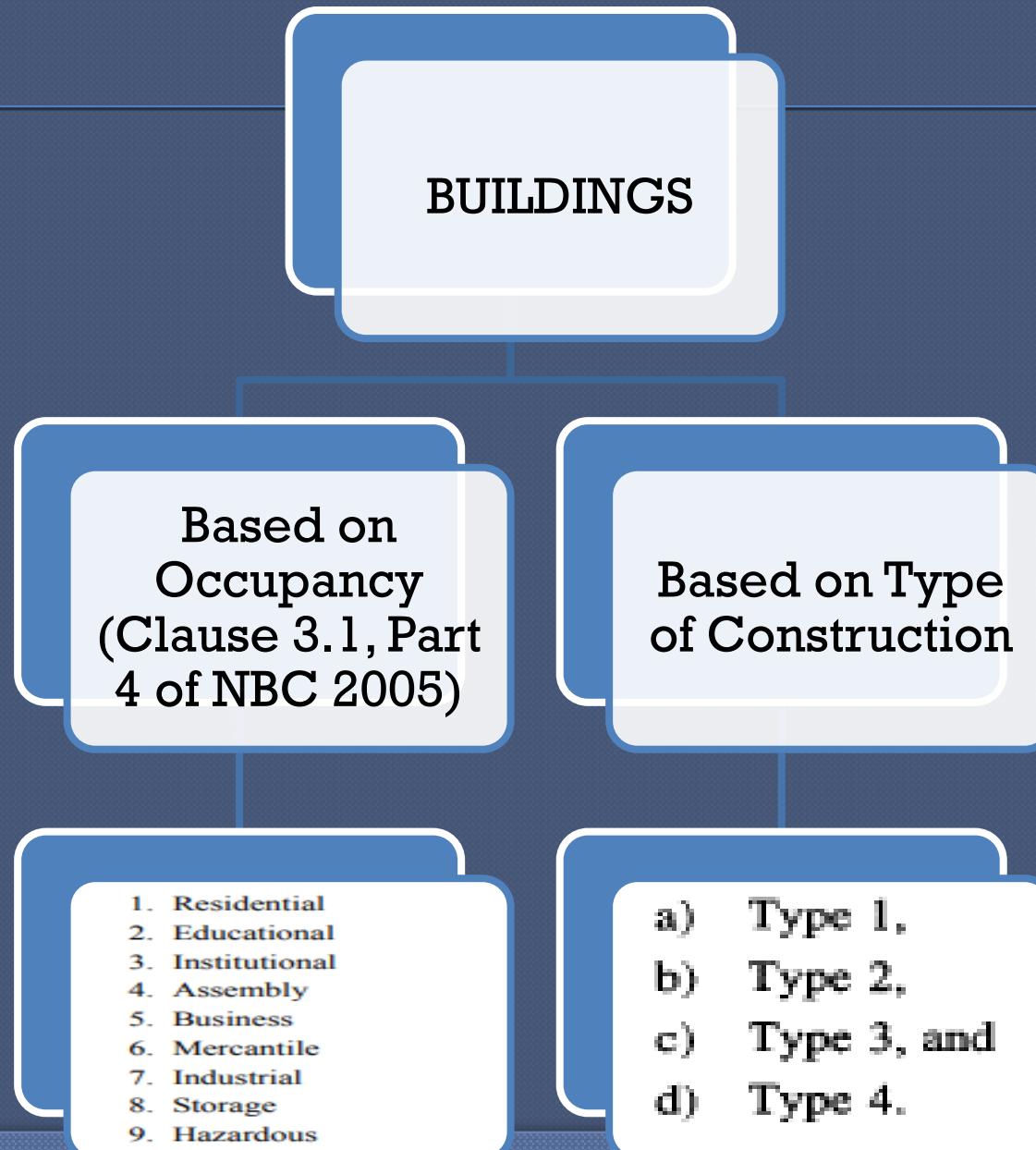


BUILDING PLANNING

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Classification of Buildings



REQUIREMENTS OF A BUILDING

- ❖ Building must be strong enough to withstand atmosphere and environment odds.
- ❖ Durable for a long time
- ❖ Stable enough to take the anticipated loads
- ❖ Well ventilated and free from dampness
- ❖ Components must not deform due to moisture or temperature variations



❖ Optimum utilization of space and max efficiency



- ❖ Planning should be done according to living and working condition of occupants
- ❖ Doors and windows must provide enough light without glare or discomfort to occupants

- ❖ Maximum use of natural sunlight and air



- ❖ Building must be resistant to moisture penetration. This can be due to poor construction, material quality or poor planning.

❖ Safe against fire hazards i.e. fire resistant (not fire proof).

- ❖ Building components should not catch fire easily
- ❖ Provide maximum no. of exits for escaping



❖ Safe against theft, burglary. External walls must be strong enough to resist any such attempt

Table 2 Side and Rear Open Spaces for Different Heights of Buildings
(Clause 8.2.3.1)

Sl No.	Height of Buildings m	Side and Rear Open Spaces to be Left Around Building m
(1)	(2)	(3)
i)	10	3
ii)	15	5
iii)	18	6
iv)	21	7
v)	24	8
vi)	27	9
vii)	30	10
viii)	35	11
ix)	40	12
x)	45	13
xi)	50	14
xii)	55 and above	16

NOTES

- 1 For buildings above 24 m in height, there shall be a minimum front open space of 6 m.
- 2 Where rooms do not derive light and ventilation from the exterior open space, the width of such exterior open space as given in col 3 may be reduced by 1 m subject to a minimum of 3 m and a maximum of 8 m. No further projections shall be permitted.
- 3 If the length or depth of the building exceeds 40 m, add to col (3) 10 percent of length or depth of building minus 4.0 m.

Type of Development	Plot Size m ²	Frontage m
(1)	(2)	(3)
Detached building	Above 250	Above 12
Semi-detached building	125-250	8 to 12
Row type building	50-125	4.5 to 8

8.2.1.1 Front open space

- a) Every building fronting a street shall have a front space, forming an integral part of the site as below:

Sl No.	Front Open Space, Min m	Width of Street Fronting the Plot m
(1)	(2)	(3)
i)	1.5 ^{b)}	Up to 7.5 ^{b)}
ii)	3.0	7.5 to 18
iii)	4.5	18 to 30
iv)	6.0	Above 30

^{b)} For buildings up to a maximum height 7 m.

NOTE — In case a building abuts two or more streets, the value of open spaces is to be based on the average width of streets, subject to a minimum of 1.8 m for cases (ii), (iii) and (iv) above.

6.4 Distance from Electric Lines

No *VERANDAH*, balcony, or the like shall be allowed to be erected or re-erected or any additions or alterations made to a building within the distances quoted below in accordance with the current *Indian Electricity Rules* as amended from time-to-time between the building and any overhead electric supply line:

(1)	(2)	Vertically	Horizontally
		m	m
a)	Low and medium voltage lines and service lines	2.5	1.2
b)	High voltage lines up to and including 11 000 V	3.7	1.2
c)	High voltage lines above 11 000 V and up to and including 33 000 V	3.7	2.0
d)	Extra high voltage line beyond 33 000 V	3.7 (plus 0.3 m for every additional 33 000 V or part thereof)	2.0 (plus 0.3 m for every additional 33 000 V or part thereof)

GENERAL ASPECTS OF BUILDING PLANNING

- Ventilation
- Comfort
- Safety
- Stability
- Sensitivity to environment
- Protection against outside attacks
- Orientation
- Economy

FACTORS CONSIDERED FOR SELECTION OF SITE FOR RESIDENTIAL BUILDING

- Site must be selected in developed colony or locality with facilities for schools, police, hopping centre, post office, fire safety, water lines, sewer lines, street lights, hospitals, telephone, shopping, transport, garbage disposal, drainage park etc.
- Neighborhood of equal status
- Well connected by roads
- Required area of plot must be available at site
- Avoid low-lying areas to prevent flooding
- Good soil conditions (hard, compact soil or rock) so that economic foundations are constructed

-
- Site should be on elevated land to have easy surface drainage
 - Natural light, air must not be obstructed at site.
 - Good landscape
 - Site should be free from harmful salts, chemicals.
 - Sites near kilns, quarries, factories must be avoided.
 - Site selected as per land use (NBC)

FACTORS CONSIDERED FOR SELECTION OF SITE FOR INDUSTRIAL BUILDING

- Site should be away from congested localities to accommodate future expansions. Well outside municipal limits.
- As close as possible to source of raw materials. (minerals, agricultural produce, quarry product etc.)
- Adequate drainage facilities. (elevated surface preferably)

-
- Adequate space available for future expansion and modernization.
 - Well connected by roads, rails or sea way
 - Labour and marketing facilities available nearby
 - Adequate power supply
 - Site selected as per land use (NBC)

LAND USE CLASSIFICATION

Sl No.	Use Zone (Level 1)	Use Zone (Level 2)
		(1) (2) (3)
i)	Residential (R)	Primary Residential Zone (R-1) Mixed Residential Zone (R-2) Unplanned/Informal Residential Zone (R-3)
ii)	Commercial (C)	Retail Shopping Zone (C-1) General Business and Commercial District/Centres (C-2) Wholesale, Godowns, Warehousing/Regulated Markets (C-3)
iii)	Manufacturing (M)	Service and Light Industry (M-1) Extensive and Heavy Industry (M-2) Special Industrial Zone Hazardous, Noxious and Chemical (M-3)
iv)	Public and Semi-Public (PS)	Government/Semi-Government/Public Offices (PS-1) Government Land (use determined) (PS-2) Educational and Research (PS-3) Medical and Health (PS-4) Social, Cultural and Religious (PS-5) Utilities and Services (PS-6) Cremation and Burial Grounds (PS-7)
v)	Recreational (P)	Playgrounds/Stadium/Sports Complex (P-1) Parks and Gardens — Public Open Spaces (P-2) Special Recreational Zone — Restricted Open Spaces (P-3) Multi-Open Space (Maidan) (P-4)

<i>Sl No.</i>	<i>Use Zone (Level 1)</i>	<i>Use Zone (Level 2)</i>
(1)	(2)	(3)
vi)	Transportation and Communication (T)	Roads (T-1) Railways (T-2) Airport (T-3) Seaports and Dockyards (T-4) Bus Depots/Truck Terminals and Freight Complexes (T-5) Transmission and Communication (T-6)
vii)	Agriculture and Water Bodies	Agriculture (A-1) Forest (A-2) Poultry and Dairy Farming (A-3) Rural Settlements (A-4) Brick Kiln and Extractive Areas (A-5) Water Bodies (A-6)
viii)	Special Area	Old Built-up (Core) Area (S-1) Heritage and Conservation Areas (S-2) Scenic Value Areas (S-3) Village Settlement (S-4) Other Uses (S-5)

Minimum Land Area Required (NBC 2005)

	<i>Land Area Required, Min</i>	
<i>a) Pre-Primary to Secondary Education</i>		
1) <i>Pre-primary, nursery school (1 for every 2 500 population)</i>		
i) Area per school	0.08 ha	
ii) Location of pre-primary/nursery school	Near a park	
2) <i>Primary school (class 1 to 5) (1 for every 5 000 population)</i>		
i) Strength of school — 500 students		
ii) Area per school	0.40 ha	
a) School building area	0.20 ha	
b) Play field area (with a minimum of 18 m × 36 m to be ensured for effective play)	0.20 ha	
3) <i>Senior secondary school (class 6 to 12) (1 for every 7 500 population)</i>		
i) Strength of the school — 1 000 students		
ii) Area per school	1.80 ha	
a) School building area	0.60 ha	
b) Play field area (with a minimum of 68 m × 126 m to be ensured for effective play)	1.00 ha	
c) Parking area	0.20 ha	
4) <i>Integrated school without hostel facility (class 1 to 12) (1 for every 90 000 to 100 000 population)</i>		
i) Strength of the school—1 500 students		
ii) Area per school	3.50 ha	
a) School building area	0.70 ha	
b) Play field area	2.50 ha	
c) Parking	0.30 ha	
5) <i>Integrated school with hostel facilities (class 1 to 12) (1 for every 90 000 to 100 000 population)</i>		
i) Strength of school — 1 500 students		3.90 ha
ii) Area per school		
a) School building area		0.70 ha
b) Play field area		2.50 ha
c) Residential (including hostel area)		0.40 ha
d) Parking area		0.30 ha
6) <i>School for physically challenged (class 1 to 12) (1 for every 45 000 population)</i>		
i) Strength of school — 400 students		
ii) Area per school		0.70 ha
a) School building area		0.20 ha
b) Play field area		0.30 ha
c) Parking area		0.20 ha
<i>b) Higher Education — General</i>		
1) <i>College (1 for every 125 000 population)</i>		
i) Student strength of college — 1 000 to 1 500 students		
ii) Area per college		5.00 ha
a) College building area		1.80 ha
b) Play field area		2.50 ha
c) Residential (including hostel area)		0.40 ha
d) Parking area		0.30 ha
2) <i>University campus/centre area</i>		10.00 ha
3) <i>New university area</i>		60.00 ha

c) Technical Education

1) Technical education centre (A) (1 for every 1 000 000 population to include 1 ITI and 1 polytechnic)	
i) Strength of ITI — 400 students	
ii) Strength of polytechnic — 500 students	
iii) Area per technical education centre	4.00 ha
a) Area for ITI	1.60 ha
b) Area for polytechnic	2.40 ha
2) Technical education centre (B) (1 for every 1 000 000 population to include 1 ITI, 1 technical centre and 1 coaching centre)	
Area per technical education centre	4.00 ha
a) Area for ITI	1.60 ha
b) Area for technical centre	2.10 ha
c) Area for coaching centre	0.30 ha
d) Professional Education	
1) Engineering college (1 for every 1 000 000 population)	
i) Strength of the college — 1 500 students	
ii) Area per college	6.00 ha
2) Medical college (1 for every 1 000 000 population)	
Area of site including space for general hospital	15.00 ha
3) Other professional colleges (1 for every 1 000 000 population)	
i) Area of site for students strength upto 250 students	2.00 ha
ii) Additional area of site for every additional 100 students or part thereof upto total strength of 1 000 students	0.50 ha
iii) Area of site for strength of college — From 1 000 to 1 500 students	6.00 ha

5.5.2 Health Care Facilities

	Land Area Required, Min
1) Dispensary (1 for every 15 000 population)	0.08 ha to 0.12 ha
Area	
2) Nursing home, child welfare and maternity centre (1 for every 45 000 to 100 000 population)	
i) Capacity 25 to 30 beds	0.20 ha to 0.30 ha
ii) Area	
3) Poly-clinic with some observation beds (1 for every 100 000 population)	
Area	0.20 ha to 0.30 ha
4) Intermediate hospital (category B) (1 for every 100 000 population)	
i) Capacity 80 beds (initially the provision may be for 50 including 20 maternity beds)	1.00 ha
ii) Total area	
a) Area for hospital	0.60 ha
b) Area for residential accommodation	0.40 ha
5) Intermediate hospital (category A) (1 for every 100 000 population)	
i) Capacity 200 beds (initially the provision may be for 100 beds)	
ii) Total area	3.70 ha
a) Area for hospital	2.70 ha
b) Area for residential accommodation	1.00 ha

	<i>Land Area Required, Min</i>
6) General hospital (<i>1 for every 250 000 population</i>)	
i) Capacity 500 beds (initially the provision may be for 300 beds)	
ii) Total area	6.00 ha
a) Area for hospital	4.00 ha
b) Area for residential accommodation	2.00 ha
7) Multi-speciality hospital (<i>1 for 100 000 population</i>)	
i) Capacity 200 beds (initially the provision may be for 100 beds)	
ii) Total area	9.00 ha
a) Area for hospital	6.00 ha
b) Area for residential accommodation	3.00 ha
8) Speciality hospital (<i>1 for every 100 000 population</i>)	
i) Capacity 200 beds (initially the provision may be for 100 beds)	
ii) Total area	3.70 ha
a) Area for hospital	2.70 ha
b) Area for residential accommodation	1.00 ha

5.5.3 Socio-cultural facilities

	<i>Land Area Required, Min</i>
1) Community room (<i>1 for every 5 000 population</i>)	
Area	750 m ²
2) Community hall, mangal karyayakalayana mandapam/barat ghar/library (<i>1 for every 15 000 population</i>)	
Area	2 000 m ²
3) Recreational club (<i>1 for every 100 000 population</i>) (see also 5.2, 5.2.1, 5.2.2 and 5.3)	
Area	10 000 m ²
4) Music, dance and drama centre (<i>1 for every 100 000 population</i>)	
Area	1 000 m ²
5) Meditation and spiritual centre (<i>1 for every 100 000 population</i>)	
Area	5 000 m ²
6) Socio-cultural centre (<i>1 for every 1 000 000 population</i>)	
Area	15 ha

PRINCIPLES OF PLANNING

Aspect

Prospect

Furniture
Requirements

Roominess

Grouping

Circulation

Privacy

Sanitation

Elegance

Economy

ASPECT

- Regulation of direct or indirect sun rays, air, scenery. Deals with the arrangement of doors windows to admit maximum natural light, breeze and scenery.
- Facilitate ventilation
- Planning should be done according to sun and breeze movements.
- For example,

Kitchen: Eastern aspect, so that the morning sun would refresh and purify the air and the kitchen would remain cool during latter part of the day.

Living Room: Southern or South-East aspect ,The sun is towards the south during cooler days and the living rooms with south aspect will be benefited by the sun when it is winter and in summer as the sun would be on north side.

Bed Room: West or South-west aspects the breeze required particularly in summer, would prevail from that side.

Light from North -evenly Distributed the Studios, reading rooms and class rooms are laid out with north aspect.

Aspect of different rooms of a Residential Building are shown

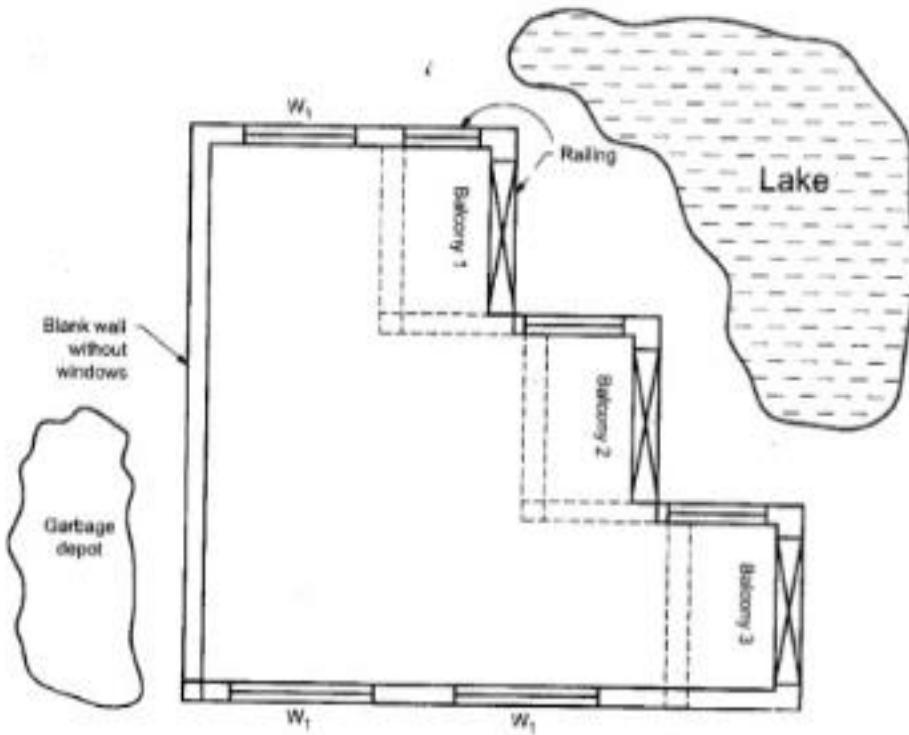
Sl.No	Room	Recommendation aspect	Influencing Factor
1	Bed	NW -W- SE	To reduce plentiful of Breeze in summer
2	Kitchen	E and rarely NE	To Receive morning sun which is germicidal . If purifier the air it should be cool during summer
3	Dinning	SE –S -SW	Proximity of Kitchen, it should be cool
4	Drawing	SE –S – SW - W	Adequate natural lighting during winter and obviate the sun during summer
5	Reading	N - NW	Light from north being diffused and evenly distributed and cool
6	Store	NW – N - NE	Dark and cool

PROSPECT

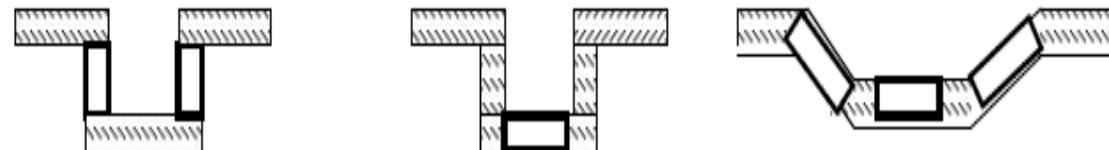
- Projections of a room, its corners or windows in external face of wall to suit a particular environment at a particular place in a particular way.
- Revealment + Concealment of certain features

- Prospect of a building require the deposition of external doors and windows in a building at particular places and in particular manner so as to expose the notable and pleasant features of the openings in the external facade of the building and concealing the undesirable views in a given site.

Prospect: Desirable and undesirable views



E.g.: Projecting of windows



Projecting windows for desired prospect



FURNITURE REQUIREMENT

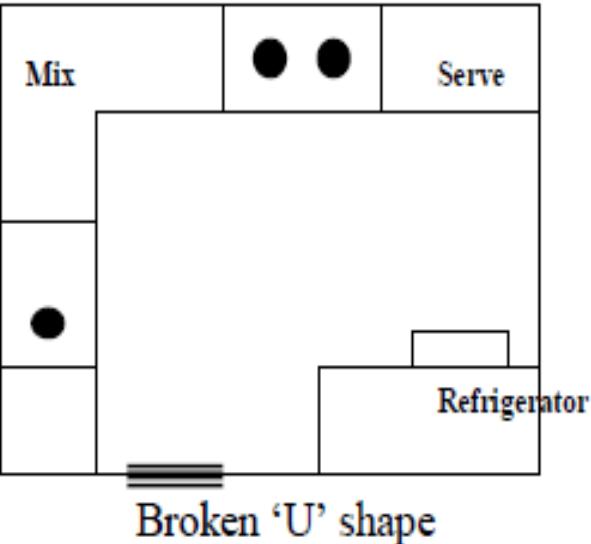
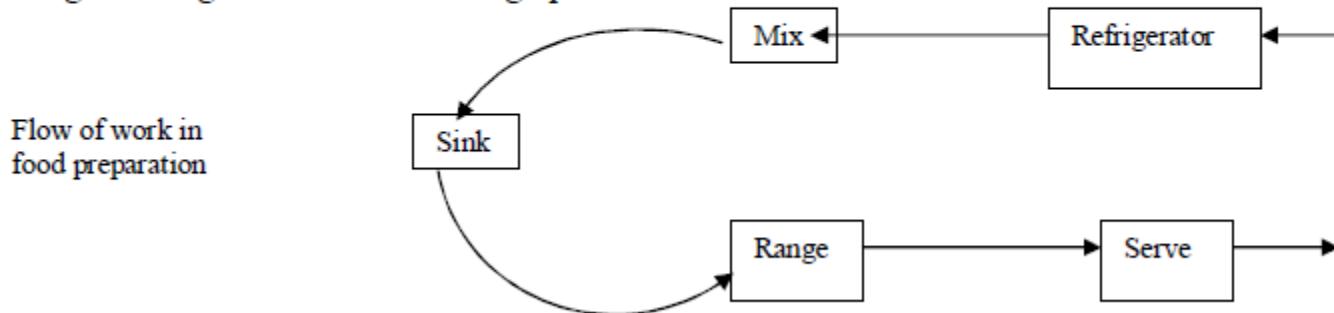
- The furniture requirements of a room depends upon the functions required to be performed there in.
- It should be sufficient to accommodate the normal needs of maximum number of persons who can use the room without over crowding.
- The space requirements of non-residential building is planned paying regard to the furniture, equipment and other fittings or fixtures which are essential to meet the need of the particular functions required to be performed in the building.
- In case of residential buildings, normally not much thought is given to the furniture requirements. It is however, desirable to prepare a sketch plan indicating required furniture as well as its located in different rooms (Viz drawing room, bedroom, kitchen etc.). So as to ensure that doors, windows, cupboards and circulation spaces do not prevent the placement of required number of furniture items in the room.

KITCHEN FURNITURE REQUIREMENT

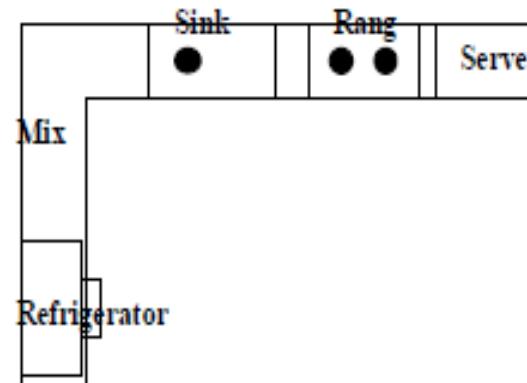
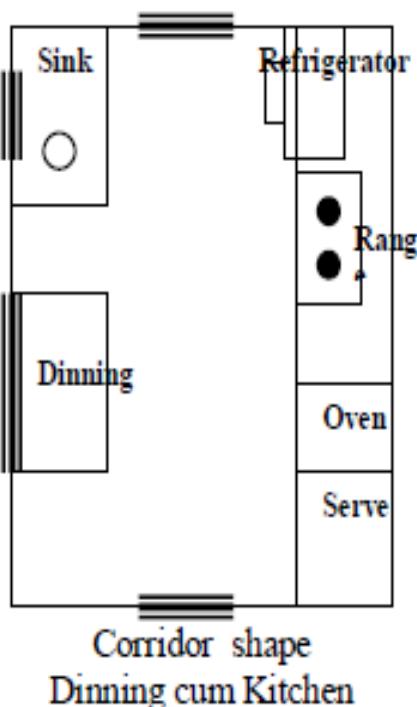
Kitchen:

Activities in Kitchen:

- 1 Storage
- 2.Cleaning & Mixing
- 3.Cooking
5. Serving or storage
6. Cleaning up



Working Space in Kitchen



'L' Shape

Dinning Room:

The principle factors are considered in planning the dinning area

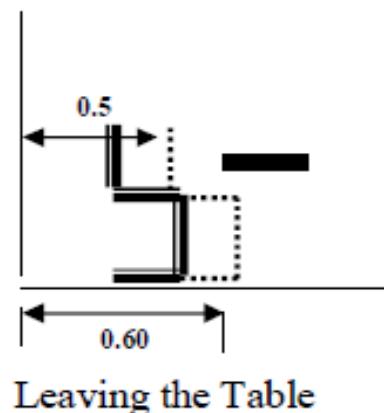
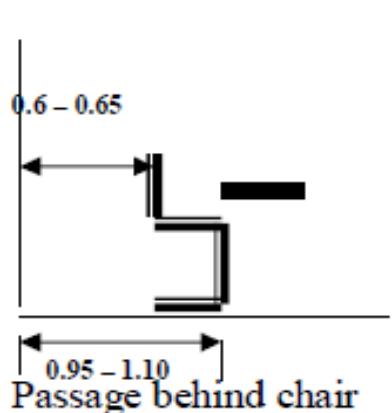
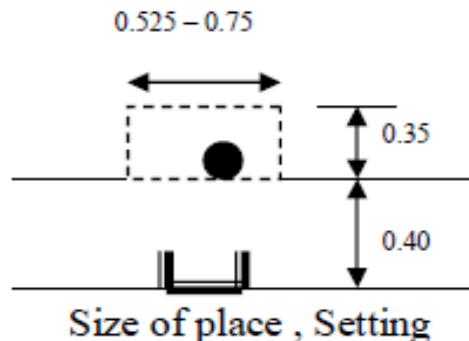
1. No. of personal occupies
2. Space used at the table
3. space for chairs and passage behind them
4. Seating arrangement
5. Size and type of furniture
6. Storage space for china, glass ware etc.

Space for total dinning area

Persons	W X L in 'm'	Area, m ²
4	3.0 X 3.6	10.8
6	3 X 4.2	12.6
8	3.0 x 4.8	14.4
10	3.0 X 5.4	16.2
12	3 X 6	18.0

Table size

1. Portable Table , Round- 0.75 m to 1.70 m in
2. Portable Table , Rectangular- 0.75 to 1.2 X 1.5 to 2.4 or 0.6 X 1.20
3. Dinning chairs,
Portable- 0.45 to 0.6 X 0.45 to 0.55



DINING ROOM FURNITURE REQUIREMENT

ROOMINESS

- Maximum benefit from minimum space (Compact yet comfortable)

- Depends on
 - size of room,
 - shape of room,
 - furniture
 - position of openings

Following points should be kept in view for creating desirable impression regarding roominess:

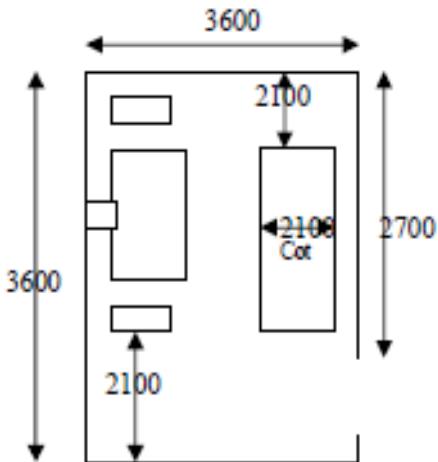
(a) A room square in plan appears relatively smaller than a rectangular room of same area.

It is also considered relatively smaller from utility point of view as compared with rectangular room of the same area. Length of beam proportion for a good room is taken as 1.2 to 1.5. If the ratio of length to breadth exceed 1.5 it creates an undesirable effect. A small room having its length more than 2 times its width is objectionable, as it creates tunnel effect.

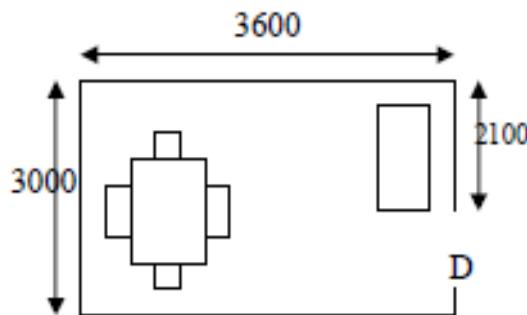
(b) A small room with high walls appears relatively smaller than its actual size

(c) The location of doors, windows and built in cupboard etc., should be such that they permit easy approach -ability and do not obstruct the placement of furniture etc.

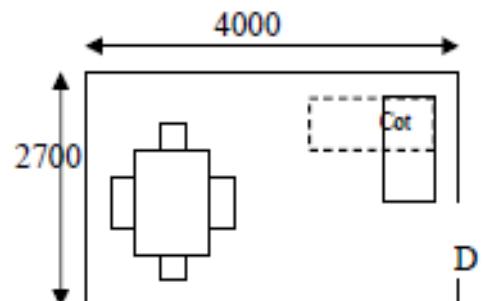
(d) It requires skill and serious thinking in making best use of the accommodation provided by suitable arrangement of rooms, by locating doors and passages in such a way that the livability, utility, privacy and exterior appearance are not adversely affected.



Let us consider square room with size 3600 mm X 3600 mm
 $\text{Area} = 12.96 \text{ m}^2$
 Chair dimension = 450mm x 450 mm
 Table = 1200mm X 1200mm
 Cot = 900 mm X 1800mm
 A chair needs 450 mm behind for moving
 Cot can be placed only one direction, perpendicular to the 2700 mm length.
 This room is not economical



Let us consider rectangular room with size 3.0 mX 3.60 m
 $\text{Area} = 10.8 \text{ m}^2$
 Difference in area between square and rectangular
 $12.96 - 10.8 = 2.16 \text{ m}^2$
 About Rs 60,000/- is saved but no space gained as such

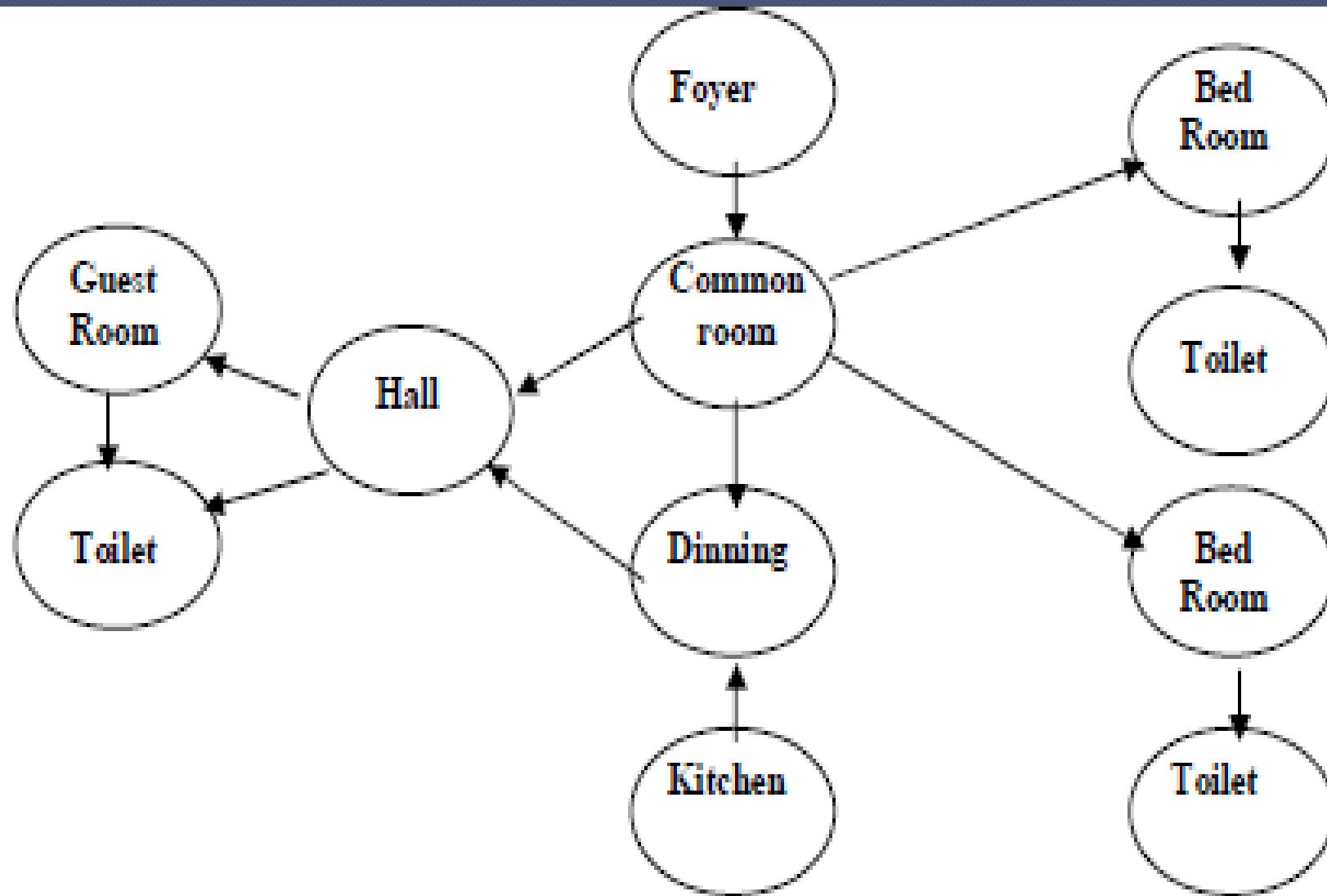


Let us consider another rectangular room with size 4.0 mX 2.70 m
 $\text{Area} = 10.8 \text{ m}^2$
 Here cot can be placed in any direction perpendicular or parallel to the table.
 This room is more economy

GROUPING

- Grouping consists in arranging various rooms in the layout plan of the building in such a manner that all the rooms are placed in proper co-relation to their functions and in proximity with each other. The basic aim of grouping of the apartments is to maintain the sequence of their function according to their inter-relationship with least interference.

- For instance
 - In a residential building dinning room should be close to the kitchen.
 - The kitchen on the other hand, should be kept away from drawing room or living room to avoid smoke or smell from kitchen spreading in these rooms.
 - The water closet should be located away from the kitchen.
 - Main bedrooms should be so located that there is independent and separate access from each room towards the water closet directly or through other un-important rooms.
 - In case of office buildings, hospitals etc., administrative department should be located centrally for convenience and economy in the cost of providing services.



Grouping of Rooms

Bed Room



- No direct access from outside
- Requires privacy
- Indirectly or directly attached to toilet
- No two bed rooms to be connected
- Not to be connected with kitchen and guest room
- Can be indirectly or directly connected with a drawing room, dining rooms, study room, office



Drawing Room

- Front entrance
- Well lighted
- Not connected with kitchen (disturbance)
- Connected to dining room, guest room, study room



Dining Room

- Directly connected to kitchen or drawing room, guest room and living room
- Not connected with toilet but washbasin must be provided
- Can also be used a circulation space

Grouping of Rooms

Kitchen



- Situated on east side
- It should not have a front access (not close to main entrance)
- Directly or indirectly connected to dining room
- Away from toilet
- Not to be connected to bedroom, drawing room, office or study room



Office or Study Room

- Attached to drawing or bed room
- Least disturbance
- Not in front space



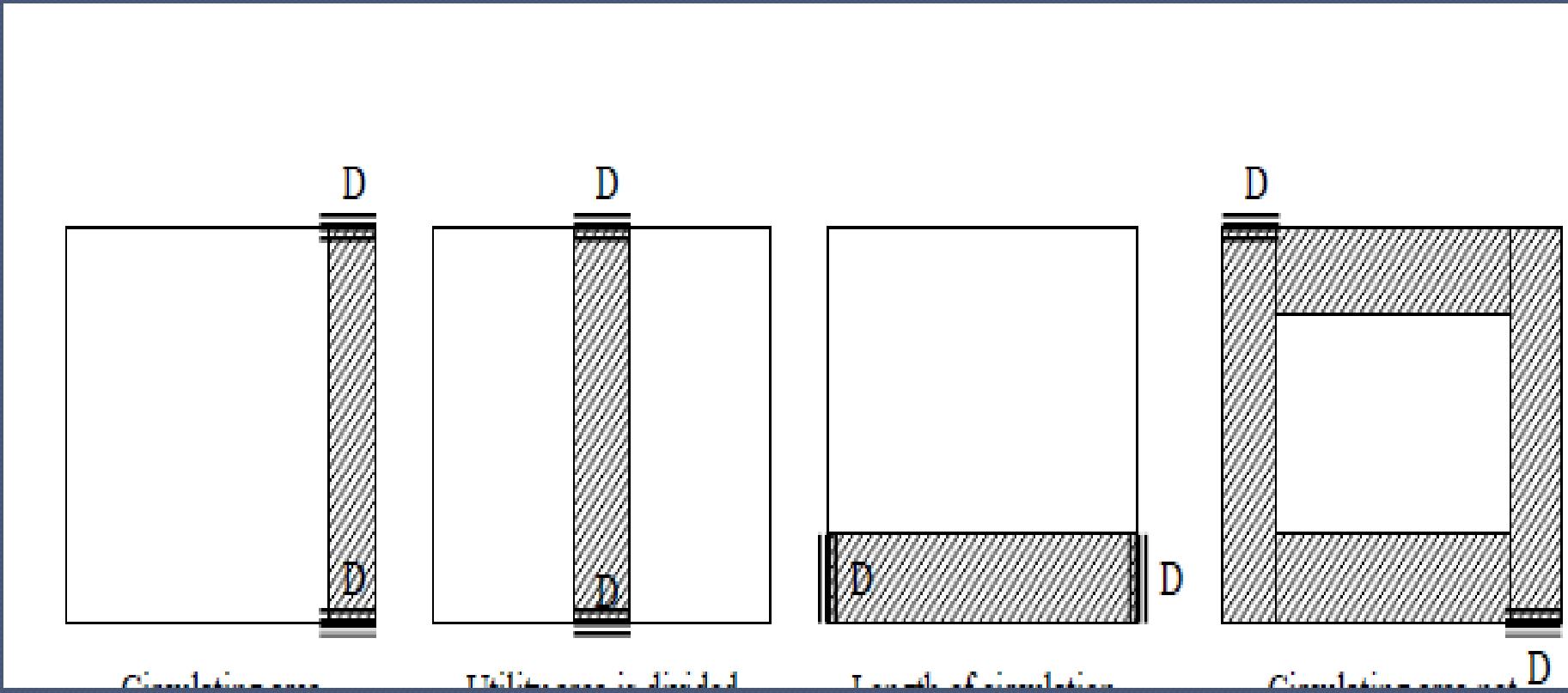
Toilet Block

- Separate for each bedroom preferably or common for two bed rooms

CIRCULATION

- Circulation means internal through fares or access providing in a room or between rooms on the same floor.
- This is two types of circulation
 - Horizontal Circulation
 - Vertical Circulation
- Horizontal Circulation : It is the circulation on the same floor i.e. it may be between rooms.e.g.- These are passage, corridor, halls and lobbies and linking of various blocks of apartment. Area of horizontal circulation may be consists of 20% to 25% of the total building area.
- 2. Vertical circulation: It nothing but the movement of upward and downward movement.. There are normally stair case. For multi storage structures electric lifts are provided, still stair are necessary if there is any electric fail, or the escape exist for fire disaster. E.g.: Stair case , lift, ramp . escalators etc.
- Area of vertical circulation is about 8% to 10 % of total area

- Following aspects should be kept in view to achieve good circulation:
 - For comfort and convenience, all passages, corridors, halls etc., on each floor should be short, straight, well ventilated and sufficiently lighted.
 - The location of entrance passages and staircase which serve as link between various rooms and floors, need careful consideration right at the initial stage of planning.
 - In a multi-storeyed building, the staircase, which perhaps serve the only unfailing means of vertical circulation, should be planned paying due regard to the size of tread and riser, width of stair and landing, light and ventilation etc. Staircase should be also located that they do not intro-due upon privacy of any room or cause disturbances in the horizontal circulation.



PRIVACY

- ◎ It is the most important principles for planning of all types of general & residential building.

- ◎ The two types of privacy are
 - Internal Privacy
 - External Privacy

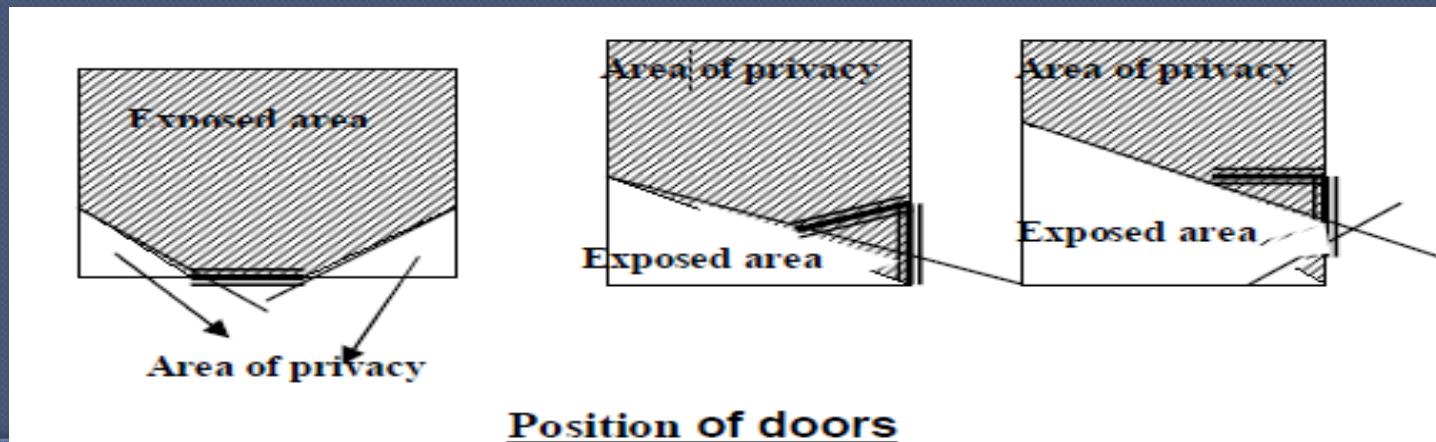
○ Internal Privacy:

It is important in case of bath room & sanitary services attached bath room, toilets, Lavatories, water closets, urinals etc.

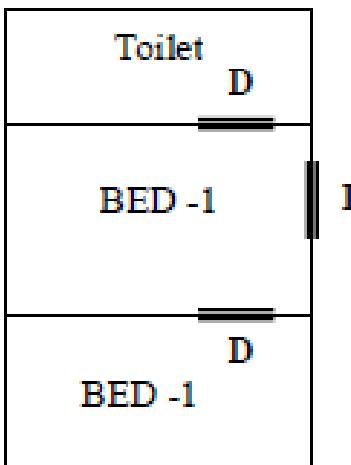
All these services should have an independent access from every bedroom without disturbing the others. Doors with single shutter are desirable for such rooms.

○ Internal privacy could be maintained in the following ways

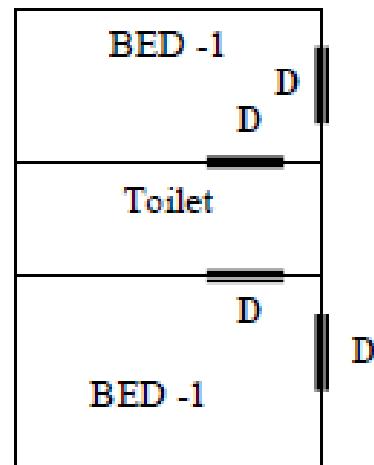
- Proper Privacy
- Proper disposition of doors
- The mode of hangings of doors
- Provision of small corridor, lobby, screen, curtain etc.



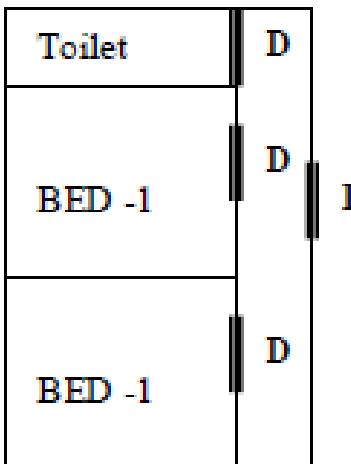
If the door is at the centre of short wall of room at disturbs the privacy & roominess



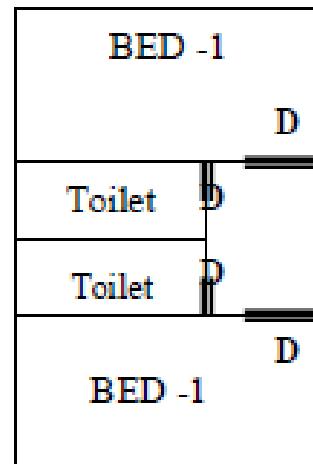
This is not a correct as bed room 1 then will be used as passage



Difficult as per operational point of view by providing accesses from both Bed rooms.



Shoulder to shoulder length of person is 600 mm width of passage for two person or more should be 1200 mm. Here passage serves the purpose. But uneconomical.



This is most economical, one lobby is a room which gives independent access to various rooms.

- ⦿ **External Privacy:**

It is the privacy of the building. If the building is exposed to the public street or neighbor buildings there is no privacy for that. The entrance can be screened with trees or suitable grid work.

The extent of privacy of a building from the street or neighboring buildings depends mainly upon the functions performed in the building.

Many a time privacy of only a part of building is necessary from exterior whereas the remaining building as a whole may be required to be exposed to view. This is achieved by proper layout of streets, approach roads, entrances, provision of trees, creepers etc.



SANITATION

- The term sanitation covers not only sanitary convenience like water closet, urinals, bath rooms, wash basins etc., but also proper and adequate lightning ventilation and facilities for general cleaning of the building.
- From hygienic considerations, all parts of the building should be well ventilated and lighted. The lighting of the interior of the building may be done by natural lighting, assisted natural lighting or by artificial lighting.
- Uniform distribution of light is necessary, specially in offices, schools, factories and other similar buildings where number of persons work in the same premises and each individual has to work at specified place.
- For ensuring sun light for greater length of time it is desirable to provide vertical windows. For proper lighting the area of windows in a room should not be less than 1/10th of the floor area which may be increased to 1/5th for buildings like schools, offices, workshops, factories etc.

- ◎ SANITATION INVOLVES PROPER

VENTILATION

LIGHTING

Ventilation

- Good ventilation is an important factor to comfort in buildings.
Ventilation is the change of air in a room .
- For living more sunlight, less over crowding and fresh air are necessary for a house.
- Requirement of space and air required

	Space, m ³	Air, m ³
Adult	8.5	20 – 30
Child	5.67	20 – 30

- Main function of ventilation
 - To maintains the quantity of air inside the building at certain level.
 - To provided thermal environment which will aspect in maintain the heat balance of the body.
 - To cool the structure of the building when the inside temperature is above outdoor.
 - To remove toxic gases, body odors, bacteria, smoke etc. from air inside the room.
 - During winter workers in factory and industrial plants from excessive heat, dust, moisture and supply fresh air for breathing

Functional requirements of Ventilation

Rate of supply of fresh air

- Depends on type of room or building, number of occupants, nature and period of working
- Required amount of fresh air must be admitted and vitiated air from inside must be removed

Air movement or air changes

- Air has to be circulated or changed
- Depends on velocity of air, disposition of inlets and outlets, number of persons using the space, type of work/activity
- Air Change is the volume of fresh air from outside allowed in one hour in a room compared with the volume of the room
- Air stagnation should not occur
- Mechanically achieved by injecting fresh air by blower and exhausting by providing exhaust

Temperature of Air

- Effective ventilation permits cool air in summers and warm air in winter
- Temperature of ventilating air must be lower than the room temperature in summers and vice-versa.
- Effective temperature for any space depends on number of occupants, type of activity, age of occupants, rate of change of air, amount of heat loss from body etc.

Humidity

- Relative humidity ranging between 30-70 % at a temperature of 21°C is considered desirable.
- At high temperature, low humidity and greater air movement is required

Purity of Air

- Air must be free from impurities such as organics matter, fumes, odour, unhealthy gases like CO, CO₂, SO₂, etc.
- Air containing less than 0.5 mg of suspended impurity per cubic meter of air and 0.5 ppm of sulfuric acid is considered pure.
- Inlet of ventilating system must not be near chimneys, latrines, septic tank, kitchen etc.

$$\text{Air changes per hour} = \frac{\text{quantity of air} \times \text{occupancy}}{\text{room volume}}$$

Table 2.1 Minimum Rate of Fresh Air Supply

<i>Type of building</i>	<i>Minimum volume of fresh air per hour</i>
1. Assembly halls, shops, canteens, cinema halls, auditorium, restaurants etc.	28 m ³ per person
2. Factories and workshops (i) Work places (ii) Lavatories & W.C.	23 m ³ per person 2 air changes
3. Residential buildings (i) Residential buildings (ii) Kitchens (iii) WC Baths (iv) Halls & corridors	3 air changes 6 air changes 6 air changes 1 air change
4. Office buildings	20–28 m ³ per person
5. Hospitals (i) Operation theatre and X-ray room (ii) Wards	10 air changes 3 air changes
6. Schools and colleges (i) Class room of lecture theatres (ii) Corridors, lavatories	28 m ³ per person 2 air changes

Clause 5.2.2.1 NBC 2005

Recommended values for air changes

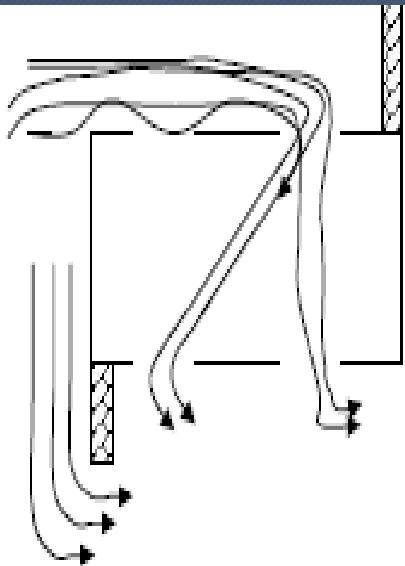
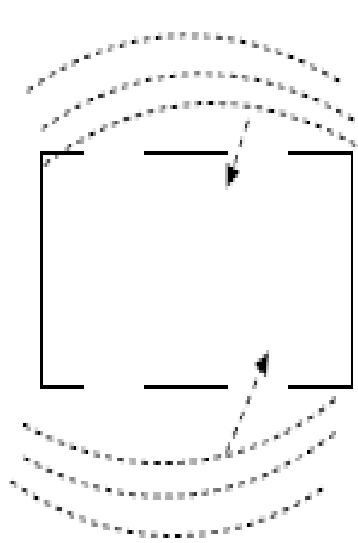
<i>Sl No.</i> (1)	<i>Application</i> (2)	<i>Air Change per Hour</i> (3)
1.	Assembly rooms	4-8
2.	Bakeries	20-30
3.	Banks/building societies	4-8
4.	Bathrooms	6-10
5.	Bedrooms	2-4
6.	Billiard rooms	6-8
7.	Boiler rooms	15-30
8.	Cafes and coffee bars	10-12
9.	Canteens	8-12
10.	Cellars	3-10
11.	Churches	1-3
12.	Cinemas and theatres	10-15
13.	Club rooms	12, <i>Min</i>
14.	Compressor rooms	10-12
15.	Conference rooms	8-12
16.	Dairies	8-12
17.	Dance halls	12, <i>Min</i>
18.	Dye works	20-30
19.	Electroplating shops	10-12
20.	Engine rooms	15-30
21.	Entrance halls	3-5
22.	Factories and work shops	8-10
23.	Foundries	15-30
24.	Garages	6-8
25.	Glass houses	25-60
26.	Gymnasium	6, <i>Min</i>
27.	Hair dressing saloon	10-15
28.	Hospitals-sterlizing	15-25
29.	Hospital-wards	6-8
30.	Hospital domestic	15-20
31.	Laboratories	6-15
32.	Laundrettes	10-15
33.	Laundries	10-30
34.	Lavatories	6-15
35.	Lecture theatres	5-8
36.	Libraries	3-5
37.	Living rooms	3-6
38.	Mushroom houses	6-10

◎ Types of ventilation

- **Natural ventilation** : air through windows, roof ventilation
- **Mechanical ventilation** : A.C, Fans, Exhausts etc.

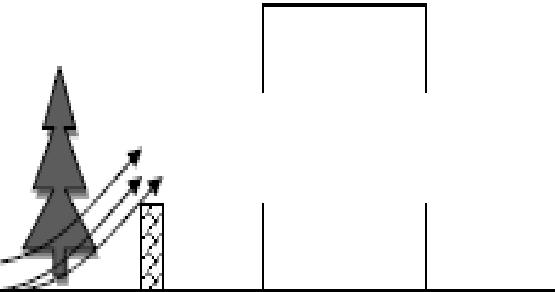
Natural Ventilation

I.

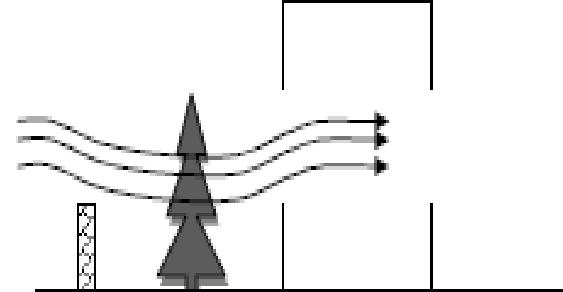


Openings are provided parallel with wind direction of the breeze but there is no air flow into the room

II. Wind hops over the room because of a poor arrangement of a row trees and a continuous hedge.



Wrong

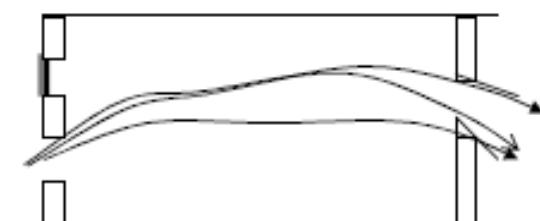


Correct

Wind can be diverted into the room by a reverse arrangement of the tree

III. How to get current natural ventilation in both summer and in Winter

Air pattern of cold and hot month



Occupants of the house should be protected from the heat and glare of the summer.

During summer the incoming air should be allowed to blow across the bodies of the occupants,

During the cold time the air should be allowed upward over the heads of the occupants,

Planning of natural ventilation:

- Vent opening properly distributed. Inlet should be located in windward side at low level and outward opening should be on the leeward side at a higher level near roof.
- Outlet openings on shorter side and inlets on longer side of rooms provide better ventilation
- Openings should not have obstructions like trees, buildings, signboards etc.
- Cross ventilation (providing openings in opposite walls) helps in more air changes. But can lead to air stagnation pockets and air circulation is restricted only to a limited portion.
- Height of a room should be proportionate to its size, number of users, nature of activity etc.
- Provisions for exit of smokes and fumes should be on roof

Standard Norms for Natural Ventilation

- Area of inlet openings should not be less than
 - 1/10th of floor area of residential building
 - 1/8th of buildings such as offices, schools, colleges, hospitals, etc.
- There must be atleast one window or ventilator in every room
- Inlet must be free from any obsruction
- Outlet openings should be provided near roof on leeward side

Mechanical Ventilation

- ◎ Fresh air supplied to the building wither by
 - positive ventilation : supply of fresh air means by mechanical device such as fan or blower, or
 - by infiltration by reduction of pressure inside due to exhaust of air: ventilated air exhausted by providing exhaust fans near ceiling of roof.
 - or by a combination of two

Types of Mechanical Ventilation

Supply/Plenum System

- Supply system sucks outside air into the house, creating positive pressures and causing inside air to leak out through holes, openings, or through ducts and vents,
- Fresh air supplied with the help of fans
- Air pressure increases and forces the ventilated air to exhaust from outlet openings
- Outlet openings can be near roof level and inlet openings at floor level (Upward Ventilation)
- Inlet openings can be near roof and outlet near floor (Downward Ventilation)

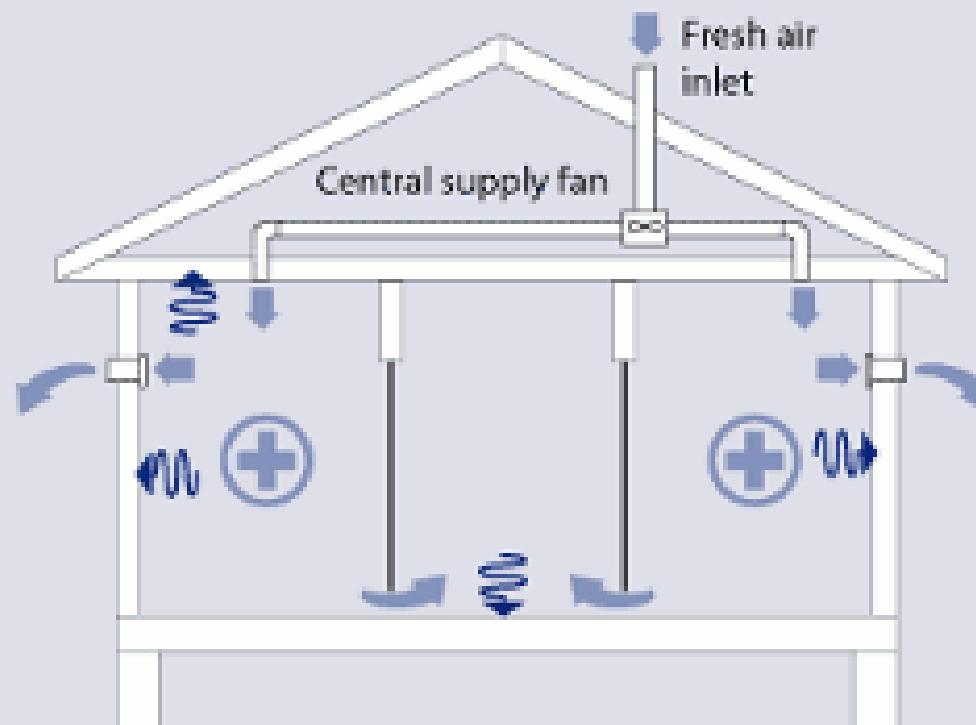
Exhaust System

- Involves **depressurizing** the building; fans create negative pressures into the living space, which brings outside air into the house through dedicated vents
- Air exhausted by exhaust fans fitted near roof level of room.
- Creates partial vacuum
- As ventilated air is exhausted, fresh air enters from openings
- Exhaust fans installed at suitable places help in admitting fresh air
- Suitable for kitchens, lavatories, industrial plants
- Helps in removing fumes, smoke, dust,

Supply and Exhaust System

- Combination of the two systems
- Air admitted through inlets by providing centrifugal fans near floor level and ventilated air exhausted by outlet opening with the help of a propeller type fan fitted near roof level

Supply Ventilation



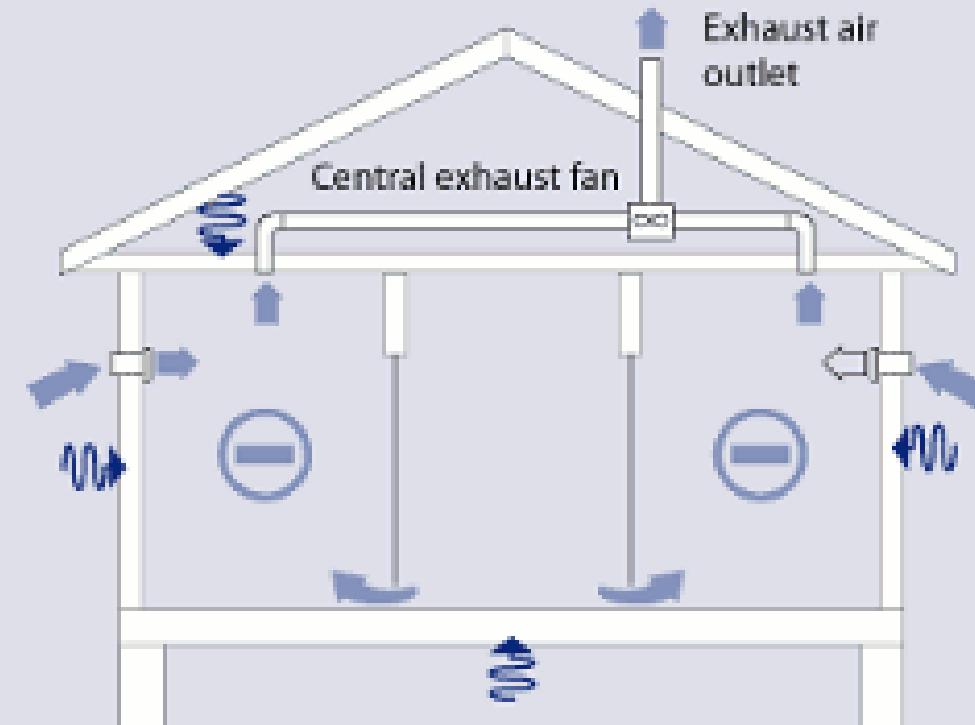
← Air flow

⊕ Positive air pressure

→ Air infiltration

⊖ Negative air pressure

Exhaust Ventilation



← Air flow

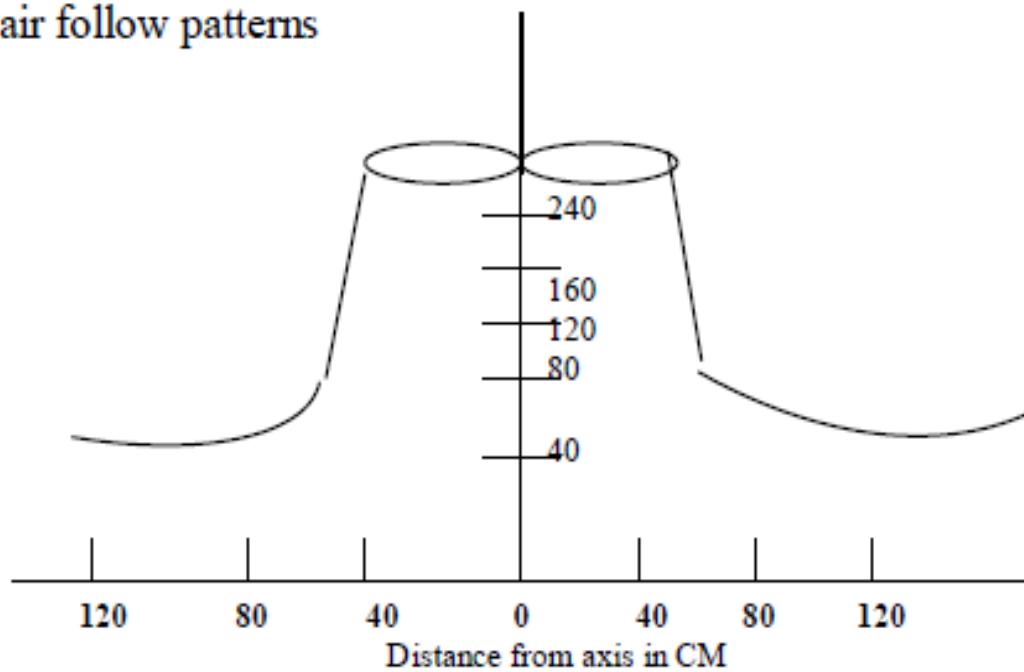
⊕ Positive air pressure

→ Air infiltration

⊖ Negative air pressure

Room size, “m”	Desired capacity o fan, “m ³ /min”	Fan size, “mm”
3.05 X 3.05	167.8	900
3.70 X 3.05	203.5	1200
4.30 X 3.70	236.5	1200
4.90 X 4.30	269.5	1400
6.10 X 4.90	335.5	1500

Ceiling fan and air follow patterns



Lightning

- Light divided in to Two types:
 1. Natural light
 2. Artificial light

For all types of buildings good lighting is a must .

- It helps in promoting different activities in the building, safety, creating pleasing atmosphere in different parts of the building.
- When illumination is sufficient , there is less tension in brain, heart rate is normal, visual sense is greater.
- If illumination is not sufficient, children bring their books closer to eyes which in turn effect eye sight.
- But more illumination is also harmful. Glaring of light is also harmful to sight.

Natural Lighting

Natural light are three types:

- a. Direct lighting
 - b. Indirect lighting
 - c. Combination of semi direct and indirect lighting
- a. **Direct lighting: By diffusing the light through frosted glass. If diffusion is perfect, light will be uniform and shade less.**
- b. **Indirect lighting : By use of Indirect lighting: A beam of light is directed to the wall, floor or ceiling and from there by reflect to other parts of the room**
 - Floor reflection - 10 % to 20 % of light
 - Wall reflection - 35 % to 55 % of light
 - Ceiling reflection - 65 % to 80 % of light
- c. **Combination of Semi direct and Indirect lighting. A luminous bowl allows some of the light to be diffused to be diffuse downward and some to be throws on the ceiling for reflection.**

Natural Lighting

① Artificial lighting:

Due to effective planning no artificial lighting is required in day time. But if recommended illumination is not reached, artificial lighting is necessary.

Direct lighting

Indirect lighting

Semi direct and indirect lighting

Table 4 Recommended Values of Illuminance
(Clauses 4.1.3, 4.1.3.2, 4.3.2 and 4.3.2.1)

Sl No.	Type of Interior or Activity	Range of Service Illuminance in Lux	Quality Class of Direct Glare Limitation	Remarks
(1)	(2)	(3)	(4)	(5)
1 AGRICULTURE AND HORTICULTURE				
1.1	Inspection of Farm Produce where Colour is Important	300-500-750	1	Local lighting may be appropriate
1.2	Other Important Tasks	200-300-500	2	Local lighting may be appropriate
1.2.1	Farm Workshops	50-100-150	3	
1.2.2	General	200-300-500	2	Local or portable lighting may be appropriate
1.3	Workbench or machine	50-100-150	3	
1.4	Milk Premises	30-50-100	3	
1.5	Sick Animal Pets, Calf Nurseries	20-30-50	3	
2 COAL MINING (SURFACE BUILDINGS)				
2.1	Coal Preparation Plant			
2.1.1	Walkways, floors under conveyors	30-50-100	3	
2.1.2	Wagon loading, bunkers	30-50-100	3	
2.1.3	Elevators, chute transfer pits, washbox area	50-100-150	3	
2.1.4	Drum filters, screen, rotating shafts	100-150-200	3	
2.1.5	Picking belts	150-200-300	3	Directional and colour properties of lighting may be important for easy recognition of coal and rock
2.2	Lamp Rooms			
2.2.1	Repair section	200-300-500	2	
2.2.2	Other areas	100-150-200	3	
2.3	Weight Cabins, Fan Houses	100-150-200	3	
2.4	Winding Houses	100-150-200	3	
3 ELECTRICITY GENERATION, TRANSMISSION AND DISTRIBUTION				
3.1	General Plant			
3.1.1	Turbine houses (operating floor)	150-200-300	2	
3.1.2	Boiler and turbine house basements	50-100-150	3	
3.1.3	Boiler houses, platforms, areas around burners	50-100-150	3	
3.1.4	Switch rooms, meter rooms, oil plant rooms, HV substations (indoor)	100-150-200	2	
3.1.5	Control rooms	200-300-500	1	Localized lighting of control display and the control desks may be appropriate
3.1.6	Control rooms	200-300-500	2	
3.1.7	Relay and telecommunication rooms	100-150-200	3	
3.1.8	Diesel generator rooms, compressor rooms	100-150-200	3	
3.1.9	Pump houses, water treatment plant houses	100-150-200	3	
3.1.10	Battery rooms, chargers, rectifiers	50-100-150	3	
3.1.11	Precipitator chambers, platforms, etc	50-100-150	3	
3.1.12	Cable tunnels and basements, circulating water culverts and screen chambers, storage tanks (indoor), operating areas and filling points at outdoor tanks	30-50-100	3	

**Part 3, Table 4,
 NBC 2005**

ELEGANCE

- ◎ Elegance is the term used to express the effect produced by the elevation and general layout of the building. Hence for a building to be elegant. It is necessary that its elevation should be evolved that it should be aesthetically pleasing and its layout should fit in well in relation to the site and its environment.

ECONOMY

- Economy is one of the very important factor which is required to be kept in view while involving any scheme. Every unit of the built up area is a function of cost and as such the architect has to make sure that the building planned by him can be completed within the funds available for the project. Many a times it becomes necessary to carry out number of alteration in the plans to keep the proposal within the limitation of funds.
- Some of the factors which can be considered to achieve economy without sacrificing the basic principles of planning are:
 - (a) Conceive simple elevation without ornamental work.
 - (b) Standardize the size of various components of the building.
 - (c) Do not use rich specification for internal and external finishes.
 - (d) Specify use of locally available materials to the extent possible.
 - (e) Do not use timber for doors/windows frames. Use R.C.C. frames and L-iron steel frames instead.

BUILDING BYE-LAWS

BYE LAWS

- Regulations/Building Bye Laws are legal tools used to regulate coverage, height, architectural design and construction aspects of buildings so as to achieve orderly development of an area, prepared by town planning authorities or municipal corporations.
- They are mandatory in nature and serve to protect buildings against fire, earth quake, noise, structural failures and other hazards.
- Regulations/Building Bye Laws help to avoid encroachments and protect the right of way.
- Proposed plans of buildings are prepared acc. to bye laws which are checked and approved by authorities.

Aspects governed by Bye Laws

Building lines

Built up area of building

Height of building

Open spaces around buildings

Provision for Size, height, ventilation of rooms etc.

Provision for water supply and disposal of waste water

Structural Design of Building

DISTANCE FROM ELECTRIC SUPPLY LINES

Clearances from Electric Supply Lines

Sr. No.	Type of Supply Line	Vertical Clearance	Horizontal Clearance
1.	Voltage lines and service lines not exceeding 650V	2.50 Metre	1.20 Metre
2.	High voltage lines above 650 Volts and including 11,000 Volts	3.70 Metre upto and including 33kV	1.20 Metre
3.	High voltage lines above 11,000 Volts and upto and including 33,000 Volts	3.70 Metre	2.00 Metre
4.	Extra high voltage lines additional 33,000 Volts	3.70 Metre plus 0.30 Metre for every additional 33,000 Volts or part thereof	2.00 Metre plus 0.30 Metre for every additional 33,000 Volts or part thereof

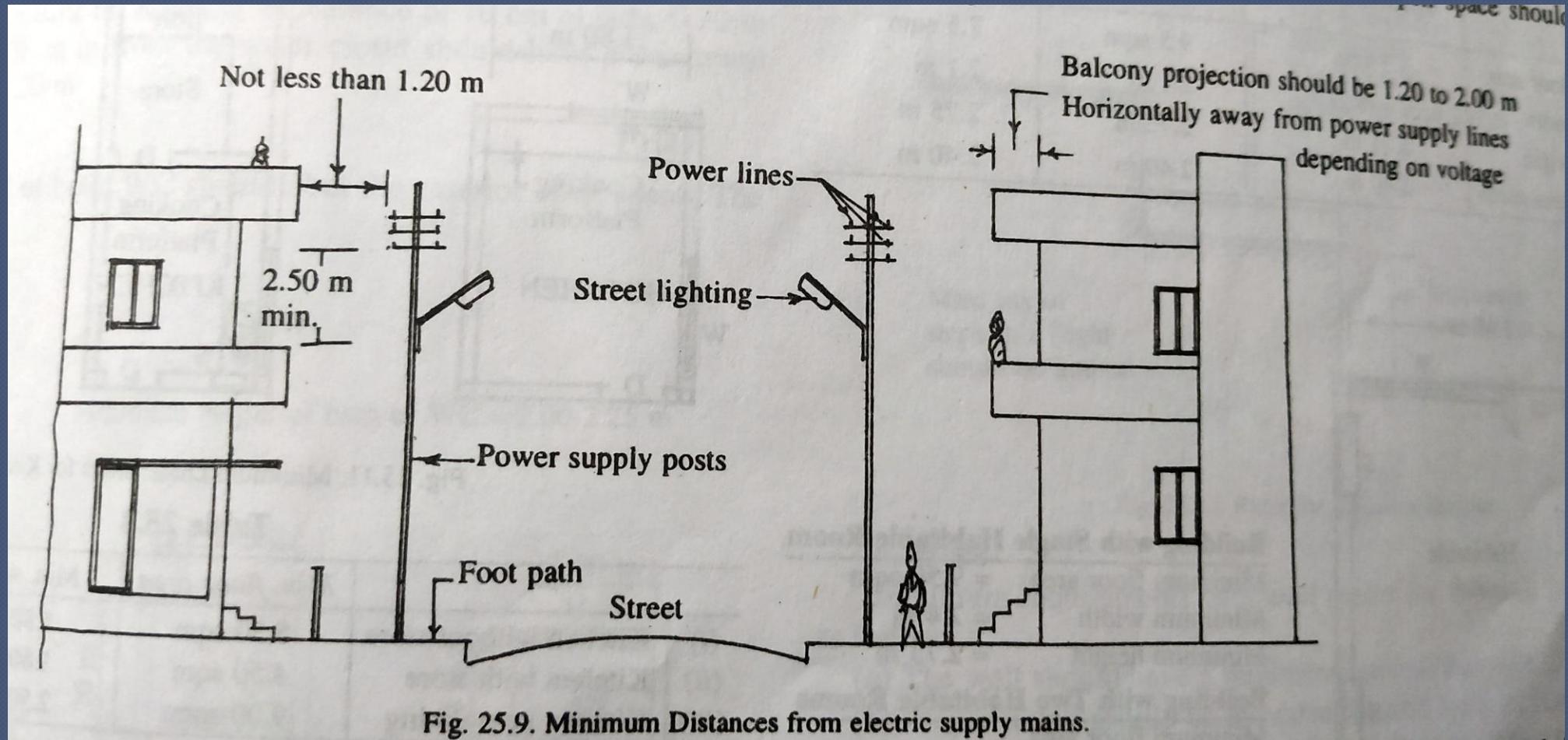


Fig. 25.9. Minimum Distances from electric supply mains.

AREA USAGE, GROUND COVERAGE

5. Development Control Regulations

5.1 Residential Buildings:

The layout plan for detached residential building is formulated keeping in view:

- (i) That there should be sufficient sun light and fresh air/ ventilation in the habitable area within the building, when constructed.
- (ii) That there is protection against noise, dust and pollution hazards.
- (iii) That circulation and access is easy and safe from any accident point of view.

Building Control in Residential Premises

Sr. No.	Plot Area (M ²)	Maximum Ground Coverage %	FAR	Maximum Height (Metre)
1.	30	80	2.00	9
2.	Above 30 upto50	75	2.00	9
3.	Above 50 upto100	65	1.80	12
4.	Above 100 upto250	65	1.80	12
5.	Above 250 upto500	55	1.65	15
6.	Above 500 upto1000	45	1.50	15
7.	Above 1000 upto1500	40	1.50	18
8.	Above 1500 upto3000	33.30	1.50	21

Note:-

1. The three stroyed building shall be permitted in the Planning Area irrespective of FAR.
2. The Floor Area Ratio (FAR) means the quotient obtained by dividing the total covered area (plinth area) on all floors multiplied by 100 by the area of the plot.

$$\text{FAR} = \frac{\text{Total covered area of all floors} \times 100}{\text{Plot Area}}$$

6.1.2. Market Area

There is dense market area. The already built up area in Nadaun market can be considered for in situ re-development. There won't be any consideration for set backs in market, but height would be restricted to 12.00 Metres only.

6.1.3. Tourism Units, Lodges, Hostels, Guest Houses

(i)	Minimum Plot Area	500 M ²
(ii)	Maximum Ground Coverage	50%
(iii)	Floor Area Ratio (FAR)	2.00
(iv)	Maximum Height	21.00 Metres

Note:- 10% of the FAR can be used as commercial space/ convenient shopping.

6.1.4. Marriage Palaces

(i)	Minimum Area	2000 M ²
(ii)	Maximum Ground Coverage	30%
(iii)	Floor Area Ratio (FAR)	1.00
(iv)	Maximum Height	15.00 Metres

6.1.5. Community Centre

(i)	Minimum Area	1000 M ²
(ii)	Maximum Ground Coverage	50%
(iii)	Floor Area Ratio (FAR)	1.50
(iv)	Maximum Height	15.00 Metres

6.1.6 Petrol Pump

(i)	Plot Size	1000 M ²
(ii)	Front of the plot should not be less than 30.00 Metres	

Note: Petrol Pump shall not be allowed within the Nagar Panchayat boundary.

6.1.7. Shops

(a)	Independent shop/ show rooms (standalone) above 10M ² to 30 M ²
-----	---

(i)	Maximum Height	6.00 Metres
(b)	Row shops with common wall on two sides above 30M ² to 100 M ²	
(i)	Floor Area Ratio (FAR)	1.75
(ii)	Maximum Height	9.00 Metres
(c)	Row shops with common wall on two sides above 100M ² to 250 M ²	
(i)	Floor Area Ratio (FAR)	1.75
(ii)	Maximum Height	18.00 Metres
(d)	Above 100M ² to 250 M ²	

(i)	Floor Area Ratio (FAR)	1.75
(ii)	Maximum Height	18.00 Metres

6.3.2 Primary School

(i)	Maximum ground coverage	40%
(ii)	Maximum FAR	1.20
(iii)	Maximum height	15 Metres

6.3.3 Higher Secondary School

(i)	Maximum ground coverage	35%
(ii)	Maximum FAR	2.00
(iii)	Maximum height	15 Metres

6.3.4 College

(i)	Maximum ground coverage	35%
-----	-------------------------	-----

meant for building.

6.4. Industrial Use:

The Regulations for Industrial use/activities shall be as per Regulations contained in Appendix-2 of the Himachal Pradesh Town and Country Planning Rules, 2014.

For Industrial use/activities, following Regulations shall be applicable:-

6.4.1 Minimum area of plot:-

- (a) For small scale industry shall be 250 M² to 500 M².
- (b) For services/light scale industry shall be 501 M² to 1000 M².
- (c) For medium scale industry shall be 1001 M² to 5000 M².
- (d) For large and heavy scale industry shall be above 5000 M².

6.4.2 Height of floor/storey:-

The minimum floor/ storey height of industrial building shall be 3.00 Metres and sloping roof height shall be in accordance with volume of the structure. In case of roof trusses, height of building should be adjusted /relaxed accordingly.

6.4.3 Type of Industry, plot area, minimum set-backs, maximum FAR and maximum height of building:-

The plot area, minimum set-backs, maximum Floor Area Ratio (FAR) and maximum height of building shall be governed by following Table: -

Sr. No.	Type of Industry	Plot area in M ²	Minimum Set Back in Metres				Max. FAR	Max. Height in Metres from Mean Sea Level upto 1000 M
			Front	Left	Right	Rear		
1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Small Scale Industries	250 to 500	3.00	2.00	2.00	2.00	1.75	15.00
2.	Services/ Light scale Industries	501 to 1000	5.00	2.00	2.00	3.00	1.50	15.00
3.	Medium Scale Industries	1001 to 5000	10.00	5.00	5.00	5.00	1.25	20.00
4.	Large and Heavy Scale Industries	Above 5000	15.00	7.50	7.50	7.50	1.00	20.00

Note:-

- (i) Minimum width of path/road abutting one side of plot shall be 5.00 M.

OPEN SPACES

Table 26.2. Open Spaces Around Buildings

<i>S. No. Description of building</i>	<i>Front open yard or width.</i>	<i>Side yard or open space width</i>	<i>Rear yard or open space width</i>	<i>Remarks</i>
1. Buildings having heights less than 10.0 m.	3.0. m In no case than 1.8m if building is facing two or more sides.	3.0 m	3.0 m in no case less than 1.8 m.	Minimum building line 7.5 m.
2. Building having heights more than 10.0 m and less then 25 m.	$3.0 + C_1$	$3.0 + C_1$ m	$3.0 + C_1$ m	The value of C_1 is 1 m for every 3 m beyond 10 m height of building.
3. Buildings having heights more than 25 m and less than 30.0 m.	10.0 m	10.0	10.0	
4. Building havings heights more than 30.0 m.	$10.0 + C_2$	$10.0 + C_2$	$10.0 + C_2$	The value of C_2 is 1.0 m for every 5 m beyond 30.0 m.

Front open space

<i>Minimum front open space</i>	<i>Width of street fronting the plot</i>	<i>Remarks</i>
(i) 1.5 m	Upto 7.50 m	For buildings upto a height of 7 m
(ii) 3.0 m	7.5 to 18.0 m	For buildings upto a height of 10 m
(iii) 4.5 m	18.0 to 30.0 m	"
(iv) 6.0 m	above 30 m	"

Note—1. For sites abutting two or more streets the value of open space should be based on the average width of the streets, subject to a minimum of 1.80 m for (ii) (iii) and (iv) above.

2. When the street fronting is less than 7.5 metres in width, the building should be at a minimum distance of 5.0 metres from the centre of the street.

Rear open space

- ◎ Min. rear space 3 m and at no place less than 1.8 m
- ◎ For back to back sites, rear open space should be 3 m throughout
- ◎ For plots of depth less than 9 m, rear open space may be reduced to 1.50 m

Side open space

3. Side open space

NBC Recommendations for buildings upto 10 m height.

- (i) *For detached buildings:* 3.0 m on both sides. However for buildings upto a height of 7.0 m in plots with a frontage less than 12 m, one of the side open spaces may be reduced to 1.50 m.
- (ii) *For semi-detached buildings:* 3.0 m on one side. In case of buildings upto a height of 7.0 m in plots with frontage less than 9 m the above side open space may be reduced to 1.50 m.

PLANNING OF INSTITUTION BUILDINGS

SCHOOLS/COLLEGES

- ◎ Rooms arranged on both sides of corridors
- ◎ Maximum usage of area

W.C.'s should be provided at the rate of 3 nos. per hundred student and urinals at the rate of 4 nos. per hundred students. The height of the rooms should be between 3.5 m to 4.8 m. The window areas should not be less than 0.167 times the floor area. Minimum two doors should be provided in each class room and laboratories. Ventilators should not be provided at the rate of 5% of floor area.

The orientation planning and arrangement of rooms should be done in proper way. There should be cross ventilation. The class rooms should be arranged in such a way that while teaching there should not be disturbances. As far as possible the class rooms and laboratories should be placed in the north side.

The area occupied by wall is 15 to 20 percent of the plinth area. The area taken by passage and verandah is 15% of the plinth area.

For the planning of institution/schools following areas may be taken :

S.No.	Description	Floor Area
1.	Principal's room	28 sq m
2.	Staff common room	0.15 sq m per student
3.	Library and reading room	0.5 sq m per student
4.	Office	0.3 sq m per student
5.	Store room	0.2 sq m per student
6.	Examination hall	0.5 sq m per student
7.	Science laboratory	1.5 sq m per student
8.	Class rooms	1.0 sq m per student

HOSTELS

Planning of hostel buildings following area may be taken:

S.No.	Description	Floor Area in sq. m
1.	Main Hostel Building	
1.	Single seated rooms	9.3 per student
2.	Double seated rooms	7.5 per student
3.	Triple or four seated rooms	6.5 to 7.0 per student
4.	Common rooms	
4.	Common and reading room	0.46 per student
5.	Dining hall	0.65 per student
6.	Kitchens	0.55 per student
7.	W.C. block	0.55 per student
	Or	
	One bath and one latrine per 8 students and one urinal per 16 students.	

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The areas of verandah, passage, stairs etc. may be taken 20% to 30% of the plinth area. The walls usually occupy 15% to 20% of plinth area. The plinth area of the hostel buildings may range from 18.6 to 22.3 sq. m per student. The height of the rooms should not be less than 3.3. The planning and inside arrangement of the hostel room should be done in such a way that one built-in wardrobe, one table, one chair, one book rack and one bed is provided to each student. All the rooms should be well lighted and ventilated and should be connected by corridor or passage. Buildings for warden and servants should also be provided at proper place.