-1

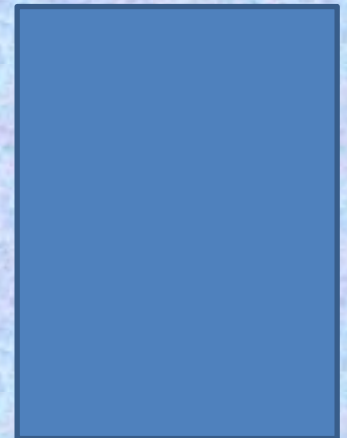
- A plot owner proposed G+1 Storeyed construction with 175 sq.m built up area on each floor .The plot size is 16m X 21 m. Find the ground coverage and FSI proposed ,if all side margins are 2m.If the F.S.I allowed in the area is 1.0, state with reasons whether plan will be sanctioned or not.

— **Ans :** F.S.I= 1.04, not sanctioned

Solution

- Plot area = $16 \text{ m} \times 21 \text{ m} = 336 \text{ sq. m.}$
- Total Built up area = $175 \times 2 = 350 \text{ sq. m.}$
- Ground coverage = $12 \text{ m} \times 17 \text{ m} = 204 \text{ sq. m.}$
- Proposed FSI = $350/336 = 1.042$
- FSI proposed > FSI allowed

Ans: - plan will not be sanctioned.



Problem on F.S.I-2

- Determine carpet area per floor of a two storeyed building from the following data:
 - Plot area=800 sq.m
 - F.S.I Allowed=1.0
 - Ratio of carpet area/built up area= 0.8.Assume equal built up area per floor.

Ans: 320sq.m

Solution

- Plot area = 800 sq.m.
- FSI = 1.0
- $\text{FSI} = \text{Built up area} / \text{Plot area}$
- $\text{Built up area} = \text{FSI} \times \text{plot area}$
 $= 1 \times 800$
 $= 800 \text{ sq. m.}$
- $\text{Carpet area} / \text{Built up area} = 0.8$
- $\text{Carpet area} = 0.8 \times \text{built up area}$
 $= 0.8 \times 800$
 $= 640 \text{ sq.m.}$

Ans :- carpet area per floor = $640/2 = 320 \text{ sq.m.}$

Problem on F.S.I-3

- Determine the total carpet area of a three storeyed building from the following data:
 - Plot area = 40m X 30m
 - F.S.I Allowed=0.9
 - Ratio of Carpet area to built up area=0.8

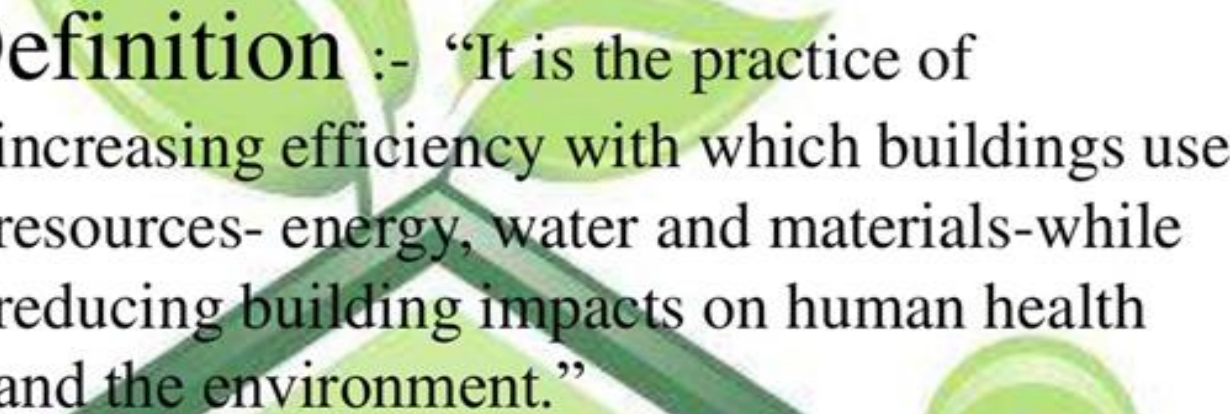
Ans: 864 sq.m

Problem on F.S.I-4

- A plot owner proposed G+1 construction with 175 sq.m construction on each floor, on a plot size of 15m X 20m. If all margins are 2m and FSI allowed=1, Find: Ground coverage, F.S.I Consumed, Whether plan will be sanctioned or not. If not, by how much amount the proposed area will be required to be reduced by the owner, so that the proposal will be sanctioned by the authorities.

- Ans:
- F.S.I- 1.17,
- Reduced Area=50 sq.m.

Green Building



Definition :- “It is the practice of increasing efficiency with which buildings use resources- energy, water and materials-while reducing building impacts on human health and the environment.”

“Green building technology should reach all”

Green Building

OBJECTIVE

Green building are designed to reduce the overall impact of the built environment on human health and the natural environment by :

- Efficiently using energy, water and other resources.
- Protecting occupant health and improving employee productivity.
- Reducing waste, pollution and environment degradation.

Green Building

- **STRUCTURE EFFICIENCY:**

- It is the concept of sustainable building and has largest impact on cost and performance.
- It aims to minimize the environment impact associated with all life-cycles.



- **ENERGY EFFICIENCY:**

- The layout of the construction can be strategised so that natural light pours for additional warmth.
- Shading the roof with trees offers an eco-friendly alternative to air conditioning.

Green Building

- **WATER EFFICIENCY:**

- To minimize water consumption one should aim to use the water which has been collected, used, purified and reused.



Green Building

- **MATERIAL EFFICIENCY:**

- Materials should be use that can be recycled and can generate surplus amount of energy.
- An example of this are solar power panels,not only they provide lightening but they are also a useful energy source.



- **WASTE AND REDUCTION:**

- It is probable to reuse resources.
- What may be waste to us may have another benefit to something else.

Green Building

Materials efficiency

- Green building materials are composed of renewable, rather than nonrenewable resources. Green materials are environmentally responsible because impacts are considered over the life of the product. Depending upon project-specific goals, an assessment of green materials may involve an evaluation of one or more of the criteria listed below.
- **Green building material/product selection criteria :**
 - Resource efficiency
 - Indoor air quality
 - Energy efficiency
 - Water conservation

Green Building

Resource Efficiency

- **Recycled Content:** Products with identifiable recycled content, including postindustrial content with a preference for post consumer content.
- **Resource efficient manufacturing process:** Products manufactured with resource-efficient processes including reducing energy consumption, minimizing waste (recycled, recyclable and or source reduced product packaging), and reducing greenhouse gases.
- **Locally available:** Building materials, components, and systems found locally or regionally saving energy and resources in transportation to the project site.
- **Durable:** Materials that are longer lasting or are comparable to conventional products with long life expectancies.

HOW TO MAKE GREEN HOMES



Green Building with Heartland Builders, LLC.
www.heartlandbuilders.com

High Efficiency Low E
insulated glass windows reduce energy use and protect your homes interior

Rain Gardens
Help reduce storm water run off

Native Landscaping
Requires less maintenance and irrigation

Conserve Water with dual-flush toilets, water saving faucets and rain sensors for lawn sprinkling

High Efficiency Mechanical Systems reduce your energy bills. Consider a Geothermal Heating System. Always seal your duct work.

Exposure to the sun Consider your homes orientation to the sun to harness energy or to shield it from heat and UV light

Other Considerations — Low VOC paints, "green" flooring, energy efficient lighting. Conduct a "blower door" test on your home to determine performance.

Insulation Air sealing a home, using a blown insulation and minimizing thermal bridging lowers utility bills. Consider GIPS or ICF's

Recycled Deck Materials utilize sustainable resources and reduce maintenance costs

Recycled Framing Materials such as finger jointed studs and an I post floor system help reduce new lumber use

Insulated Foundation Walls Improves the comfort of your home and reduces utility costs. Consider ICF's.

Insulated Basement Floors helps eliminate dampness and reduces utility costs

Energy Efficient Appliances reduce utility costs



Green Building

Indian Green Building Council

- The **Indian Green Building Council (IGBC)**, was formed in the year 2001 by Confederation of Indian Industry (CII). The vision of the council is to usher in a green building movement in India and facilitate India to become one of the global leaders in green buildings by 2015.
- With a modest beginning of 20,000 sq ft (1,900 m²). green built-up area in the country in the year 2003, today more than 1053 green buildings (*as on April 2011*) with a built-up area of over 648,000,000 sq ft (60,200,000 m²). are being constructed all over India, of which 147 green buildings are certified and fully functional
- LEED India for New Construction
- LEED India for Core and Shell
- IGBC Green Homes
- IGBC Green Factory Building
- IGBC Green SEZ
- IGBC Green Townships



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Green Building

IGBC RATING SYSTEM

- IGBC has developed green building rating programmes to cover commercial, residential, factory buildings, etc.
- Each rating system divided into different levels of certification are as follows:
 - ‘Certified’ to recognise best practices.
 - ‘Silver’ to recognise outstanding performance.
 - ‘Gold’ to recognise national excellence.
 - ‘Platinum’ to recognise global leadership.

LEED

- **LEED – Leadership in Energy and Environmental Design** which is a certification process that provides verification that a building is environmentally sustainable.
- LEED is a rating system developed by United State Green Building Council (USGBC).
- LEED is the most widely used green building rating system in the world, community and home project types.

Rating System

- Site Planning
- Water Management Energy Management
- Material Use
- Indoor Air Quality
- Innovation and Design Process

Types of Building Quality Certification

- Certified – 40-49 Points
- Silver – 50-59 Points
- Gold – 60-79 Points
- Platinum – 80 points and above

Green Buildings Project in India

- Suzlon Energy Limited-Pune
- Biodiversity Conservation India-Bangalore
- Olympia Technology Park-Chennai
- ITC Green Centre-Gurgaon
- The Druk White Lotus School-Ladakh
- Doon School-Dehradun
- Raintree Hotels-Chennai
- Nokia-Gurgaon



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Green Buildings Project in India

- Rajiv Gandhi International Airport-Hyderabad
- Hiranandini-BG House, Powai
- ABN Amro Bank, Chennai
- Palais Royale at Worli, Mumbai
- Punjab Forest Complex, Mohali



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Green Buildings Project in India

- **SUZLON ENERGY LIMITED, PUNE:**
 - Several accolades continue to shower upon Suzlon's global headquarter in Pune "One Earth".
 - LEED certified it as 'PLATINUM' and it is built on an area of 10.13 acres.
 - One Earth can be counted as among the largest green building projects in India.



Green Buildings Project in India

- **NOKIA-GURGAON:**

- 'GOLD' rated building by LEED.
- Its smart lighting, heat recovery wheel and high efficiency chillers makes this office stand out from the rest.



Suzlon 'one earth'

- One Earth is one of only five buildings in India to be LEED rated and the first in the state of Maharashtra. It is also the only building in India with the highest ratings from LEED (Platinum rating with 57 points which it obtained in 2010) and GRIHA (Five Star rating with 96 points).
- A hybrid wind (80%)– solar (20%; through photovoltaic panels)
- 100% rainwater is harvested, 100% of grey water
- Essential resources such as printers, fax machines, Storage cabinets, the pantry etc., are located to minimize unproductive movement.



Top 10 green buildings in India

1. ITC Green Building, Gurgaon(LEED Platinum)
2. Suzlon One Earth, Pune (LEED Platinum), 5 star GRIHA
3. Patni (I-GATE) knowledge Center, Noida (LEED Platinum)
4. Olympia Tech Park, Chennai (LEED Largest Gold)
5. Infinity Benchmark, Kolkata (LEED Platinum)
6. CRISIL House, Mumbai
7. Indira Paryavaran Bhavan, New Delhi (LEED Platinum) 5 star GRIHA
8. ITC Maurya Hotel, New Delhi (LEED Platinum)
9. Infosys, Hyderabad.(LEED Platinum for software development block 1,2,3)
10. CISCO Building, Bangalore (LEED Platinum)