



**GOVERNMENT POLYTECHNIC  
FOR GIRLS, AHMEDABAD  
CIVIL DEPARTMENT, SEM – 6<sup>TH</sup>**

**BUILDING SERVICES**

**Topic :-LIFTS OR  
ELEVATORS**

**GOVERNMENT POLYTECHNIC FOR GIRLS**

**AHMEDABAD**

**COURSE: BUILDING SERVICES**

**COURSE CODE : 3360604**

**TOPIC: LIFTS**

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## Introduction:

**In a building the following mechanical services are required:**

1. Lifts (elevators)
2. Dumbwaiters
3. Conveyors
4. Escalators
5. Air conditioning
6. Pumps

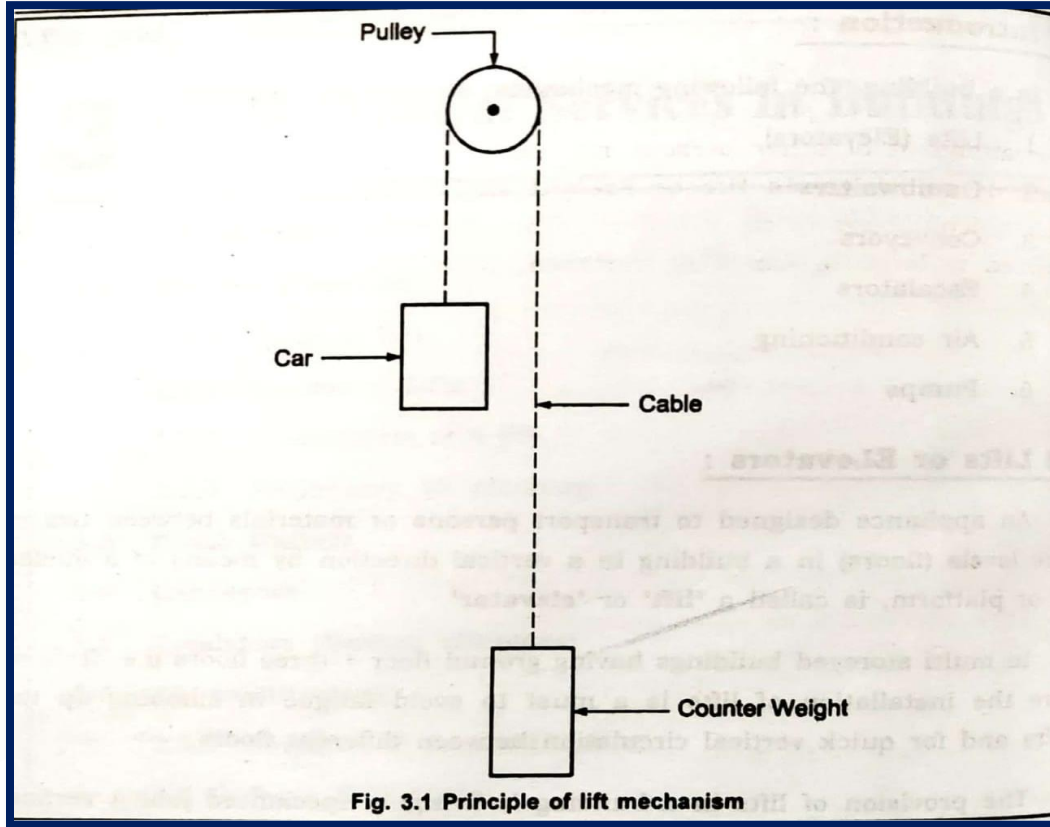
## Lift or elevators:

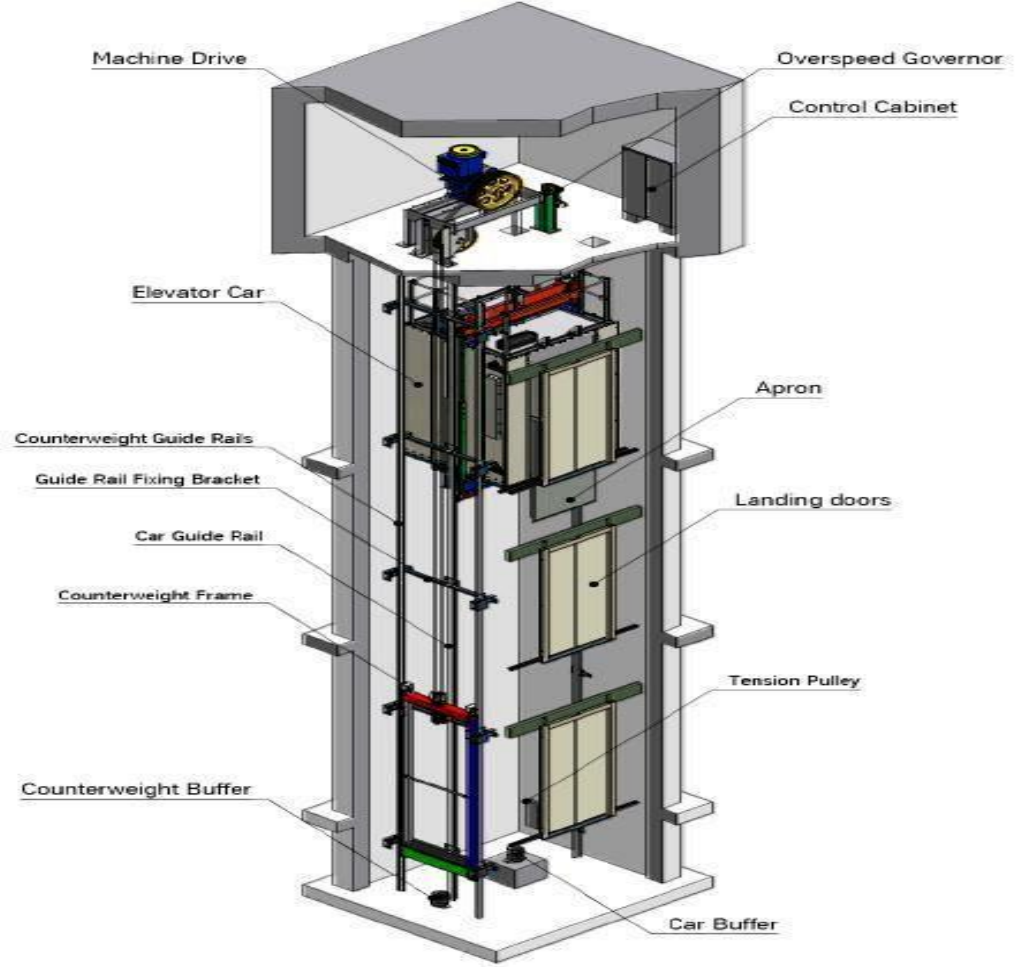
- An appliance designed to transport persons or materials between two or more levels (floors) in a building in a vertical direction by means of a guided car or platform, is called a 'lift' or 'elevator'.
- In multi strayed buildings having ground floor + three floors ( i.e. G+3 ) or more the installation of lifts is a must to avoid fatigue in climbing up the stairs and for quick vertical circulation between different floors.
- The provision of lifts in a building is a highly specialized job.
- A vertical Shaft with openings at the floor level is provided. the shaft is located at a suitable place e.g. by the side of staircase or within the open well of stair.

- The shaft (well) extends below the ground floor to accommodate the spring buffers for low speed lifts and hydraulic buffers for high speed lifts.
- Usually a machine room ( control room ) is located at the top of the lift shaft for hoisting equipment and accessories.

## Lift mechanism:

- Fig. shows a lift mechanism. A cable passes over a large pulley. One end of the cable is attached with the car and the other with the counter weight. car and counter weight always move in the opposite direction to each other, i.e. when car moves upwards the counter weight goes down.

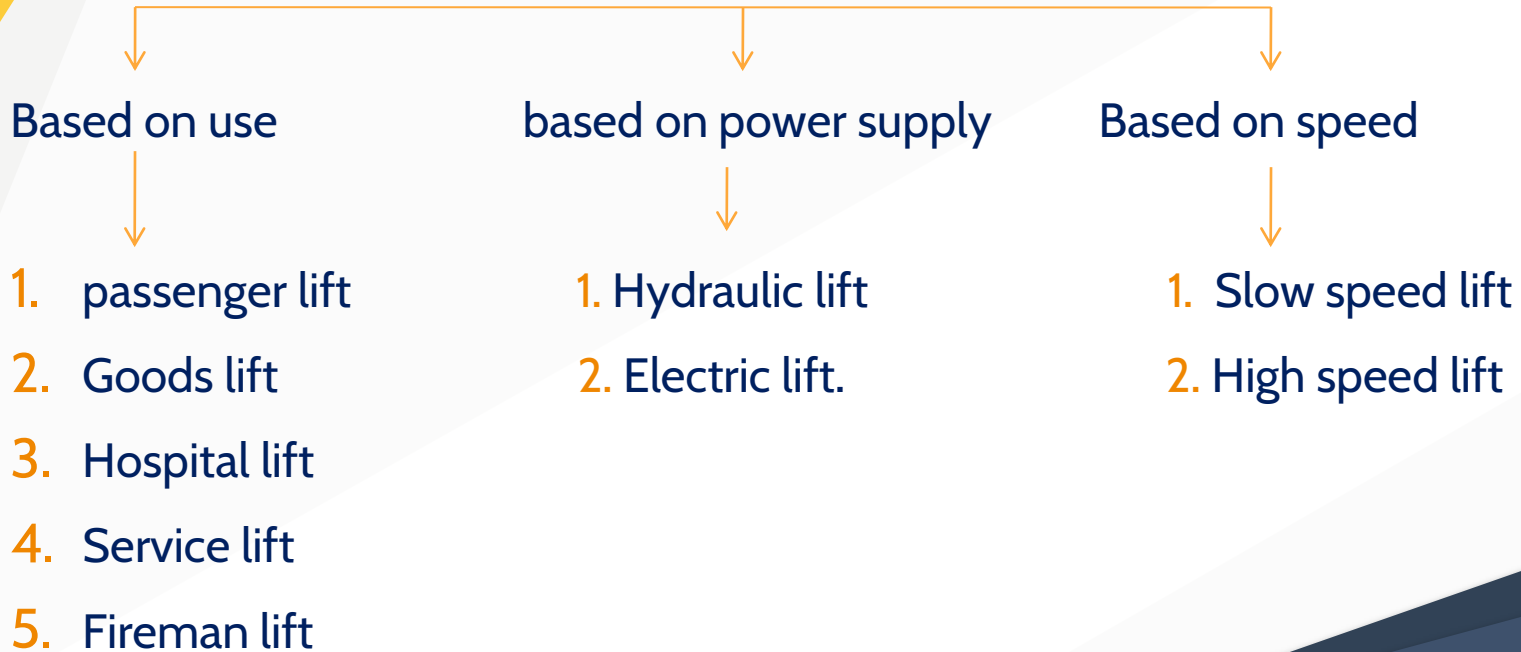






# Types of lifts :

## Types of lifts



- A lift designed for the transport of passengers is called passenger lift. They are provided in apartments, high-rise buildings and offices, etc.
- A lift designed primarily for the transport of goods, but which may carry a lift attendant or other person necessary for the loading and unloading of goods, is called goods lift or Freight lift..
- These are usually provided in industrial buildings to carry material from one floor to another floor.
- The size provided is large to carry big cartoons or packages. the speed is normally moderate or Slow.

- A lift normally installed in hospital/dispensary/clinic and design to accommodate one number bed /stretcher along its depth, with sufficient space around to carry a minimum of three attendants in addition to the lift operator, is called hospital lift.
- A service lift is passenger cum goods lift meant to carry goods along with people. Typically in an office building this may be required to carry food or stationeries, in a residential building to carry a bureau or accommodate a stretcher and in a hotel to be used for food trolley or baggage.

## Fireman lift :

- For buildings having height of 15 m or more at least one lift shall meet the requirement of fireman's lift as under:
- Lift car shall have floor area of not less than 1.44 m<sup>2</sup> ..it shall also have a loading capacity of not less than 544 kg (8 person)
- Lift landing doors shall have a minimum of fire resistance of one hour.
- Doors shall be of automatic operation for car and landing.
- It shall work at or above the speed of 1.0 m/s, so as to reach top floor from ground level within one minute.

## Construction Aspects of Lifts :

- The important construction Aspects of lifts are :
- In every building with height more than 15 m at least one lift should be provided.
- In buildings more than 24 m in height at least two lifts should be provided.
- In high rise buildings, one of the lift provided should be exclusively kept for freight (goods).
- The lift shaft walls should have a fire resistance of not less than 2 hours.
- Lift shafts should have permanent vent at the top not less than 0.2 sq.m in clear area.
- The machine room (control room ) should be located above lift shaft and separated by floor of machine room.

- Landing doors in lift enclosure should open into the ventilating lobby/ Landing area and doors should have fire resistance not less than 1 hour.
- Maximum four numbers of lifts should be provided in a lift bank. The lift shaft should be separated by brick masonry or RCC wall of fire resistance not less than 2 hours.
- A fire lift carrying 8 persons (544 kg) with floor area not less than 1.44 sq.m and speed not less than 1.0 m/s shall be provided in all high rise buildings . The lift should have solid door and the word 'FIRE-LIFT' Conspicuously displayed in fluorescent paint on the landing doors at each floor level.
- The minimum factor of safety for any part of the lift shall not be less than 5.

# Components of a lift :

Various components of a lift are :

1. Lift car
2. Lift well
3. Lift pit
4. Machine room
5. Landing doors
6. Guides
7. Counter weight
8. Hoistway
9. Hoist rope
10. Buffer

## Lift Car

- Lift car is a load carrying unit with its floor or platform, car frame and enclosing bodywork. Lift car has a basic frame work of steel angles and channels, which is called a sling incorporating the fixing for the guide shoes and the safety gear .
- The car has been made a wood panels or of sheet metal on light framing . There is a considerable range of decorative finish available ,such as aluminum sheet with matt, or anodized finish ,metal faced plywood ,plywood or block board with wood veneer or linoleum or rubber sheet . A vision panel with wired glass is necessary



- It is important that there is good ventilation in the car ,either by simple grills or by concealed louvers in the roof.
- These are often combined in the lighting fitting which can be set in a recess in the ceiling with air gaps on all sides .
- The lift car is connected by four wire ropes passing over the pillows to the counter weight.



The internal dimensions of a lift car shall be as under (NBC-2005)

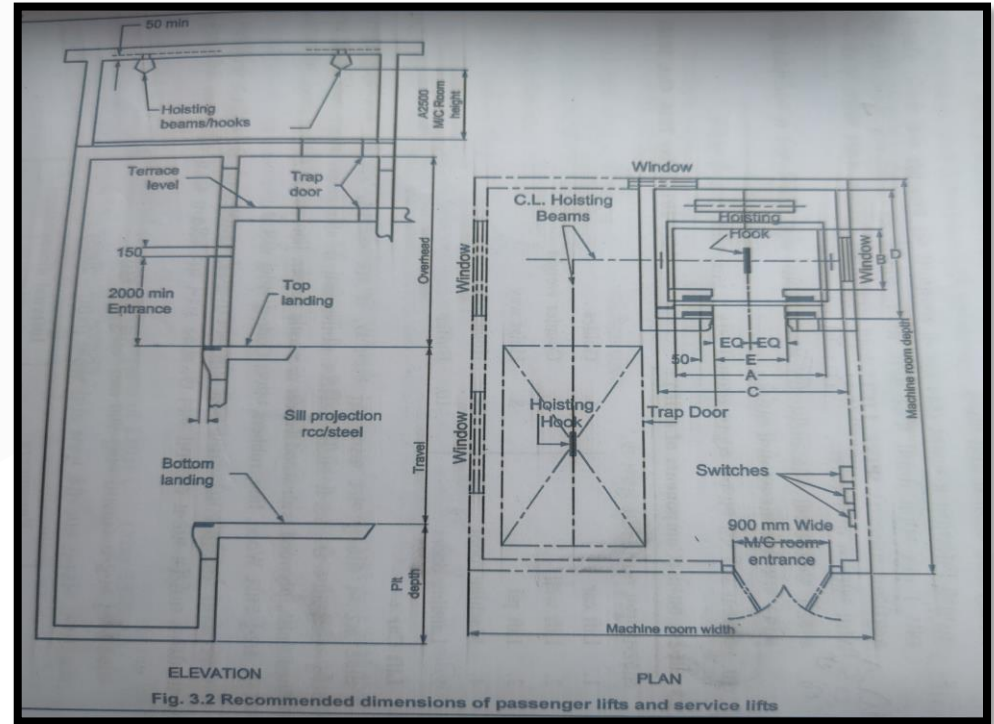
Passengers	Internal Dimensions
4	1100 x 700 mm
6	1100 x 1000 mm
8	1300 x 1100 mm

The width of entrance for a lift car shall not be less than 700 mm.

## Lift Well( Lift Shaft)

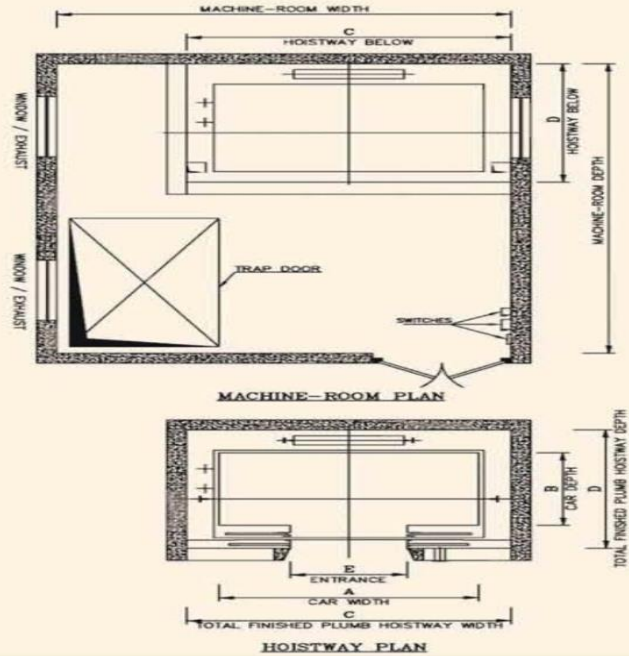
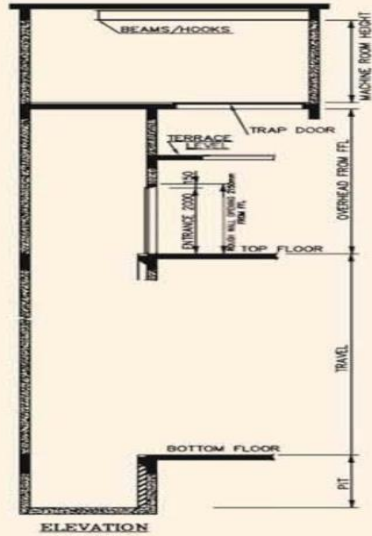
- The unobstructed space within an enclosure provided for the vertical movement of the lift car and counter weights , including the lift pit and the space for top clearance is known as lift well or lift shaft .
- Any structure which separates the lift well from it's surroundings is called lift well enclosures
- The guides at the point of balance of the car on each side are fixed to the lift well wall or to special steel work.

- These fixings are at about floor levels .
- Two other guides are required for the balance weight. These guides are T- section still accurately machined and finished.



**Table 12 Recommended Dimensions of Passenger Lifts and Service Lifts**  
*(Clause 5.10.3.1)*

All dimensions in millimetres.





The internal dimensions of a lift well shall be as under ( NBC-2005) :

Passengers	Internal dimensions of lift well
4	1900 × 1300 mm
6	1900 × 1700 mm
8	1900 × 1900 mm

# Lift Pit

- The lift well is extended down the lowest landing into what is known as the lift pit.
- In this pit are fixed the buffers, spring type for slower speed lifts and oil loaded for high speed lifts supported on a cement concrete block of 40×40×75 cm size.
- The depth of lift pit ranges from 1.35 m to 2.5 m depending upon the speed of the lift car.
- For higher speed lift cars, deep lift pit is required.

- Lifts pits shall be of sound construction and maintained in a dry and clean condition.
- Waterproofing shall be done to make it watertight .
- Where necessary ,provision shall be made for permanent drainage. where the pit depth exceeds 1.5 m suitable descending arrangement shall b provided to reach the lift pit.





## Recommended Dimensions Of Passenger Lifts And Service Lifts (NBC 2005).

Load		Car side		Lift well		Entrance
Person ( 1 ).	kg ( 2 )	A ( 3 )	B ( 4 )	C ( 5 )	D ( 6 )	E ( 7 )
4	272	1100	700	1900	1300	700, Min
6	408	1101	1000	1900	1700	700, Min
8	544	1300	1100	1900	1900	800
10	680	1300	1350	1900	2100	800
13	884	2000	1100	2500	1900	900
16	1088	2000	1300	2500	2100	1000
20	1360	2000	1500	2500	2400	1000

## Machine Room ( Control Room):

- The machine room is generally located above the lift well. The lift machine, controller and other apparatus and equipment of a lift installation shall be placed in the machine room
- The following equipments are housed in a machine room:
- Winding machine, comprising of the motor ,electrochemical brake ,worm gear and traction sheave.
- Controller mounted on a frame ,against a wall

- Floor selector that is operated by a steel tape attached to the car
- Over speed governor that operates the safety gear
- Pulleys etc.

Width of machine room = width of lift well (C)+1000mm

Depth of machine room =depth of lift well (D) +2000mm

The floor height of machine room shall not be less than 2 m.

- The machine room should not be used as store room
- The machine room should be provided with an insulated portable hand lamp for examining the machinery.

# Recommended Dimensions of Pit, Overhead and Machine Room for Passenger Lifts and Service Lifts

SPEED IN M/S (1)	UP TO 0.70 (2)	$>0.70 \leq 1.00$ (3)	$>1.00 \leq 1.50$ (4)	$>1.50 \leq 1.75$ (5)	$>1.75 < 2.00$ (6)	$>2.00 \leq 2.50$ (7)
Pit depth	1350	1500	1600	2150	2200	2500
Overhead	4200	4250	4800	4800	5200	5400
Machine-room Depth	D + 2000			D + 2500		
Machine – room Width	C + 1000		C + 1200		C + 1500	

# Landing Doors

- Every lift must have an openable door from which there is access to a
- landing, fitted with a landing door.
- The doors must be fitted with efficient interlocking or other devices so as to
- secure that the door can not be opened except when the lift car is at landing
- level and that the lift can not be moved up/down from the landing until the
- door is closed and locked.
- The doors are made of lightweight/thin materials like sheet steel, collapsible
- steel gates, flush leaf shutter wooden gates, etc
- The minimum size of door should be 700 mm x 2100 mm.

## ❖ Indicators:-

- when lifts are installed in totally enclosed wells, position indicators are
- recommended to be provided at each floor, however, where position
- indicators are not provided, at least 'direction indicators' or 'in use'
- indicators shall be provided at each landing

### ❖ **Call Indicators:-**

- A visual and audible device in the car to indicate to the attendant the lift landings
- from which calls have been made.
- On each floor, ' call push' are provided to call the lift at a particular floor.

### ❖ **Hoist Way :-**

- The shaft which guides the lift car to travel up and down is called hoist way.
- It extends from the bottom of the pit to the underside of the overhead machine
- room.

## ❖ Runby:-

- The distance a lift car can travel little beyond the terminal landing is called runby.
- The distance between the car buffer striker plate and the striker surface of the car buffer when the car is in level with the bottom terminal landing.
- For lift car and counter weight, the bottom run by should not be less than 150 mm
- For car, bottom runby should not exceed 600 mm and for counter weight,
- the bottom run by should not exceed 900 mm



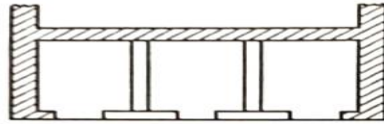
# Preliminary Lift Planning

## Number of lifts and capacity:-

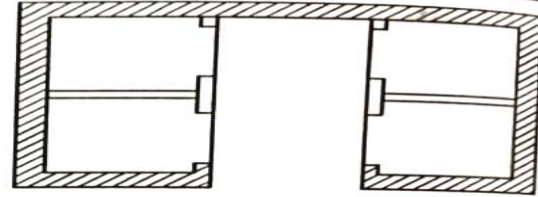
- Two basic consideration, namely, the quantity of service required and the
- quantity of service desired
- determine the type of lifts to be provided in a particular building.
- Quantity of service gives the passenger handling capacity of the lifts during the peak periods.
- The quantity of service is measured in terms of waiting time of passengers at various floors

- The number of passenger lifts and their capacities, that is load and speed, required for a given building depends on the characteristics of the building like;
- Number of floors to be served by the lift
- Floor to floor distance
- Populations of each floor to be served
- Maximum peak demand, this demand may be unidirectional, as in up and down peak periods.

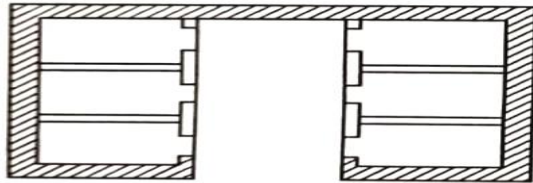
# Arrangement of lifts



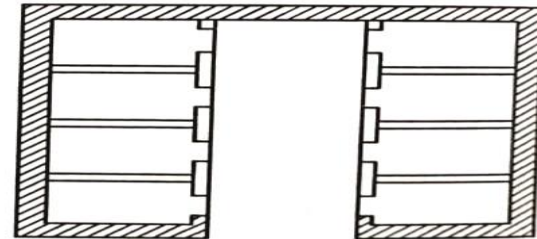
1A STRAIGHT LINE  
ARRANGEMENT FOR THREE LIFTS



1B ALCOVE ARRANGEMENT FOR  
FOUR LIFTS

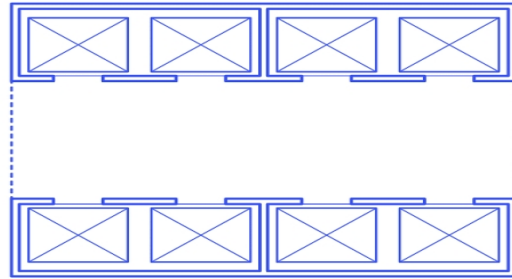
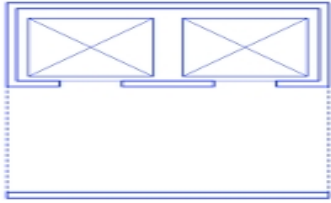


1C ARRANGEMENT FOR SIX LIFTS



1D ARRANGEMENT FOR EIGHT LIFTS

Fig. 3.3 Arrangement of lifts



- When a number of lifts are to be installed in a building, their possible arrangement is Shown in fig.
- The lifts should be easily accessible from all entrance to the building usually near the center of the building.
- It is preferable not to have all the lifts in a straight line.

# Planning **A Lift For Office Building** :

- A lift installation for office building is normally designed to populate the building at a given rate and the three main factors to be considered are :

( i ) Population of a building

( ii ) Quantity of service ( passenger handling capacity )

( iii ) Quantity of service ( passenger waiting time )

## ( i ) Population of a **building** :

- The first point to be ascertained from the eventual occupier is the total building population and whether this is likely to increase in the future.
- If a definite population figure is unobtainable an assessment should be made from the net area and probable population density. An average population density may be taken equal to 5 sq.m per person.

## ( ii ) Quantity of service :

- The quantity of service is a measure of the passenger handling capacity of a lift .
- It is measured in terms of the total number of passengers handled during each five minute peak period of the day.
- The recommended passenger handling capacity for various buildings is as follows :

Type of Building	Handling Capacity
Office – diversified tenants	10 to 15 %
Office – single tenant	15 to 25 %
Residential	7.5 %



### ( iii ) Quality of service :

- the quality of service is generally measured by the passenger waiting time at the various floors. The following shall be the guiding factor for determining this aspect.

Waiting time	Quality of service
20 to 25 seconds	Excellent
30 to 35 seconds	Good
34 to 40 seconds	Fair
45 seconds	Poor
Over 45 seconds	Unsatisfactory

## Capacity of car :

- For determining the load capacity of a lift car, the weight of a person shall be taken as 68 kg .
- The minimum size of car recommended for a single purpose building is one suitable for a duty load of 884 kg ( 13 person ).
- Generally, for large office buildings cars with capacities up to 2040 kg ( 30 persons ) are recommended.

## Speed of car :

- The speed of car depends upon the quantity of service required and the quality of service desired. The following general recommendations are made :

No. of floors	Speed
4 to 5	0.5 to 0.75 m/s
6 to 12	0.75 to 1.5 m/s
13 to 20	1.5 to 2.5 m/s
Above 20	2.5 m/s and above

## ❖ **Determination of handling capacity of lift :**

- The handling capacity of a lift is calculated by the following formula :
- $H = 300 \times Q \times 100 / T \times P$

Where,

H = Handling capacity as the peak population handled during 5 min period

Q = Average number of passengers carried in a car

T = Waiting interval in seconds

P = Total population to be handled during peak morning period

- The waiting interval ( T ) is calculated by the following formula :

$$T = \text{RTT}/N$$

Where,

T = Waiting interval in seconds

N = Number of lifts

RTT = Round trip time ( The average time required by each lift in taking one full load of passengers from ground floor, discharging them in various upper floors and coming back to ground floor for taking fresh passengers for the the next trip.

❖ RTT is the sum of the time required in the following process :

- i. Entry of the passengers on the ground floor
- ii. Exit of the passengers on each floor of discharge
- iii. Door closing time before each starting operation.
- iv. Door opening time on each discharging operation
- v. Acceleration periods
- vi. Stopping and leveling periods
- vii. Periods of full rated speeds between stops going up
- viii. periods of full rated speeds between stops going down.

# Maintenance of lifts/Elevators :

- Only authorized person, who have been approved by the electrical engineering to Government, can take up maintenance of lifts.
- The agency must inspect the lift once in a quarter year and should attend to all calls as and when required. The agency is supposed to undertake the routine works like ;
  1. Lubrication of wire ropes and guide-rails
  2. Motor gearing
  3. Checking the level of machine pits

4. • Cleaning of all the equipment
5. • Adjustment in electrical circuits, landing gate lock and car gate switch
6. • Inspection of hoist way switches
7. • Painting of all structural steel works
8. • Electrical circuit diagram of lift installation must be displayed.
9. • Maintenance log book to record all items relating to general servicing and inspection.



# Thank You

Courtesy : Dr R.P.Rethaliya  
Atul Prakashan