Elevators

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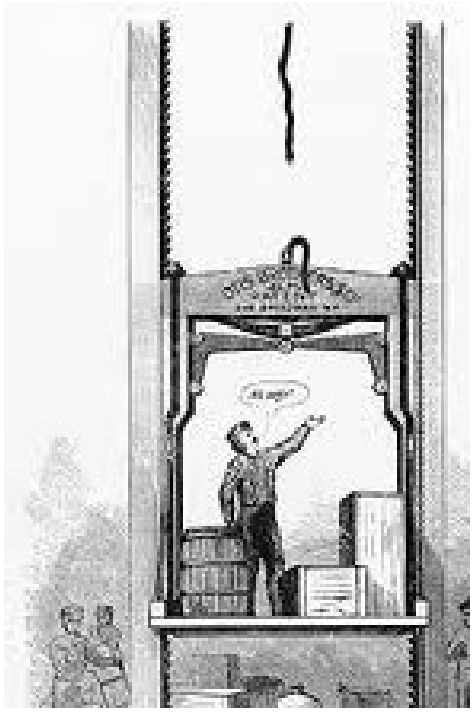
Lifts

- The first reference in literature to a lift is in the works of the Roman architect Vitruvius, who reported that Archimedes (c. 287 BC – c. 212 BC) built his first lift probably in 236 BC.

- Elisha Otis's invention of the Safety Gear in 1852 marks the birth of lifts as we know them



Other important inventions

- In 1874, J.W. Meaker patented a method which permitted lift doors to open and close safely.
- In 1887, American Inventor Alexander Miles of Duluth, Minnesota patented a lift with automatic doors that would close off the lift shaft.
- In 1888 Nikola Tesla invented the first practicable AC motor and with it the polyphase power transmission system.

Lifts mean taller buildings!

- The Equitable Life Building completed in 1870 in New York City was the first office building to have passenger lifts. They served 8 floors.

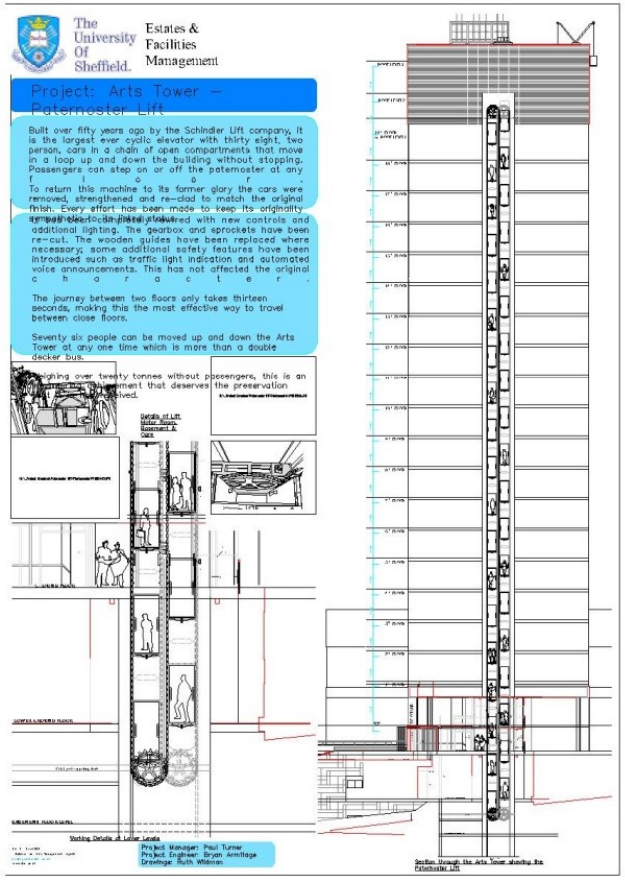
- The Tallest building in the world is currently The Burj Khalifa in Dubai with 160 floors.

Paternosters

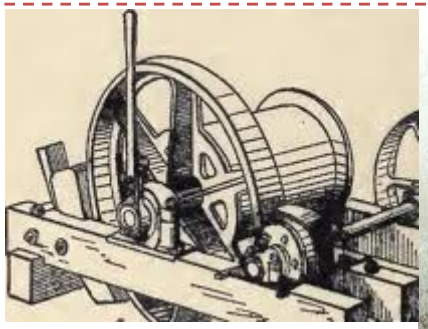
- First built in 1884 by the engineering firm of J & E Hall Ltd of Dartford as the Cyclic Elevator, the name paternoster ("Our Father", the first two words of the Lord's Prayer in Latin) was originally applied to the device because the elevator is in the form of a loop and is thus similar to rosary beads used as an aid in reciting prayers.

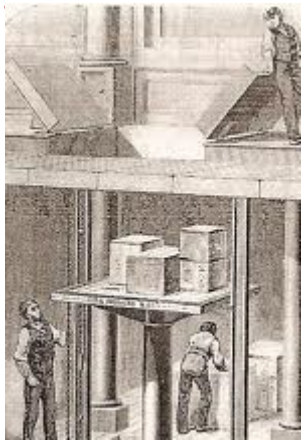
Paternosters

- Can move up to 1400 passengers per hour
- Best up to 6 floors
- The Arts Tower serves 21 floors!
- Not suitable for the elderly, disabled passengers or children
- Must not be used to transport goods



Moving Goods





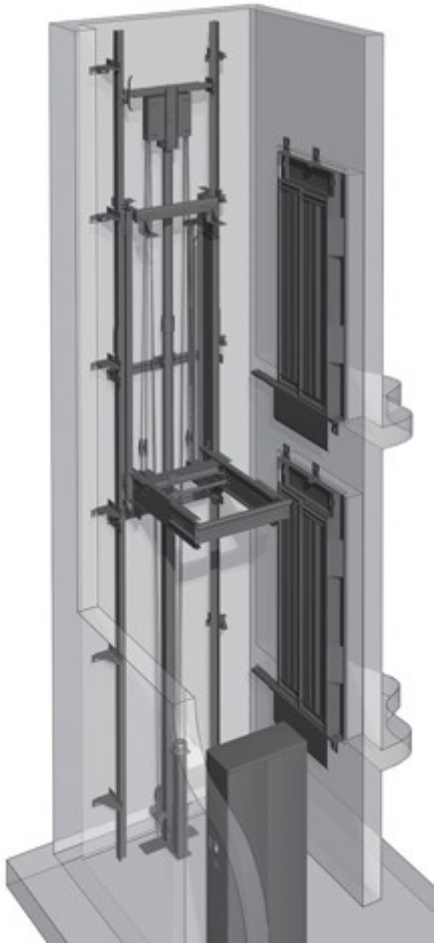
Moving People - planning a VT system

- How many people need to be transported in a 5 min period? Arrival rates as % of population
- How long do passengers have to wait for a lift? AWT
- How long do passengers take to get to their destination?
- How many lifts are needed?
- How big do the lifts need to be?
- How fast do the lifts need to be?
- How many journeys per year will the lifts make?

Choosing the Right Equipment

Hydraulic Lifts are best for:-

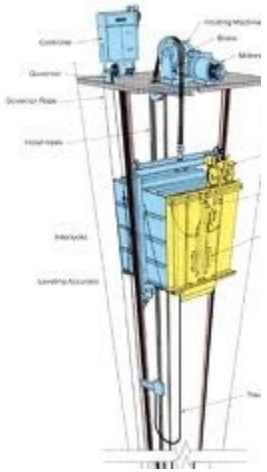
- Heavy Loads > 2000kg
- Low travel < 18metres
- Low number of starts per hour max 120
- Temperature stable environments
- Slow travel speeds max 1 m/sec
- Life expectancy < 20 years
- Some Machine room less versions



Choosing the right equipment

Traditional Electric lifts are best for:-

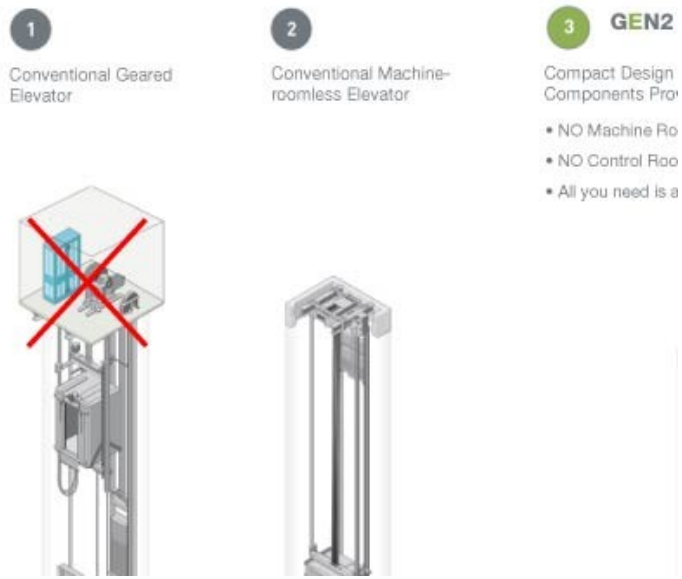
- Busy lifts with >180 starts per hour
- Fast performance up to 18m/sec,
- Excellent ride quality < 10mg
- Longer travel up to 150 m
- Loads up to 5000kg
- Life expectancy 25 to 40 years!



Choosing the right equipment

Machine Room Less (MRL) lifts

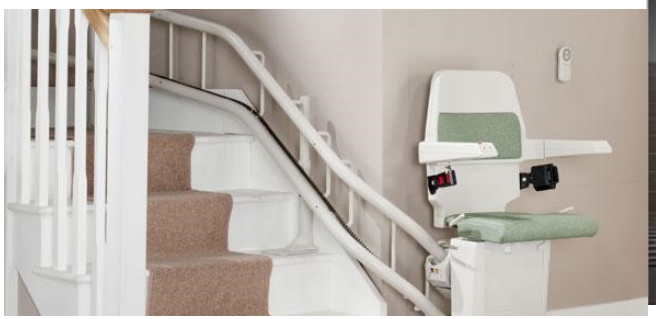
- Do not need a machine room and so save space
- Limited to about 40m travel
- Limited to 180 starts per hour
- Limited to 3.5m/s
- Limited to 3000kg
- Efficient gearless drives are best
- Life expectancy <20 years



Moving People

But not with lifts!

Machinery
Directive devices



Machinery Directive Devices

- Slow- less than 0.15m/sec
- Unsuitable for more than 10 to 30 operations per hour
- Unsuitable for travel over 3 metres (NB approval required).
- Require limited pit and headroom
- Mostly designed for transporting disabled passengers and not goods.
- Some designed for transporting goods but only trained operators as passengers.

Classification

Elevators

- **Passenger**
- **Freight**
- **Special service**

TYPES OF LIFTS

Lifts can be classified according to their use:-

Passenger Capsule lift

Passenger Enclosed lift

Hospital or bed lifts

Hydraulic lifts

Service lifts or dumbwaiters

Automobile lifts

Goods or freight lifts

Types

Elevators

- **traction**
  - **gearless → medium-high speed passenger**
  - **geared → low speed passenger**
- **hydraulic**
  - **plunger**
  - **hole-less**
  - **roped**

Traction elevators

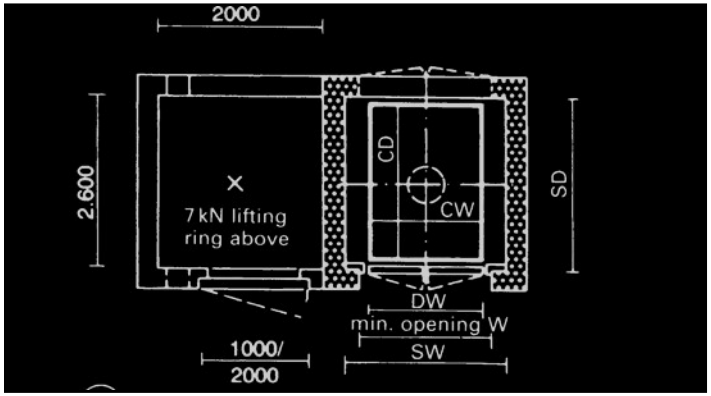
- **Geared traction** machines are driven by AC or DC electric motors.
- Geared machines use worm gears to control mechanical movement of elevator cars by "rolling" steel hoist ropes over a drive sheave which is attached to a gearbox driven by a high speed motor.
- These machines are generally the best option for basement or overhead traction use for speeds up to 500 ft/min (2.5 m/s).
- **Gearless traction** machines are low speed (low RPM), high torque electric motors powered either by AC or DC.
- In this case, the drive sheave is directly attached to the end of the motor. Gearless traction elevators can reach speeds of up to 2,000 ft/min (10 m/s), or even higher.
- A brake is mounted between the motor and drive sheave (or gearbox) to hold the elevator stationary at a floor.
- This brake is usually an external drum type and is actuated by spring force and held open electrically; a power failure will cause the brake to engage and prevent the elevator from falling.

Hydraulic Elevators

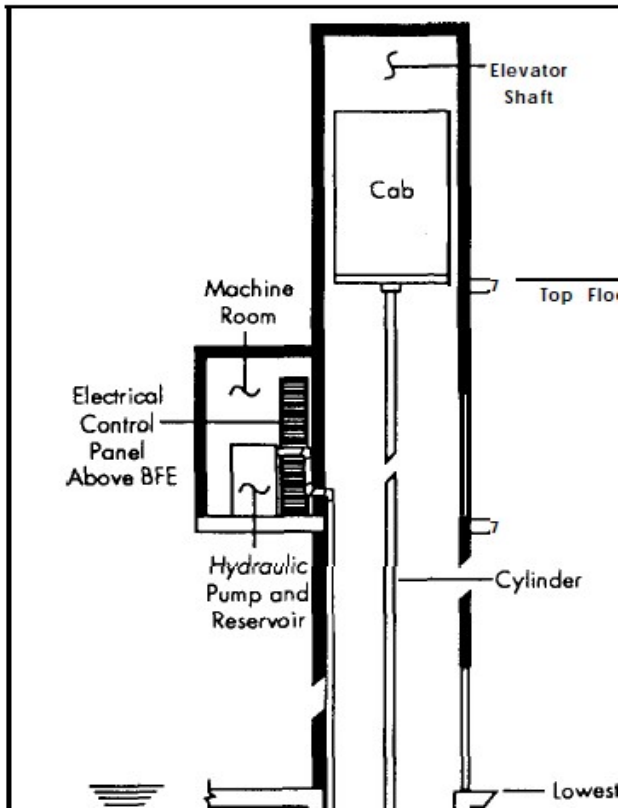
- Hydraulic elevator systems lift a car using a hydraulic ram, a fluid-driven piston mounted inside a cylinder.
  - •**Conventional hydraulic elevators.** They use an underground cylinder, are quite common for low level buildings with 2-5 floors (sometimes but seldom up to 6-8 floors), and have speeds of up to 200 feet/minute (1 meter/second).
  - •**Holeless hydraulic elevators** were developed in the 1970s, and use a pair of above ground cylinders, which makes it practical for environmentally or cost sensitive buildings with 2, 3, or 4 floors.
  - •**Roped hydraulic elevators** use both above ground cylinders and a rope system, they can serve up to 8-10 floors.

- Ideal for use in buildings up to six floors . Supported and raised by a powerful hydraulic plunger
- The machine room can be located nearly anywhere
- Height are the best used for up to 12m lift ht.
- The lift motor room can be located remotely from the shaft itself.

HEIGHT CLEARANCE OF THE LIFT DOOR SHOULD BE 50-100MM.
THE OPERATING SPEED OF HYDROLIC LIFTS IS 0.2-0.8M/S.



PLAN OF SHAFT WITH LIFT ROOM



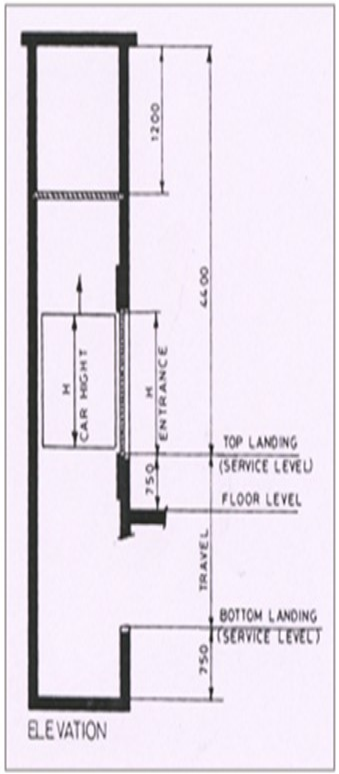
GOODS ELEVATORS

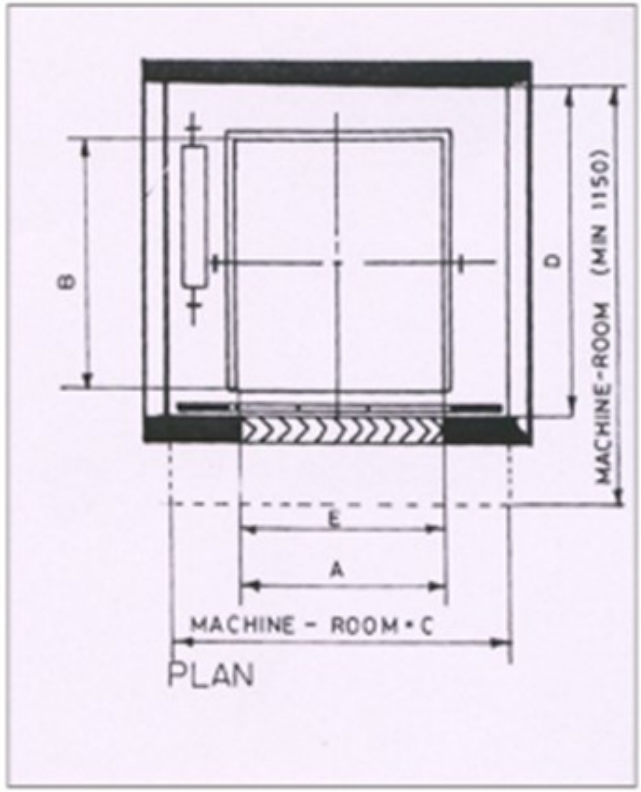
- Unlike passenger lifts, these lifts operate at considerably reduced speeds.
- Recommended speeds range from **15 to 25 meters per minute(50 to 80 ft. per minute).** Higher speeds increase the running costs.
- The control system in these types of lifts is usually of the semi-automatic type, or is fully steering.

SR.No	LOAD	CAR INSIDE		LIFT WELL		ENTRANCE
	KG	A	B	C	D	E
1	500	1100	1200	1900	1500	1100
2	1000	1400	1800	2300	2100	1400
3	1500	1700	2000	2600	2300	1700
4	2000	1700	2500	2600	2800	1700
5	2500	2000	2500	2900	2800	2000
6	3000	2000	3000	2900	3300	2000
7	4000	2500	3000	3400	3300	2500
8	5000	2500	3600	3400	3900	2500

DUMB WAITER

- Dumbwaiters which are definitely a boon to large commercial organizations like hotels, restaurants etc.
- They can be designed to suit a specific application like carrying mails, food & other light weight stuff.
- A small freight elevator is often called a dumbwaiter, mostly used for the taking of the small items such as dishes in a 2-storey kitchen or books in a multi-storey rack assembly resorts, hotels, restaurants, hospitals, and banks.





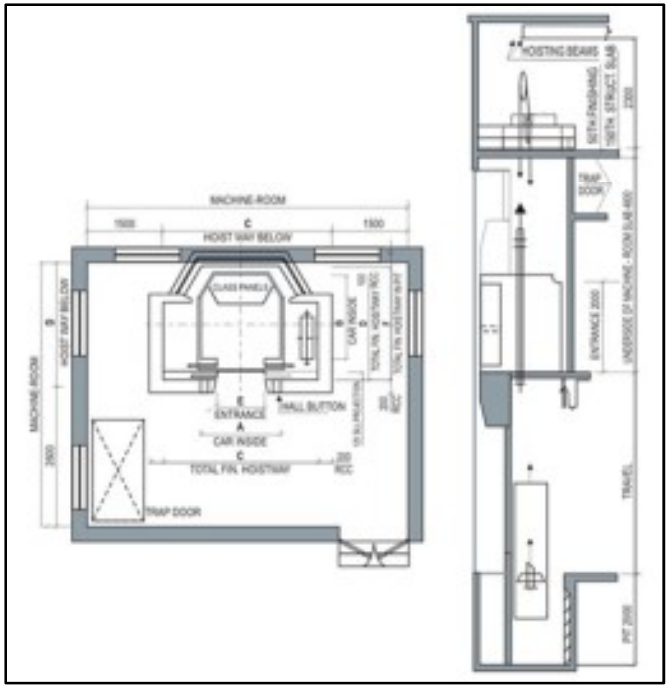
SR.No.	LOAD	CAR INSIDE			LIFT WELL		ENTRANCE
	KG	A	B	H	C	D	E
1	100	700	700	800	1200	900	700
2	150	800	800	900	1300	1000	800
3	200	900	900	1000	1400	1100	900
4	250	1000	1000	1200	1500	1200	1000

PANORAMIC GLASS LIFT

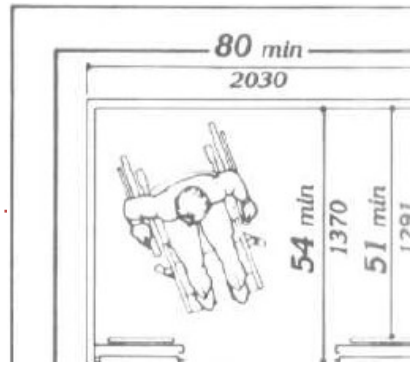
Panoramic lifts are available in a verity of cabin shapes and a carrying capacity of 400-1500kg (5-20 passenger)

Persons	Load	A	B	C	D	E	F
8	544	1100	1400	2350	1300	800	2200
10	680	1350	1400	2600	1300	800	2200
13	884	1350	1700	2600	1600	900	2500
16	1088	1600	1700	2800	1600	1000	2500
20	1360	1600	2000	3050	1900	1000	2800

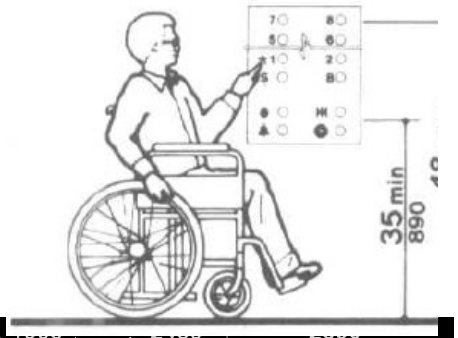
Persons	Load	A	B	C	D	E	F	G
13	884	900	2100	2700	1200	800	2800	1600
16	1088	1100	2200	3000	1250	900	3000	1700

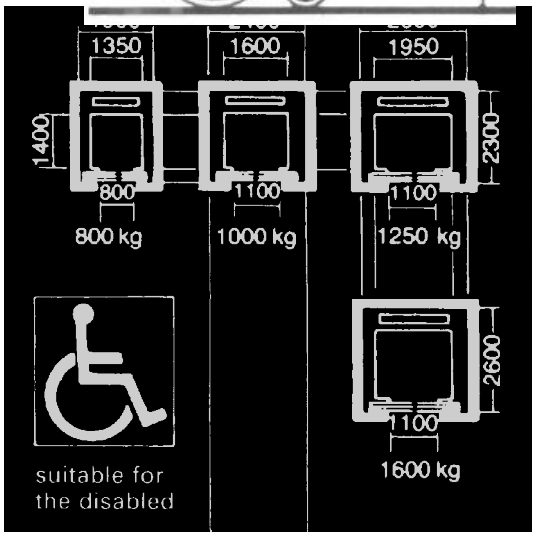


HOSPITAL LIFT



- The elevator car of hospital lifts
- [internal size: 1600mm x 2400mm]
- can easily carry a standard hospital bed.
- Bulky hospital equipments can also be transported via these elevators.
- The speed of these elevators ranges from **0.40mps to 2.5mps as per the need**. These hospital lifts make minimum noise therefore quite atmospheres of the hospitals are not disturbed.





STAIR LIFTS

- Stair lifts are mainly intended to take persons up the staircase with the ease of usability.

- The stair lifts are mainly utilized by the people confined to a wheel chair or who have knee problems or other medical conditions which make staircases difficult to climb.

- Stair lifts are also known by different names such as "stair chair lifts" & "stairway lifts".

Performance Criteria

Ideal Performance:

- minimum waiting time
- comfortable acceleration
- rapid transportation
- smooth/rapid slowing
- accurate leveling
- rapid loading/unloading
- quick/quiet door operation
- good visual travel direction/floor indicators
- easily operated controls
- comfortable lighting
- reliable emergency equipment
- smooth/safe operation of mechanical equipment

Codes and Standards

dards and codes of practice for electrically operated lifts and escalators, including equipment and components."

Bureau of Indian Stand
BIS at website: www.bi

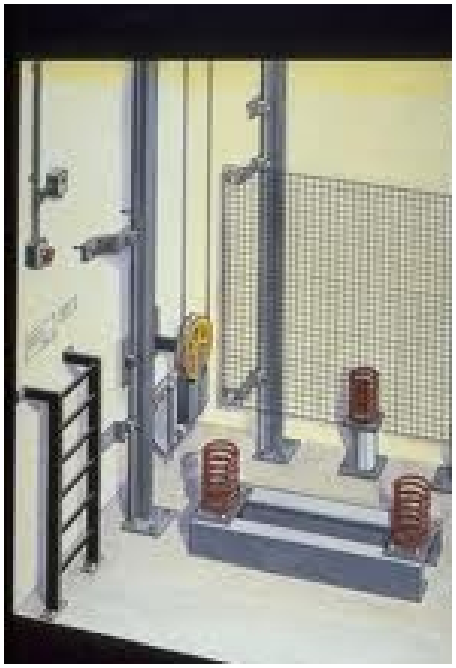
S1. No.	IS Number/ DOC Number	Title
1	IS 4591: 1968	Code of practice for installation and maintenance of escalators
2	IS 8216: 1976	Guide for inspection of lift wire ropes
3	IS 14665: Part 1: 2000	Electric Traction Lifts – Part 1: Guidelines for outline dimensions of passenger, goods, service and hospital lifts
4	IS 14665: Part 2: Sec 1 and 2: 2000	Electric Traction Lifts – Part 2: Code of practice for installation, Operation and maintenance: Section 1; Passenger and goods lifts: Section 2; Service Lifts
5	IS 14665: Part 3: Sec 1 and 2: 2000	Electric Traction Lifts – Part 3: Safety rules: Section 1; Passenger and goods lifts: Section 2; Service lifts
6	IS 14665: Part 4: Sec 1-9: 2001	Electric Traction Lifts – Part 4: Components: Section 1; Lifts buffers: Section 2; Lift guide rails and guide shoes: Section 3; Lift car frame, car, counterweight and suspension: Section 4; Lift safety gears and governors: Section 5
7	IS 14665: Part 5: 1999	Electric Traction Lifts – Specification – Part 5: Inspection manual

Elevator Terms

- Lift - An lift is a vertical transport equipment that efficiently moves people or goods between floors (levels, decks) of a building, vessel or other structure. Elevators are generally powered by electric motors that either drive traction cables or counterweight systems like a hoist, or pump hydraulic fluid to raise a cylindrical piston like a jack. The word 'elevator' is also synonymously used for 'lift'.
- Buffer -A device designed to stop a descending car or counter weight beyond its normal limit of travel by storing or by absorbing and dissipating the kinetic energy of the car or counterweight.
- Spring Buffer- A buffer which stores in a spring the kinetic energy of the descending car or counterweight.
- Car Bodywork - The enclosing bodywork of the lift car which comprises the sides and roof and is built upon the car platform.
- Counterweight - A weight or series of weights to counter-balance the weight of the lift car and part of the rated load.

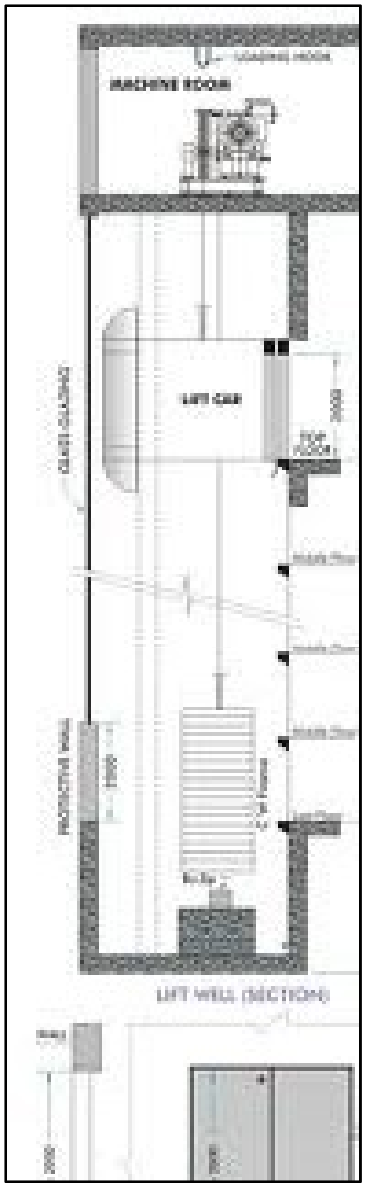
Elevator Terms

- Lift Landing — The portion of a building or structure used for discharge of passengers or goods or both into or from a lift car.
- Lift Pit — The space in the lift well below the level of the lowest lift landing served.
- Lift Well — The unobstructed space within an enclosure provided for the vertical movement of the lift car(s) and any counterweight(s), including the lift pit and the space for top clearance.
- Rated Speed (Lift) — The mean of the maximum speed attained by the lift car in the upward and downward direction with rated load in the lift car.
- Total Headroom — The vertical distance from the level of the top lift landing to the bottom of the machine room slab.

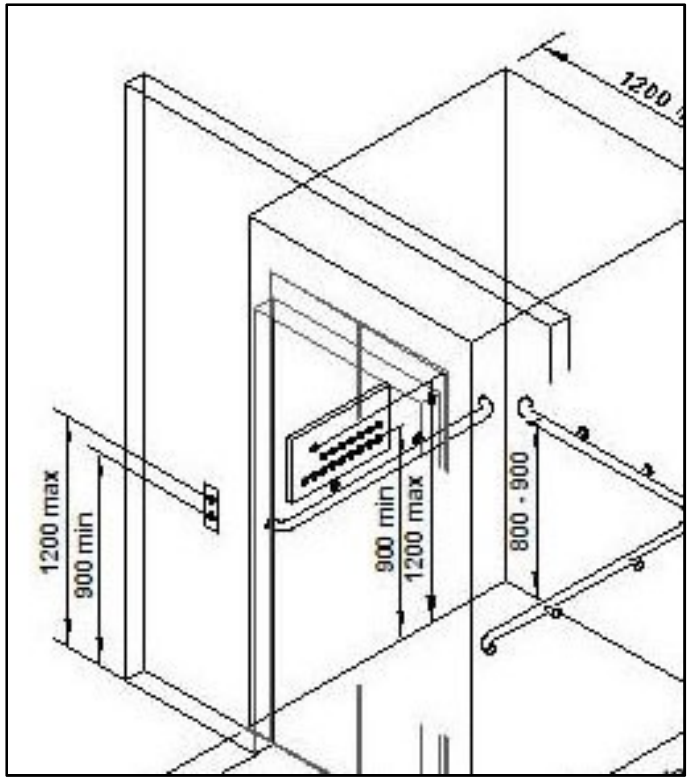


Lift pit

Spring Buffer



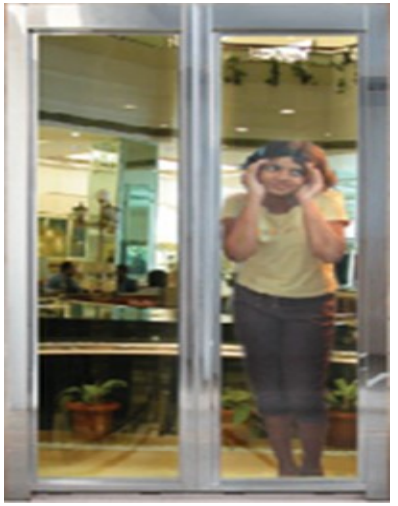
Lift well



Lift cabin

PASSENGER LIFTS

- Single speed lifts operate at a maximum speed of **40 meters(130 ft) per minute** powered by specially designed lift duty Single Speed motors.
- High Speed lifts are manufactured with self leveling devices.
- The Lift Control System can be of Car Switch or Automatic Type.



LIFTS CABIN

HYDRAULIC :

- For low-rise buildings –
- Speeds up to 200 ft/min .
- Ideal where design limitations preclude overhead supports and machine rooms.
- Economical to install and maintain
- No penthouse or load-bearing walls required

GEARED TRACTION :-

- For low- to medium rise buildings
- speeds up to 400 ft/min .
- Recommended for all types of buildings where higher speeds are not essential .

GEARLESS TRACTION :

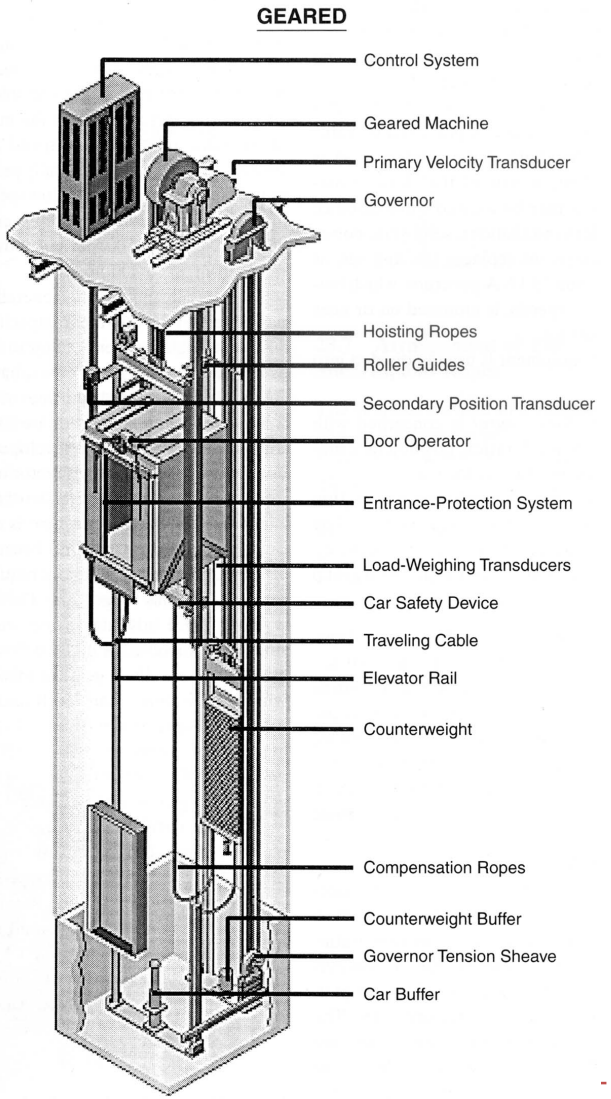
- Recommended for high-rise applications requiring the ultimate in service
- speeds of 500 ft/min and up.

Elevator Design Considerations

Passenger Elevator Components

Traction Elevator

- car
- cables
- elevator machine
- controls
- counterweight
- Hoist way
- rails
- penthouse
- pit



S: p. 1395, F.31.1

Traction Elevator Components

Machine room

- 8’-6” minimum clear

Bottom of Beam (OH)

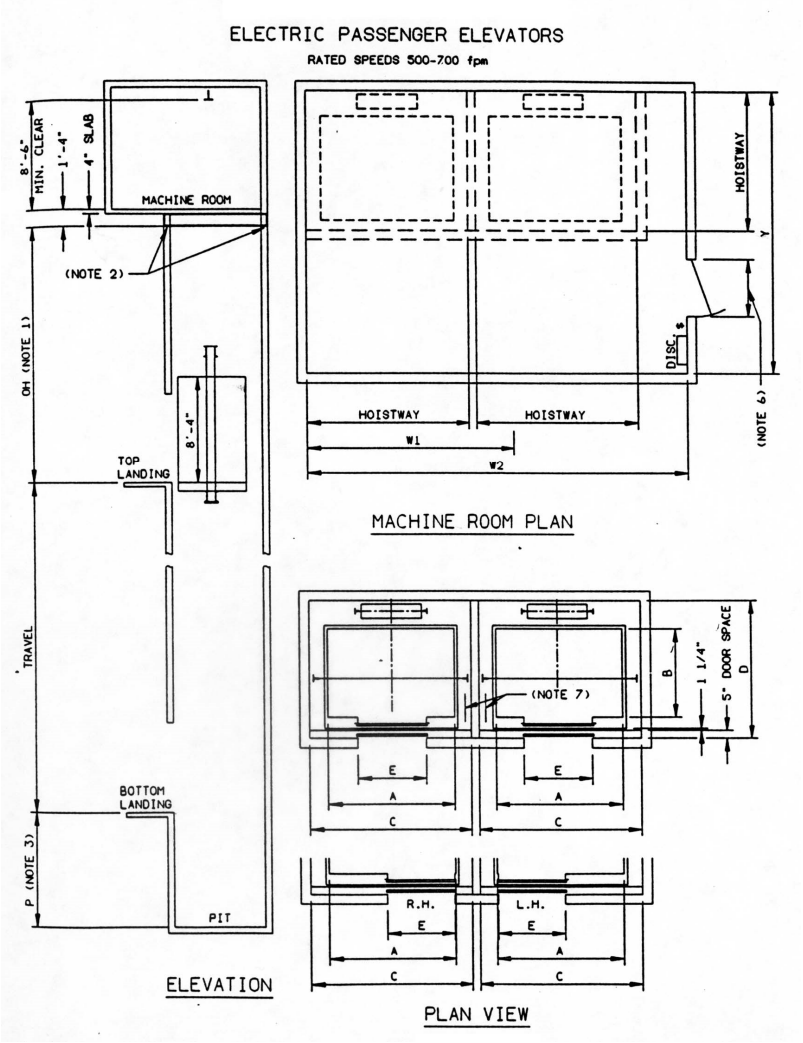
- 17’-6” – 20’6”

Travel

- number of floors

Pit (P)

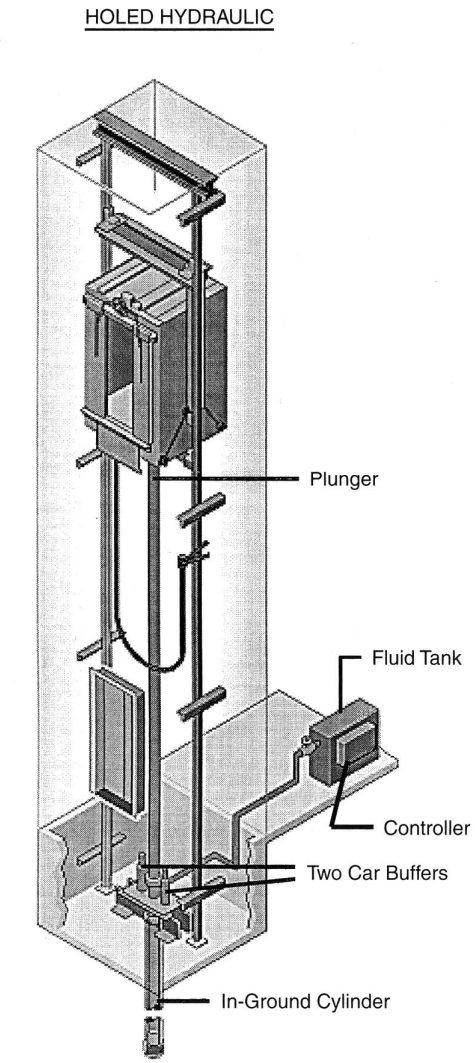
- 10’-1” – 11-5”



Passenger Elevator Components

Hydraulic

- car
- plunger/piston/jack
- elevator machine
- controls
- hoist way
- rails
- penthouse/headway
- pit



Hydraulic Elevator Components

Machine room

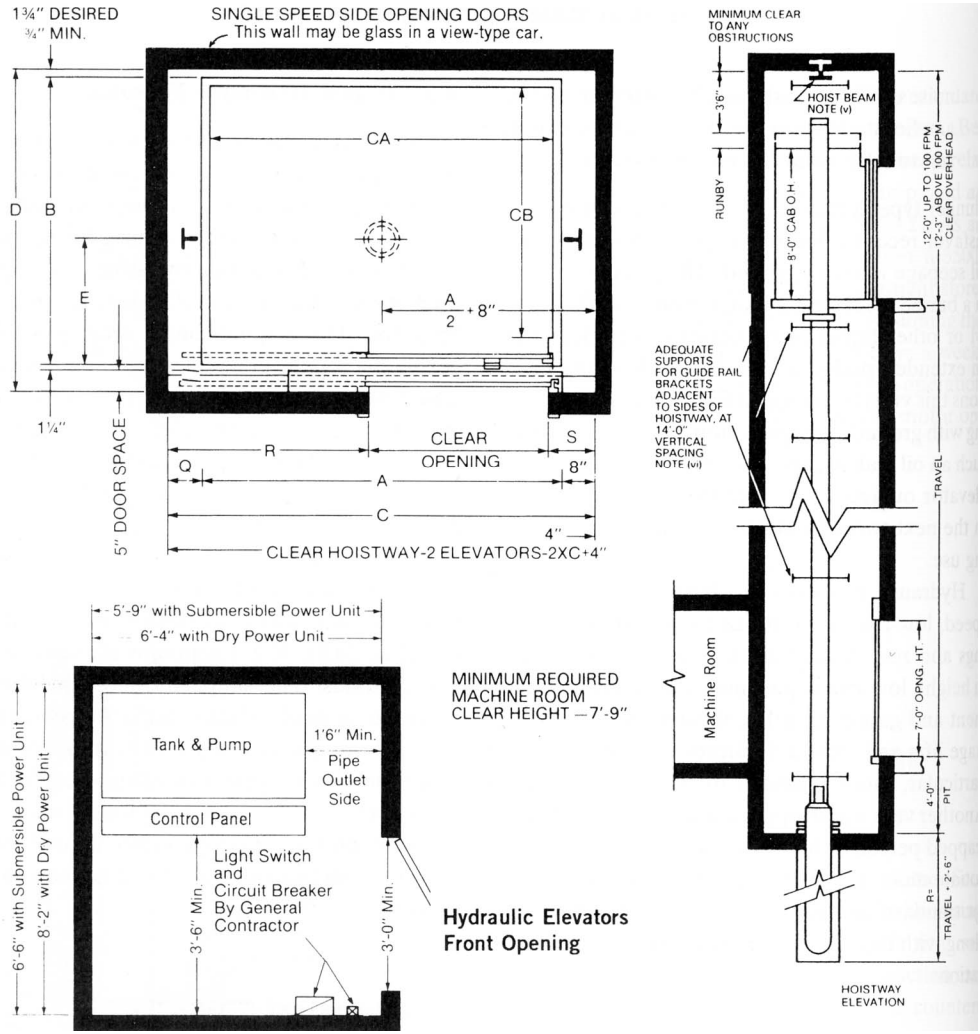
- 7’-9” minimum clear

Bottom of Beam (OH)

- 12’-0” – 12’3”

Pit (P)/Plunger

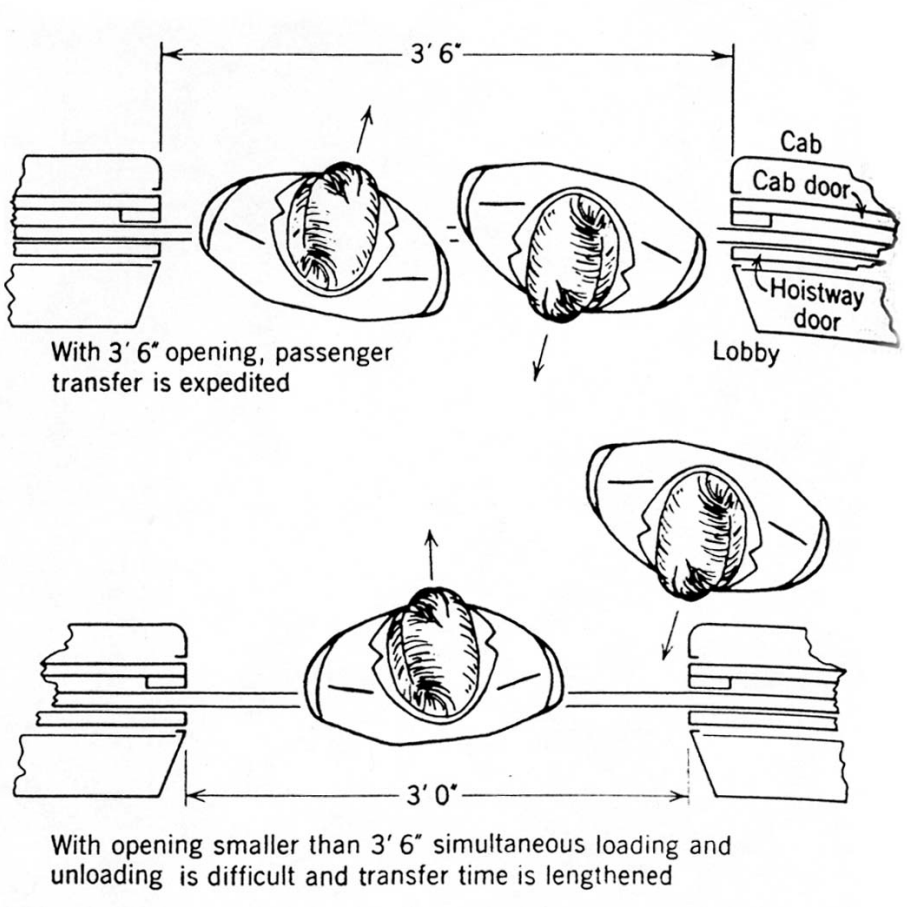
- 4’-0”
- Travel +2’-6”



Design Considerations

Door openings

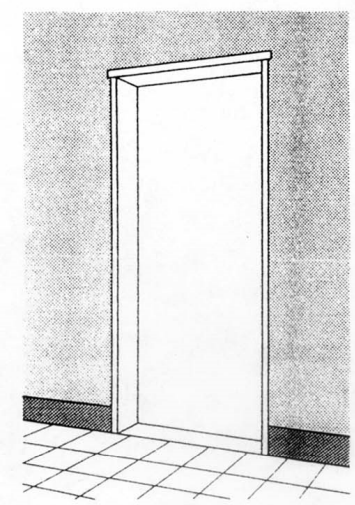
- **>3'-6" for simultaneous loading/unloading**
- **<3'-6" for singular loading**

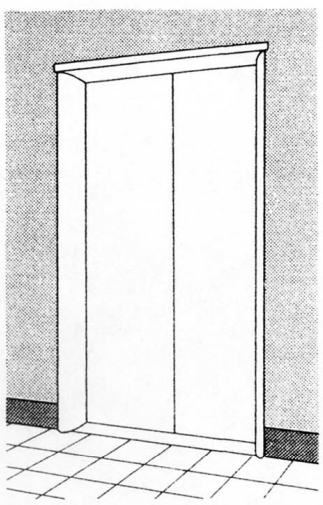


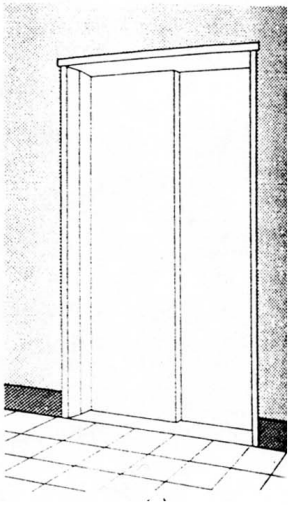
Design Considerations

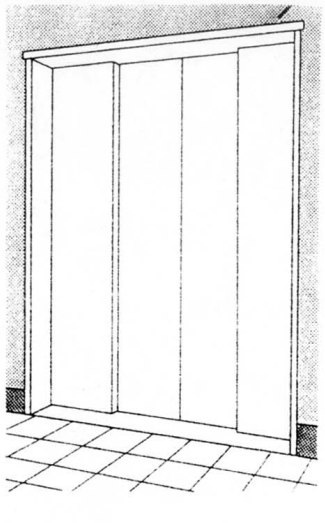
Doors

- single slide (24-36”)
- center opening (42-60”)
- two-speed, side opening (42”)
- two-speed, center opening (60”)





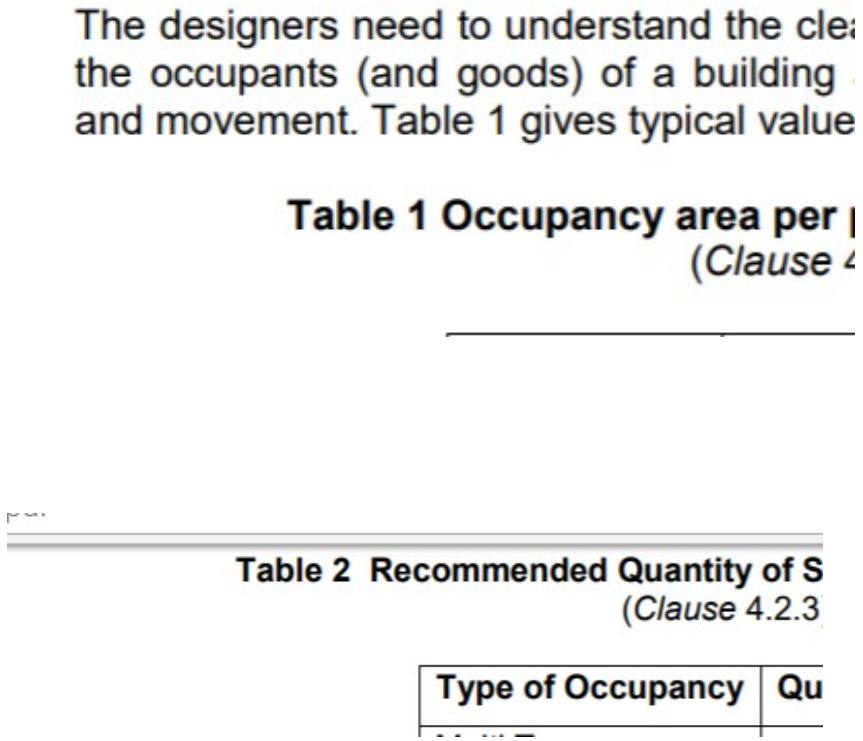




Elevator Selection Parameters

Quantity Of Service

- It is measured in terms of the total number of passengers handled during the peak five-minute period of the day.
- This is calculated by determining the number of trips made by the lifts over the peak 5 minute period and then multiplying it by the average number of passengers carried in each trip.
- The target handling capacity as a percentage of the building population is usually the estimated value of passenger arrival rate for the 5-minute up-peak period.
- The minimum recommended quantity of service is given in Table 2.



The designers need to understand the cle
the occupants (and goods) of a building
and movement. Table 1 gives typical value

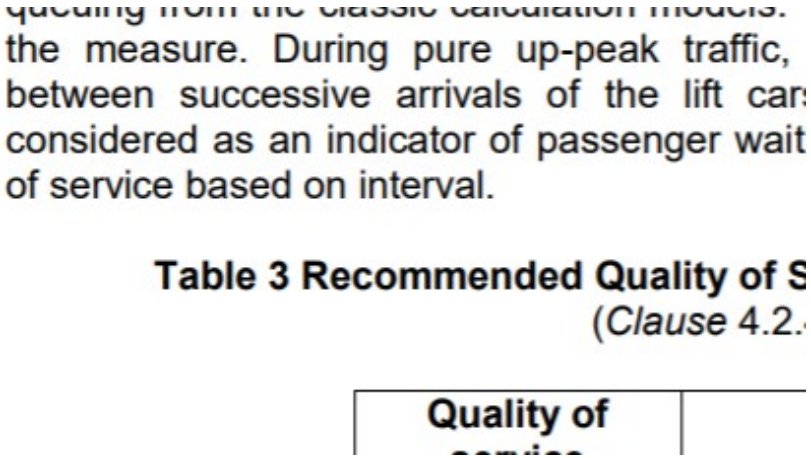
Table 1 Occupancy area per
(Clause

Table 2 Recommended Quantity of S
(Clause 4.2.3

Type of Occupancy	Qu

Quality Of Service

- It is very difficult to get real indications of passenger waiting time and lobby queuing from the classic calculation models.
- Therefore, interval is considered as the measure. During peak traffic, the interval or the average time between successive arrivals of the lift cars at the main lobby is generally considered as an indicator of passenger waiting time.
- Table 3 gives the quality of service based on interval



queuing from the classic calculation models.
the measure. During pure up-peak traffic,
between successive arrivals of the lift car
considered as an indicator of passenger wait
of service based on interval.

Table 3 Recommended Quality of S
(*Clause* 4.2.

Quality of

Lift Speed

For passenger lifts in a residential building the following general recommendations can be followed:

Sl No.	No. of Floors	Spe m/
i)	Upto 15	1.0 to
ii)	16 - 20	1.5 to
iii)	21 – 30	1.75 t
iv)	31 - 45	3.0 to
v)	46 - 60	4.0 to

Definitions

Interval (I) or lobby dispatch time

- **average time between departure of cars from lobby**

Waiting time

- average time spent by a passenger between arriving in the lobby and leaving the lobby in a car
- equals (0.6 x I)

Recommended Elevator Intervals and Related[a] Lobby Waiting Time

Facility Type	*Interval (sec)*	*Waiting Time[a] (sec)*
Office Buildings		
Excellent service	15–24	9–14
Good service	25–29	15–17
Fair service	30–39	18–23
Poor service	40–49	24–29
Unacceptable service	50+	30+
Residential		
Prestige apartments	50–70	30–42
Middle-income apartments	60–80	36–48
Low-income apartments	80–120	48–72
Dormitories	60–80	36–48
Hotels—1st quality	30–50	18–30
Hotels—2nd quality	50–70	30–42

[a]Based on the relationship: waiting time = 0.6 × interval.

Definitions

Car passenger capacity (p)

- **passengers per car**

Car Passenger Capacity (*p*)

Elevator Capacity (lb)	*Maximum Passenger Capacity*	*Normal Passenger[a] Load per Trip*
2000	12	10
2500	17	13
3000	20	16
3500	23	19
4000	28	22

[a]The number of passengers carried on a trip during peak conditions is approximately 80% of the car capacity.

Definitions

Handling Capacity (HC)

- maximum number of passengers handled in a 5 minute period
- when expressed as a percentage of the building population it is called *percent handling capacity* (PHC)

$$HC = \frac{300(p)}{I}$$

Minimum Handling Capacities (HC)

Facility	*Percent of Population to be Carried in 5 Min*
Office Buildings	
Center city	12–14
Investment	11.5–13
Single purpose	14–16
Residential	
Prestige	5–7
Other	6–8[a]
Dormitories	10–11
Hotels—1st quality	12–15
Hotels–2nd quality	10–12

[a]Due to more urgent traffic demands, particularly at the school and work exodus.

Definitions

Average trip time (AVTRP)

- average time from passengers from arriving in lobby to leaving car at upper floor

Round-trip time (RT)

- average time required for a car to make a round trip

Parameters

Elevator equipment recommendations

- building type
- car capacity
- rise
- speed

Elevator Equipment Recommendations

Building Type	Car Capacity[a] (lb)	Car Capacity[a] [kg]	Rise (ft)	Rise [m]	Minimum[a] Car Speed (fpm)	Minimum[a] Car Speed [m/s]
Office Building	2500	1250	0–125	0–40	350–400	2.0
	3000	1250	126–225	41–70	500–600	2.5
	3500	1600	226–275	71–85	700	3.15
			276–375	86–115	800	4.0
			Above 375	>115	1000	5.0
Hotel	2500	1250	As above		As above	
	3000	1250				
Hospital	3500	1600	0–60	0–20	150	0.63
	4000	2000	61–100	21–30	200–250	1.0
			101–125	31–40	250–300	1.6
			126–175	41–55	350–400	2.0
			176–250	56–75	500–600	3.15
			>250	>75	700	4.0
Apartments	2000	1000	0–75	0–25	100	0.63
	2500	1250	76–125	26–40	200	1.0
			126–200	41–60	250–300	1.6
			>200	>60	350–400	2.0
Stores	3500	1600	0–100	0–30	200	1.0
	4000	2000	101–150	31–45	250–300	1.6
	5000	2500	151–200	46–60	350–400	2.0
			>200	>60	500	2.5

Sizing Equations

Handling capacity (HC): **HC=300p/I**
Interval (I): **I=RT/N**
5-min. handling capacity (h): **h=300p/RT**
Number of cars (N): **N=HC/h**

Interval (I)
Percent Handling Capacity (PHC)
Handling Capacity (HC)
Round Trip Time (RT)
Single Car Capacity (p)
number of cars (N)
5-minute Handling Capacity (h)

Elevator Design Example

Example Problem

- Design an elevator system for a 10 story, single purpose tenant, office building that provides an "good" level of service.
- Construction level is "normal"
- Floor height: 12'-0" floor to floor
- Floor area: 15,000 net square feet (nsf) each

1. Determine Percent Handling Capacity (PHC)

Office building
Investment

range → 11.5-13 %
say 12%

PHC=0.12

Minimum Handling Capacities (HC)

Facility	*Percent of Population to be Carried in 5 Min*
Office Buildings	
Center city	12–14
Investment	11.5–13
Single purpose	14–16
Residential	
Prestige	5–7
Other	6–8[a]
Dormitories	10–11
Hotels—1st quality	12–15
Hotels–2nd quality	10–12

[a]Due to more urgent traffic demands, particularly at the school and work exodus.

S: p. 1422, T.31.6

2. Determine Interval (I)

Office building

“Good” service

I=25-29 sec

Recommended Elevator Intervals and Related[a] Lobby Waiting Time

Facility Type	*Interval (sec)*	*Waiting Time[a] (sec)*
Office Buildings		
Excellent service	15–24	9–14
Good service	25–29	15–17
Fair service	30–39	18–23
Poor service	40–49	24–29
Unacceptable service	50+	30+
Residential		
Prestige apartments	50–70	30–42
Middle-income apartments	60–80	36–48
Low-income apartments	80–120	48–72
Dormitories	60–80	36–48
Hotels—1st quality	30–50	18–30
Hotels—2nd quality	50–70	30–42

[a]Based on the relationship: waiting time = 0.6 × interval.

3. Determine Building Population

Office building

Single tenant

Normal construction

range → 90-110 sf/person

say 100 sf/person

Pop= $\frac{\text{9 floors@15,000 nsf}}{\text{100sf/person}}$

Pop=1350 people

Population of Typical Buildings for Estimating Elevator and Escalator Requirements

Building Type	*Net Area*
Office Buildings	*Square feet per person*
Diversified (Multiple Tenancy)	
Normal	110–130[a]
Prestige	150–250
Single Tenancy	
Normal	90–110
Prestige	130–200
Hotels	*Persons per sleeping room*
Normal use	1.3
Conventions	1.9
Hospitals	*Visitors and staff per bed*[b]
General private	3
General public (large wards)	3–4
Apartment Houses	*Persons per bedroom*
High-rental housing	1.5
Moderate-rental housing	2.0
Low-cost housing	2.5–3.0

4. Determine Handling Capacity (HC)

PHC=0.12

HC=0.12 x 1350 people

HC= 162 people

5. Determine Rise & Select Car

9 floors (above lobby)

12’-0” floor-floor

Rise=9 x 12’-0’

Rise=108’

Select Car:

2500# car

@400 fpm

Elevator Equipment Recommendations

Building Type	Car Capacity[a] (lb)	Car Capacity[a] [kg]	Rise (ft)	Rise [m]	Minimum[a] Car Speed (fpm)	Minimum[a] Car Speed [m/s]
Office Building	2500	1250	0–125	0–40	350–400	2.0
	3000	1250	126–225	41–70	500–600	2.5
	3500	1600	226–275	71–85	700	3.15
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	4000	2000	61–100	21–30	200–250	1.0
			101–125	31–40	250–300	1.6
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			126–200	41–60	250–300	1.6
			>200	>60	350–400	2.0
Stores	3500	1600	0–100	0–30	200	1.0
	4000	2000	101–150	31–45	250–300	1.6
	5000	2500	151–200	46–60	350–400	2.0
			>200	>60	500	2.5

6. Determine Average Trip Time (AVTRP)

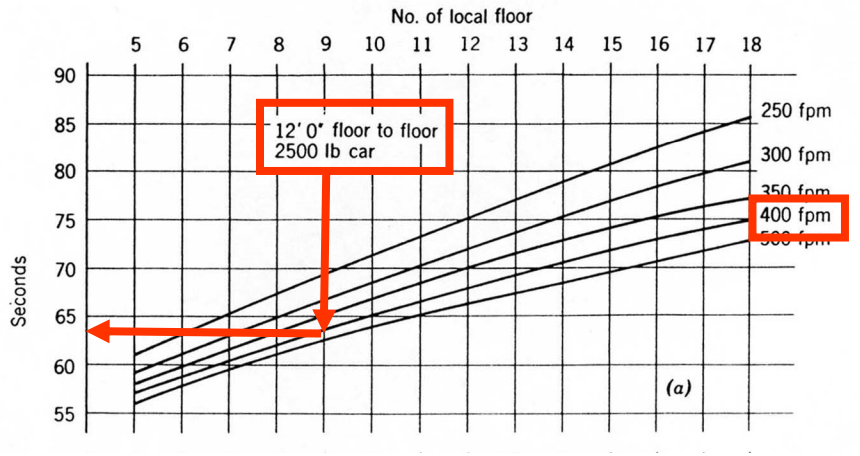
12’-0” floor-floor

2500# car

400 fpm

9 floors

AVTRP= 64 sec



7. Determine Round Trip Time (RT)

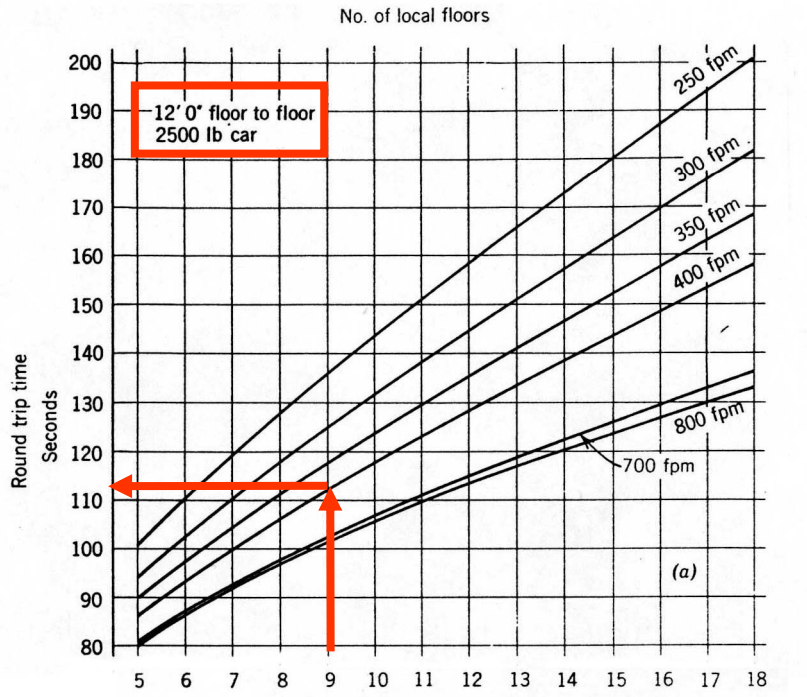
12’-0” floor-floor

2500# car

9 floors

400 fpm

RT= 112 sec



8. Verify Single Car Capacity (p)

2500# car

p= 13 people

Car Passenger Capacity (p)

Elevator Capacity (lb)	*Maximum Passenger Capacity*	*Normal Passenger[a] Load per Trip*
2000	12	10
2500	17	13
3000	20	16
3500	23	19
4000	28	22

[a]The number of passengers carried on a trip during peak conditions is approximately 80% of the car capacity.

S: p. 1422, T.31.5

9. Determine 5-minute Handling Capacity (h)

$h = 300p/RT$

$h = 300 \times 13/112$

$h = 34.8$ people

10. Determine number of cars (N)

N=HC/h

N= 162/34.8

N= 4.7 cars say 5 cars

11. Confirm Interval (I)

I=RT/N

I= 112/5

I= 22.4 sec

Required I → 25-29 sec

Design exceeds performance requirements

11. (Re)Confirm Interval (I)

I=RT/N

I= 112/4

I= 28 sec

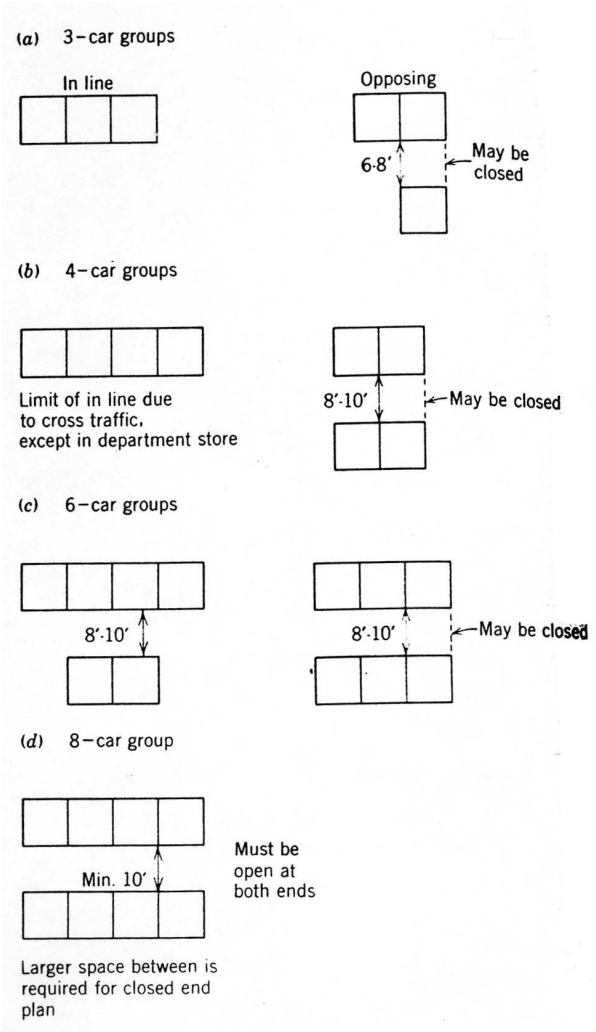
Required I → 25-29 sec

Design meets performance requirements

Elevator Lobby Requirements

Lobby Parameters

- Proximity to other cars
  - single zone
  - multizone
- Proximity to emergency exits/egress stairs
- Adjacent to main lobby



Lobby Sizing

Size based on peak interval

- **15 or 20 minute peak time**
- **5 sf/person**

From previous example using 15 minute peak

h=34.8 people/5-min. →104.4 people/15 min.

Area= 104.4 people x 5 sf/person = 522 sf

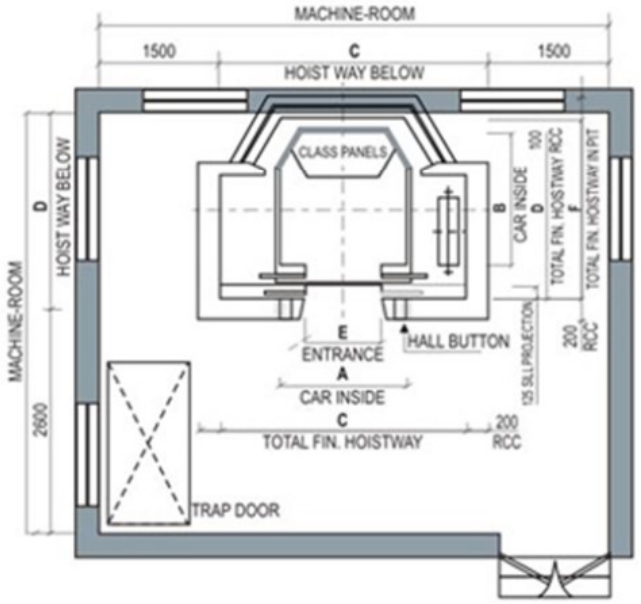
CIVIL DIMENSIONS

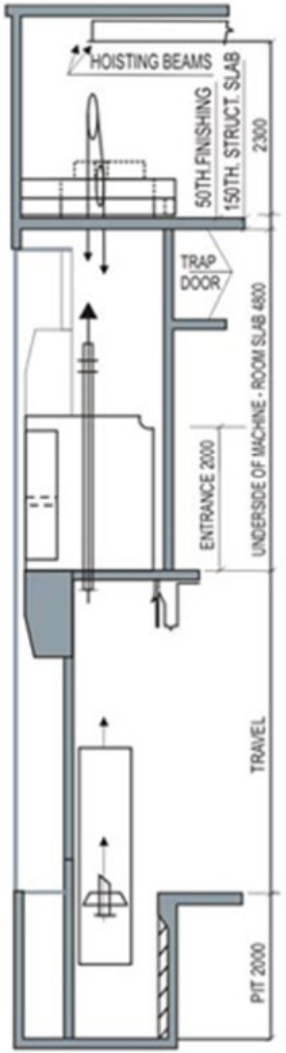
Persons	Load	A	B	C	D	E	F
8	544	1100	1400	2350	1300	800	2200
10	680	1350	1400	2600	1300	800	2200
13	884	1350	1700	2600	1600	900	2500
16	1088	1600	1700	2800	1600	1000	2500
20	1360	1600	2000	3050	1900	1000	2800

Persons	Load	A	B	C	D	E	F	G
13	884	900	2100	2700	1200	800	2800	1600
16	1088	1100	2200	3000	1250	900	3000	1700

NOTE-

All Dimensions are in mm. and based on automatic doors requirement.





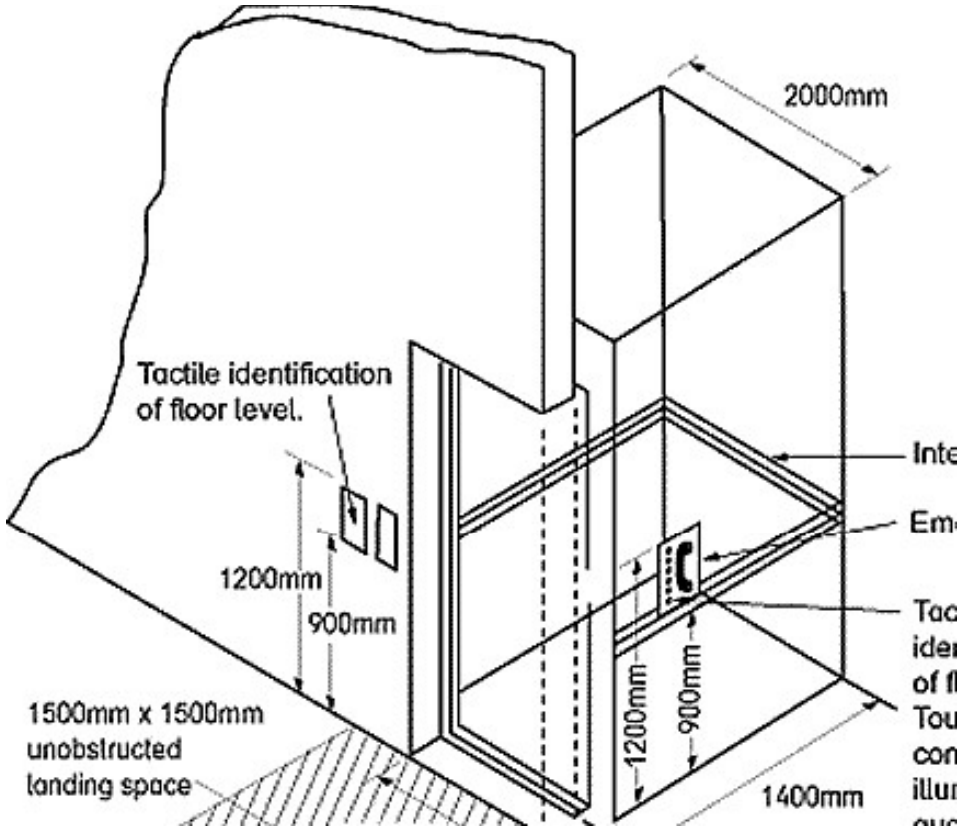
Kone Passenger Elevator

SYSTEM SPECIFICATION	A	B
Speed (m/s)	1.0 meter per second	1.0 meter per second
Load(kg)	544 kg.8 persons	544 kg.8 persons
Car dimensions	1300mm(wide)x1800mm(deep) clear dimensions	1300mm(wide)x1100mm(deep)
Number of stops	6 Floors 6 Stops 6 Levels 6 Openings [All on the same side]	6 Floors 6 Stops 6 Levels 6 Openings [All on the same side]
Travel(m)	16 m (Basement + Ground Floor to 4th floor)	16 m (Basement + Ground Floor to 4th floor)
Type of drive	A.C. Variable Voltage Variable Frequency With 16-bit Microprocessor	A.C. Variable Voltage Variable Frequency With 16-bit Microprocessor
Price	Rs. 14,00,000 per elevator	Rs. 12,20,000 per elevator

COMPONENTS OF LIFTS

LIFT LANDING

•That portion of the building or a structure used for reception and discharge of passengers or
goods and both into or from a lift car.



LIFT CAR

The load carrying unit with its floor or platform , car frame and enclosing body work.

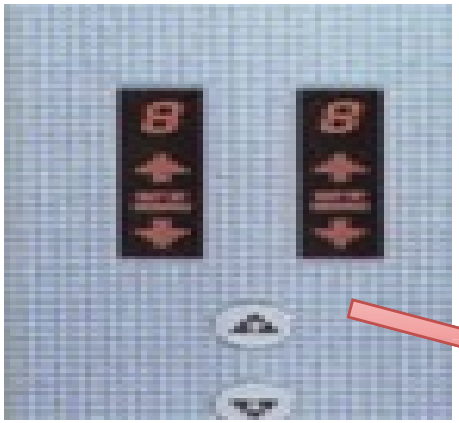
•Sliding doors are recommended when **power operation** is used .
• If space is restricted collapsible doors may be installed but they shall **not be power operated.**

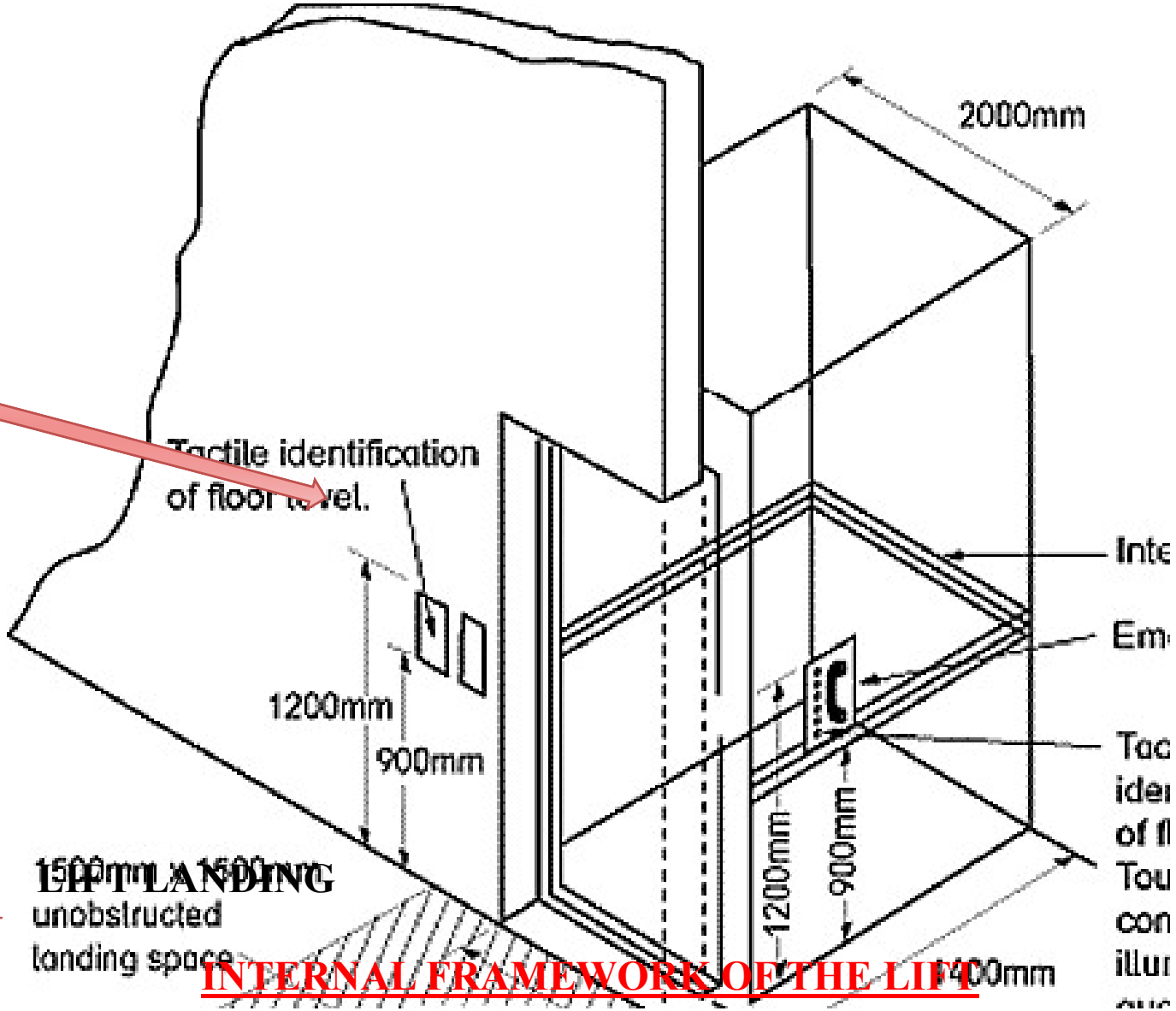
•The **levelling difference** between the car and the landing shall be **within 4 cm** where no levelling device is provided.
•Battery operated alarm system shall be installed inside the lift car so as to raise an alarm at a convenient place in case passengers are trapped inside the car.

LANDING CALL PUSH:

• A **push button** fitted at the lift landing either for calling the lift car or for actuating the call indicated.

•**Stainless steel push button** panels working with **4 micro switch system.**





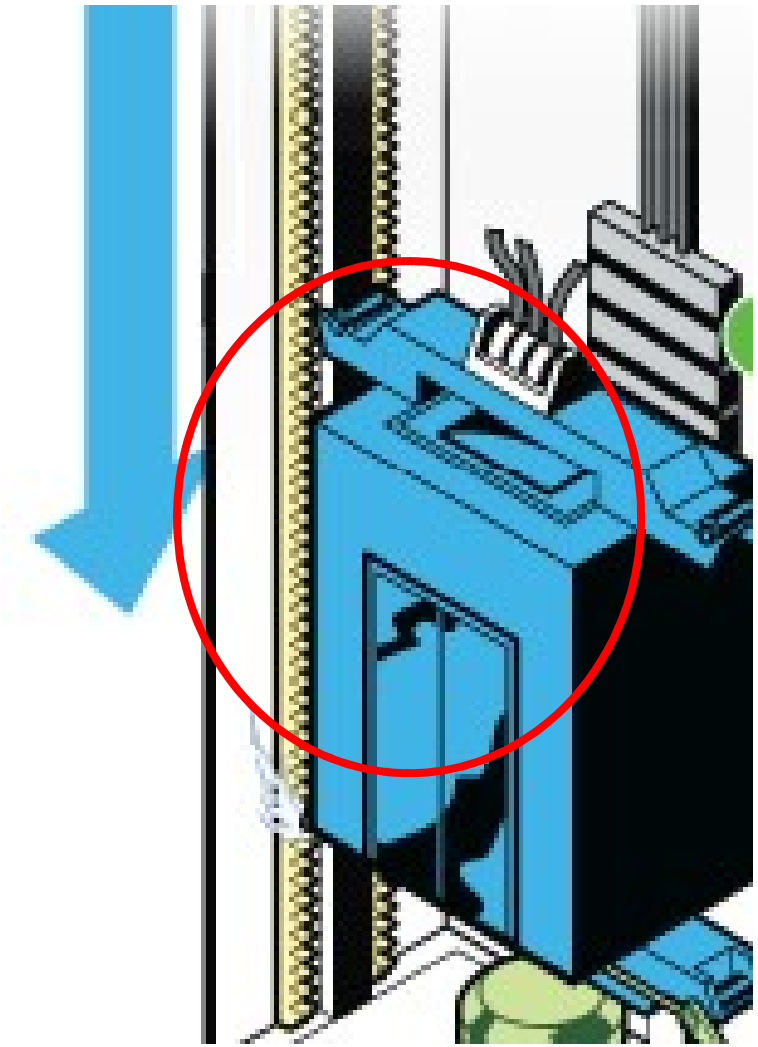
INTERNAL FRAMEWORK OF THE LIFT

CAR INDICATOR

A visual and audible device in the car to indicate to the attendant ,the lift landings from which calls have been made.

CAR BODY WORK

The enclosing body work of the platform of the lift car, Its safety gear, guide shoes and suspension ropes are attached.



CAR FRAME

The supporting frame to which platform of lift car, its safety gear, guide shoes and suspension ropes and cables are attached.

SUSPENSION ROPES OR CABLES

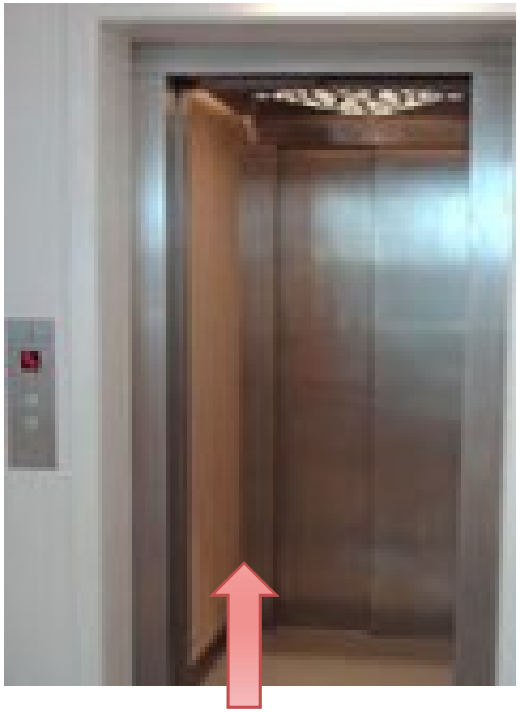
Ropes by which car and counter weight are suspended .

CAR PLATFORM

The part of lift car which forms the floor and directly supports the load .

SUSPENSION ROPES

CAR FRAME



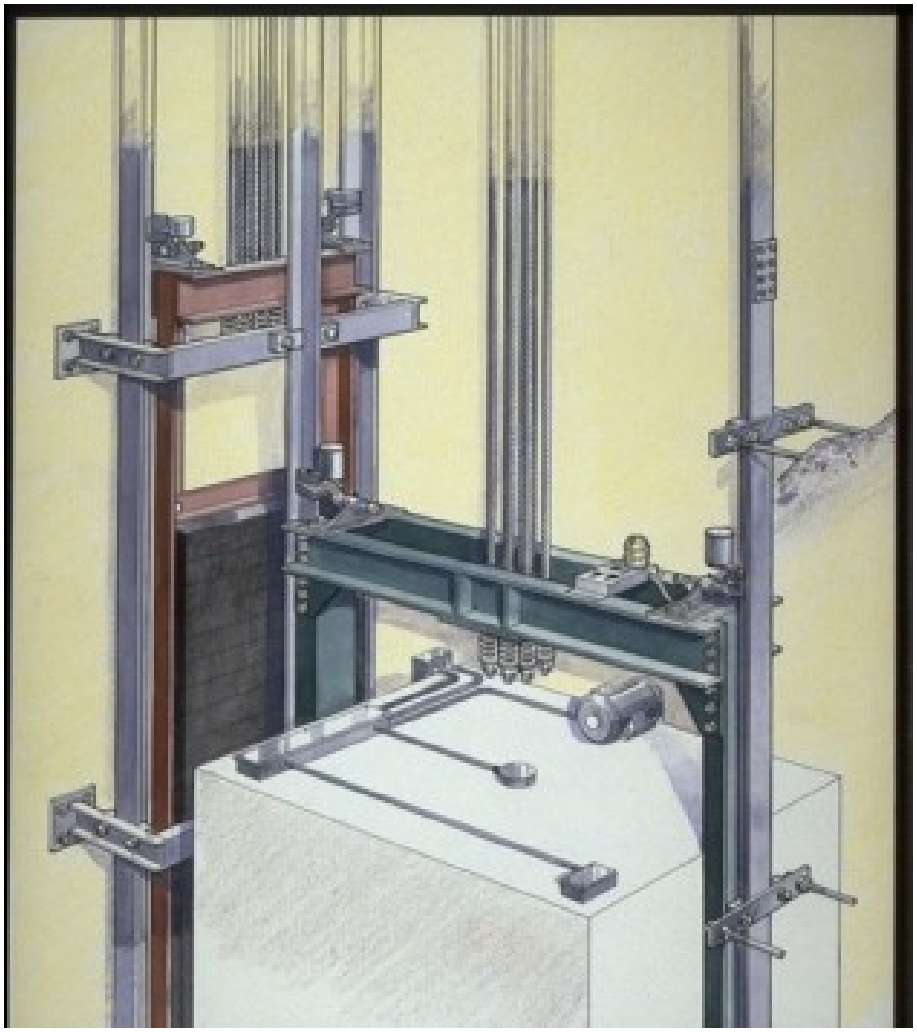
CAR PLATFORM

GUIDES RAILS

- Members used to **guide the moment of** lift car or counter weight in the vertical direction.
- Guide rails-shall be of **steel**

PRECAUTIONS

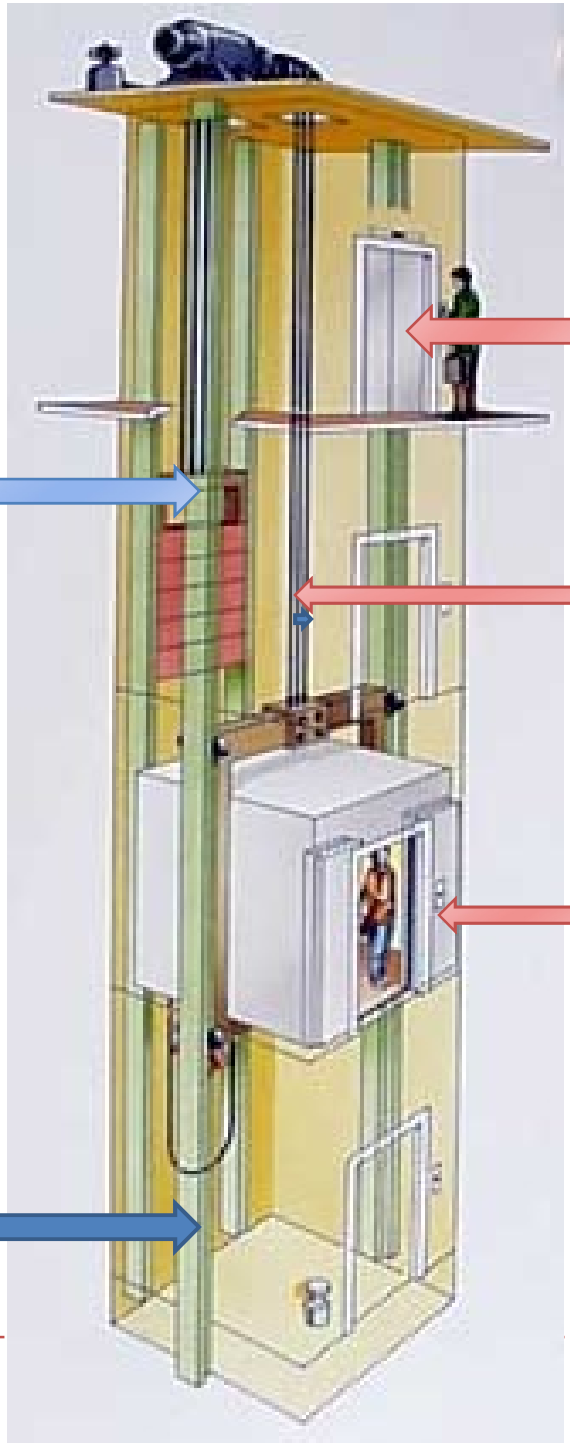
- The nature of processess carried on in the building give rise to acid fumes or corrosive substances
- The steel rails shall be treated for corrosion.



GUIDE RAILS SHALL BE CONTINUOUS –

- Throughout The Entire Length Right From **The Bottom Of The Pit Floor To The Top** Most Floor Served Plus Additional length as may be required for operation of safety against over run.

- They shall be provided with a**dequate brackets** or equivalent fixing of such designs and spacing that **the rails shall not deflect more than 5mm under normal operations.**

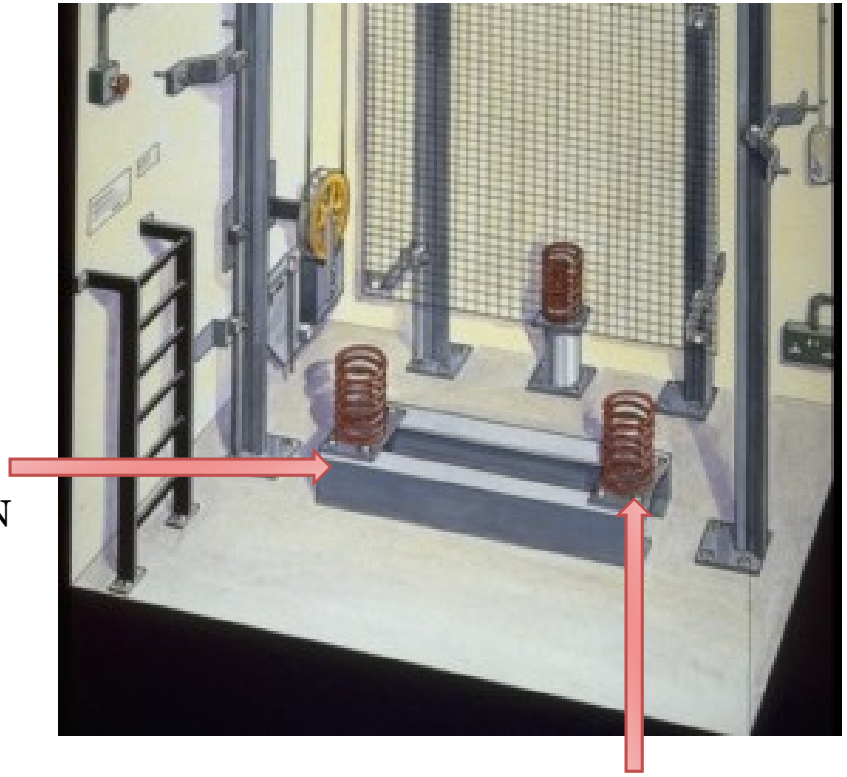


BUFFERS

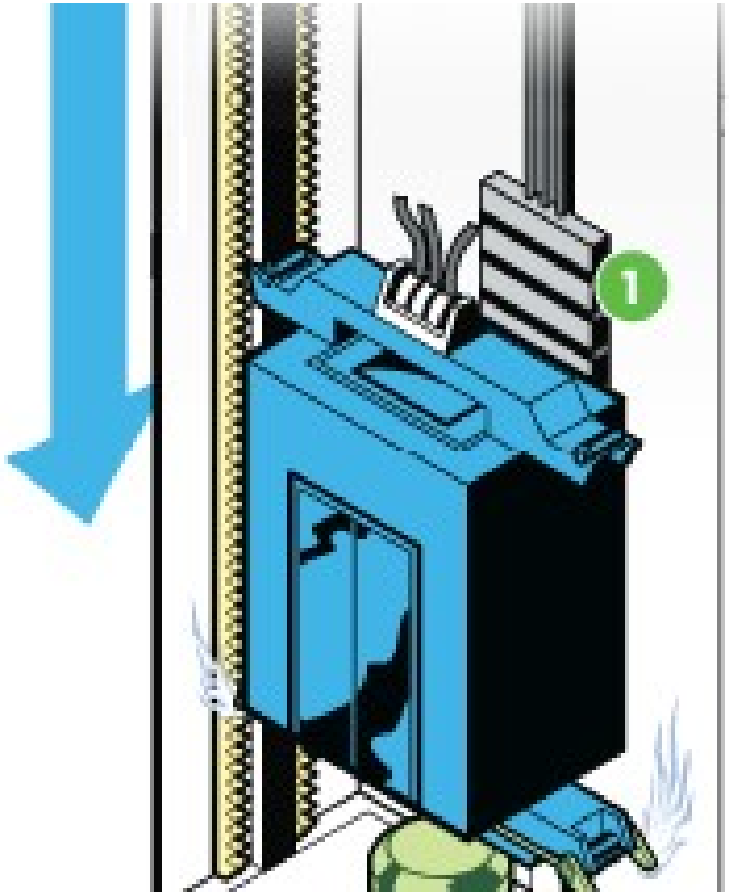
•Buffers shall be located **symmetrically with reference to the vertical centre line** of the car frame with a tolerance of 50mm.

•Spring or **oil buffers** shall be used with lifts having **rated speed in excess of .25m/s** and up to and including 1.5 m/s.

•**Oil buffers** shall be used with lifts having rated **speed in excess of 1.5m/s.**



SPRINGS



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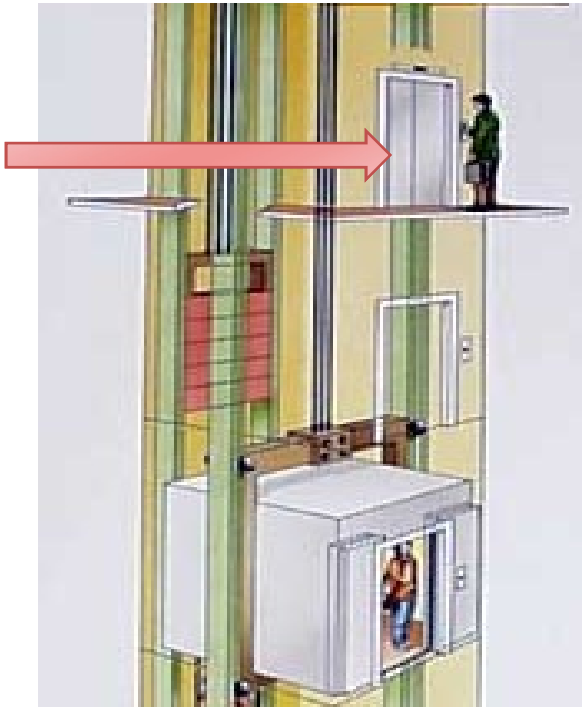
LANDING DOOR

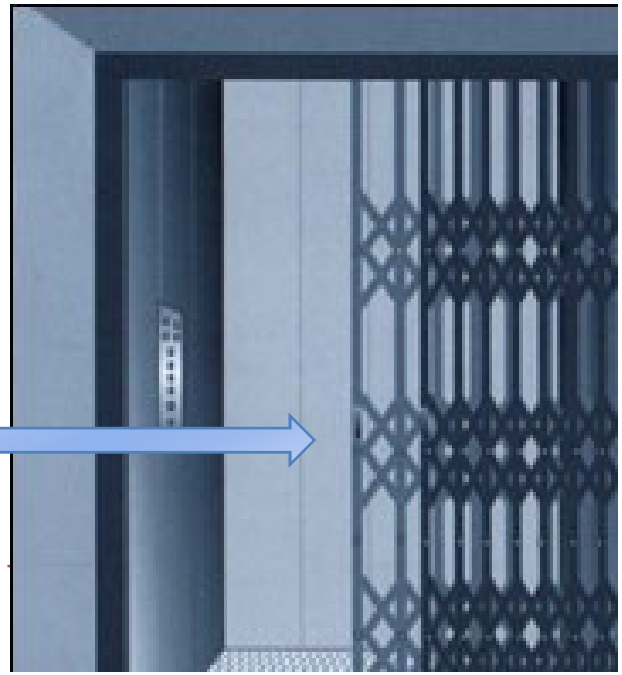
•The **hinged or sliding portion** of a lift well enclosure
•controlling **access to the lift car** at the lift landing.
•Doors are **interlocked** so as to secure that the door cannot be opened except when the lift car is at the landing
•The lift car **cannot be moved away from the landing** until the door is closed and locked.

LANDING DOOR



PRECAUTIONS

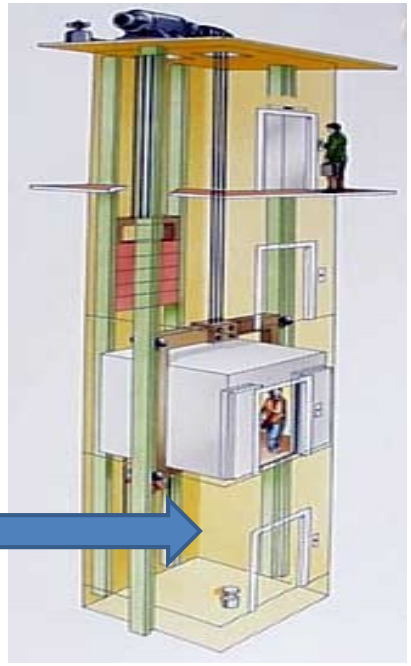
•If landing doors are **mannually operated ,**then no indicators are provided.
•**No automatic fire door** which operates by means of a fusible link or due to the **action of heat** shall be allowed.
•For buildings **above 15m in height solid doors** shall be provided.
•In case of buildings **above 24m in height collapsible** doors shall not be provided.
•**Solid swing doors** may also be used where sliding space is not **available parallel** to the entrance door.



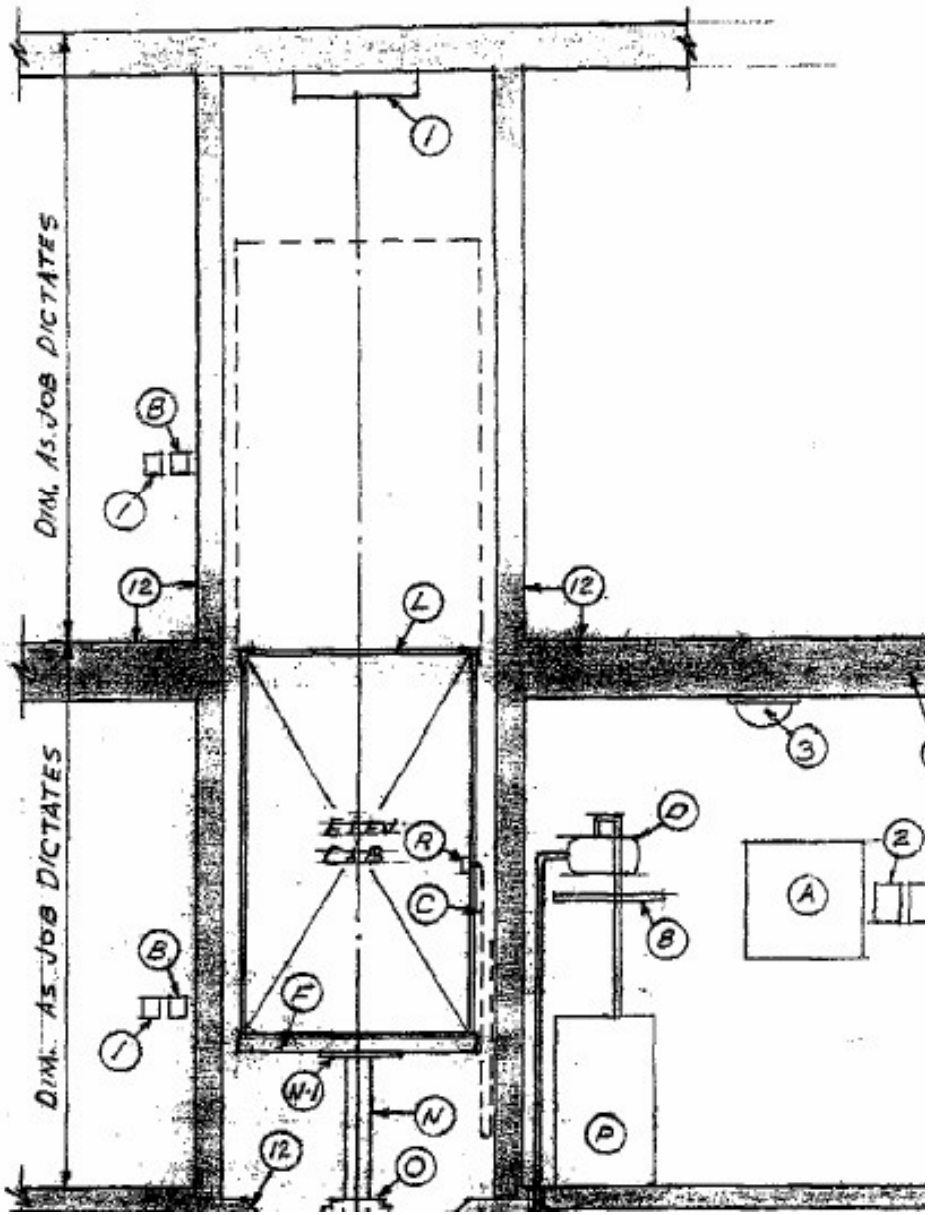
LIFT WELL/SHAFT:

•**Unobstructed space** within an **enclosure** provided for **vertical moment of lift** cars or any counterweight including lift pit and space for top clearance.

•No equipment except that forming a part of the lift or necessary for its operation and maintenance shall be installed in the lift well.



Lift well



•The **main supply lines** shall be deemed to be a part of the lift and the underground cables.

•If laid along the lift well shaft **shall be clamped** to the wall

LIFT PIT:

•Space in the lift well **below the level of the lowest lift landing served.**

•A lift pit shall be provided at the bottom of every lift.

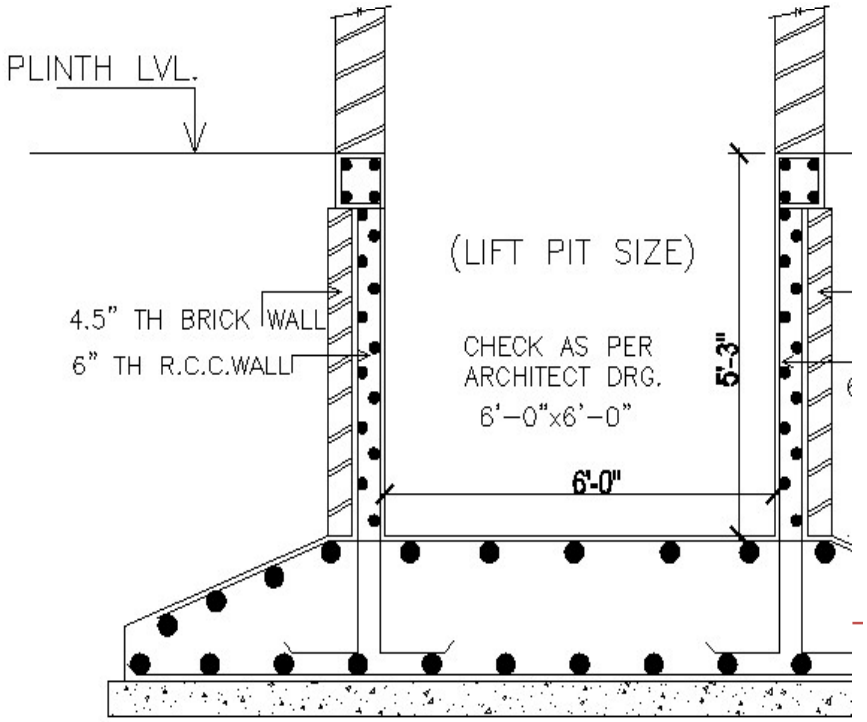
LIFT WELL ENCLOSURE

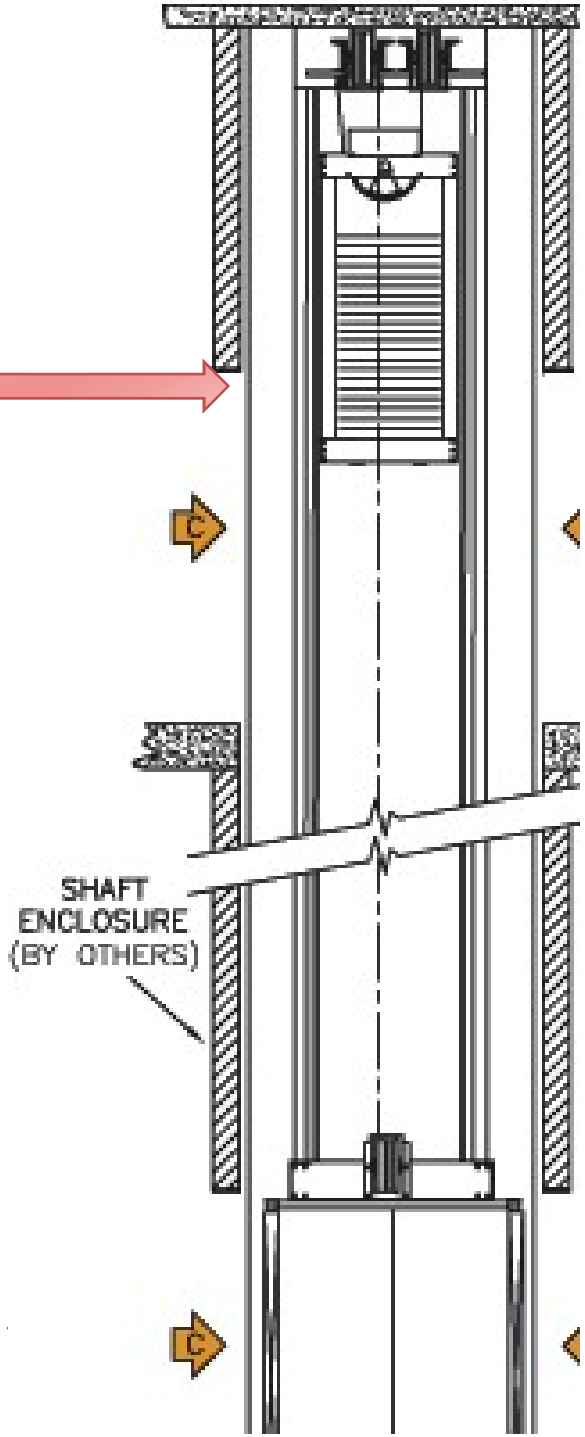
Any structure which separates lift well from its surroundings, generally **of R.C.C.**

•It shall be provided and extend on all sides from floor to floor or stair to stair.

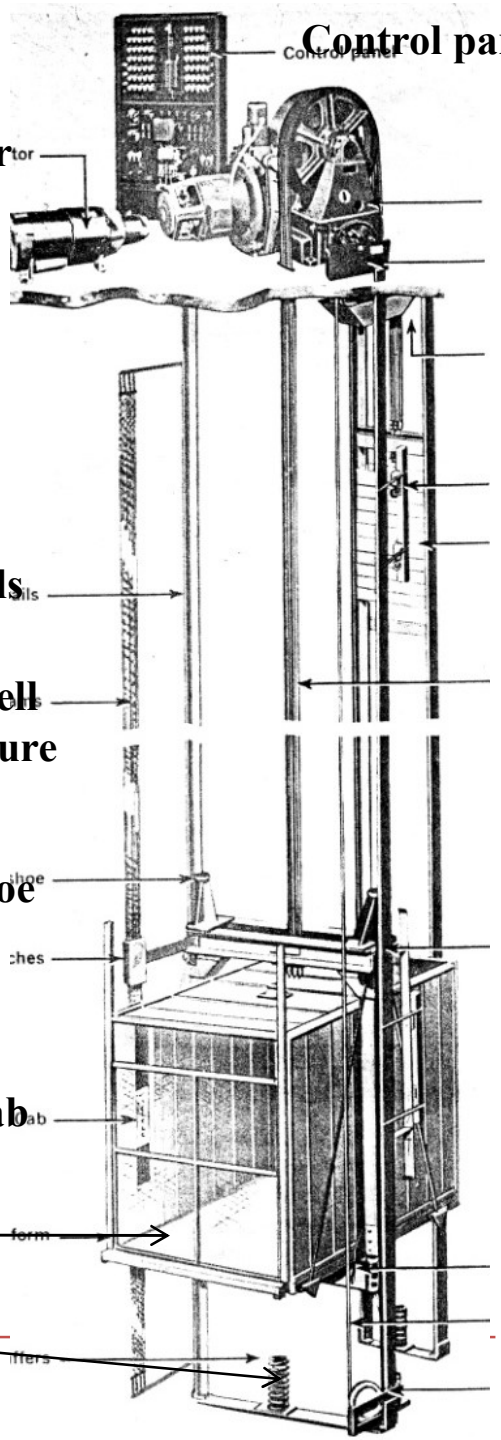
•The enclosure shall be of **sufficient mechanical strength**.

•The inner sides of the lift well enclosures **facing any car entrance** form a **smooth,continuous,flush surface.**



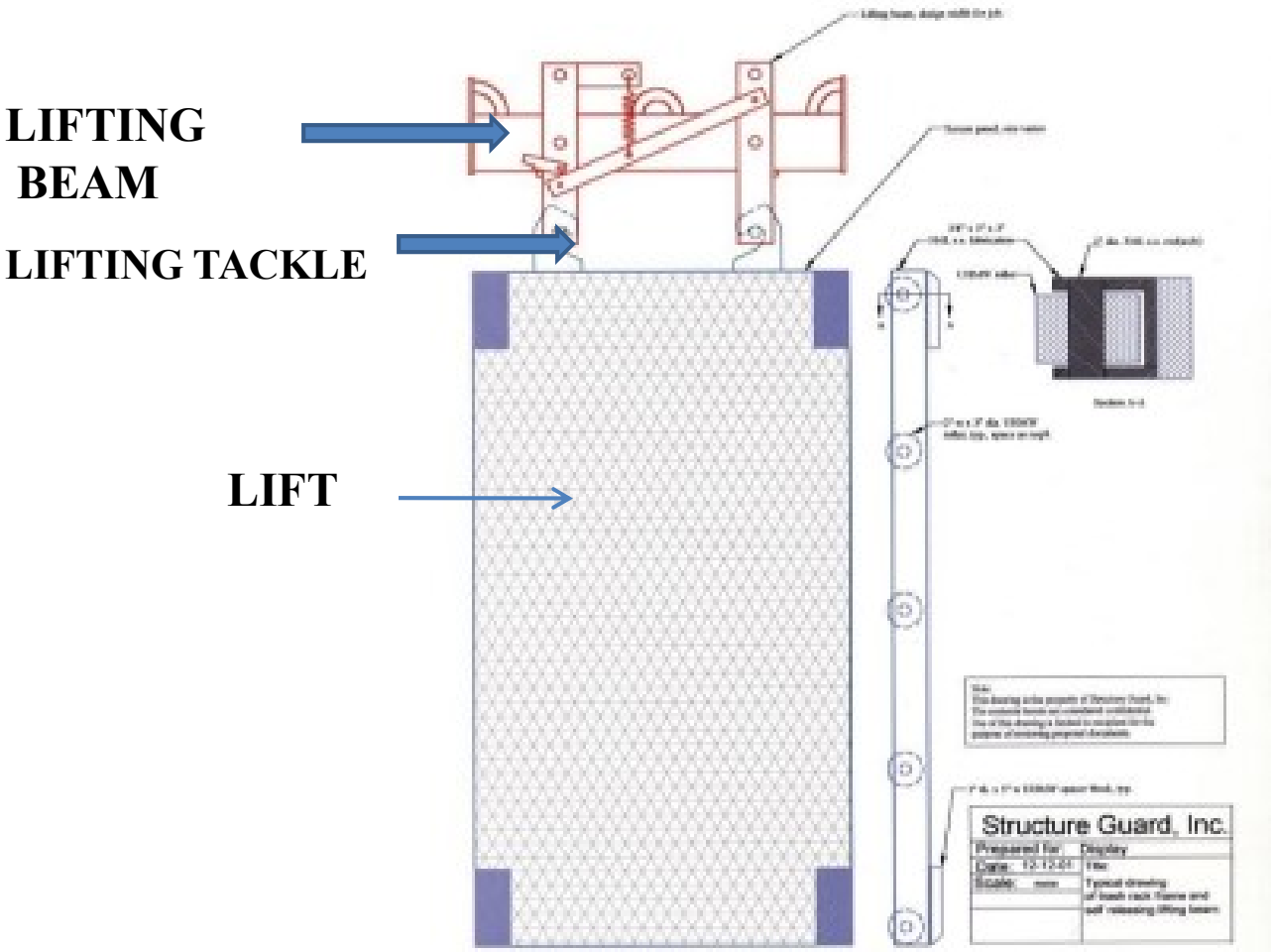


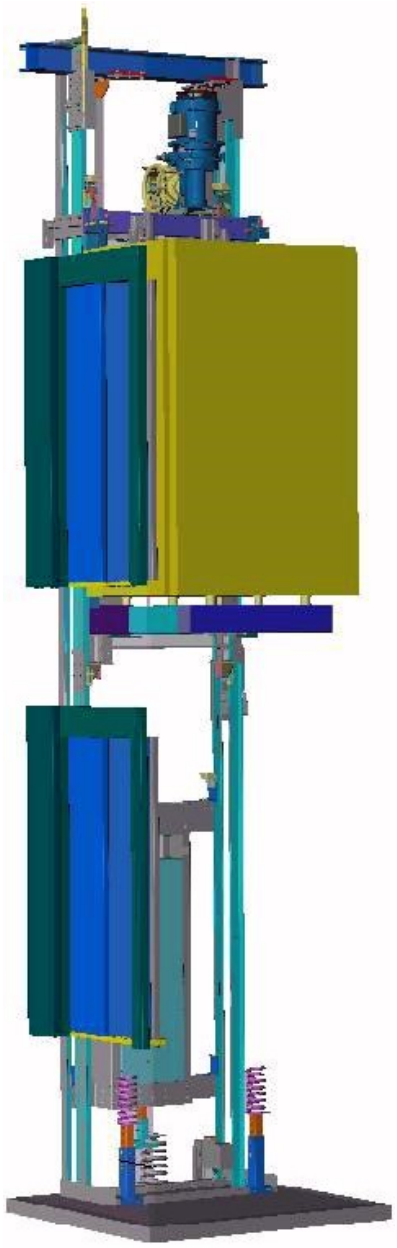
LIFT WELL


Control panel
Motor generator
Geared machine
counterweight
Guide rails
suspension cables
Lift well enclosure
Solid guide shoe
cab
Platform
buffers

THE LIFTING BEAM:

Beam mounted immediately below the machine room ceiling to which lifting tackle can be fixed for raising parts of lift machine level of the top lift landing to the floor of the machine room.





MACHINE ROOM

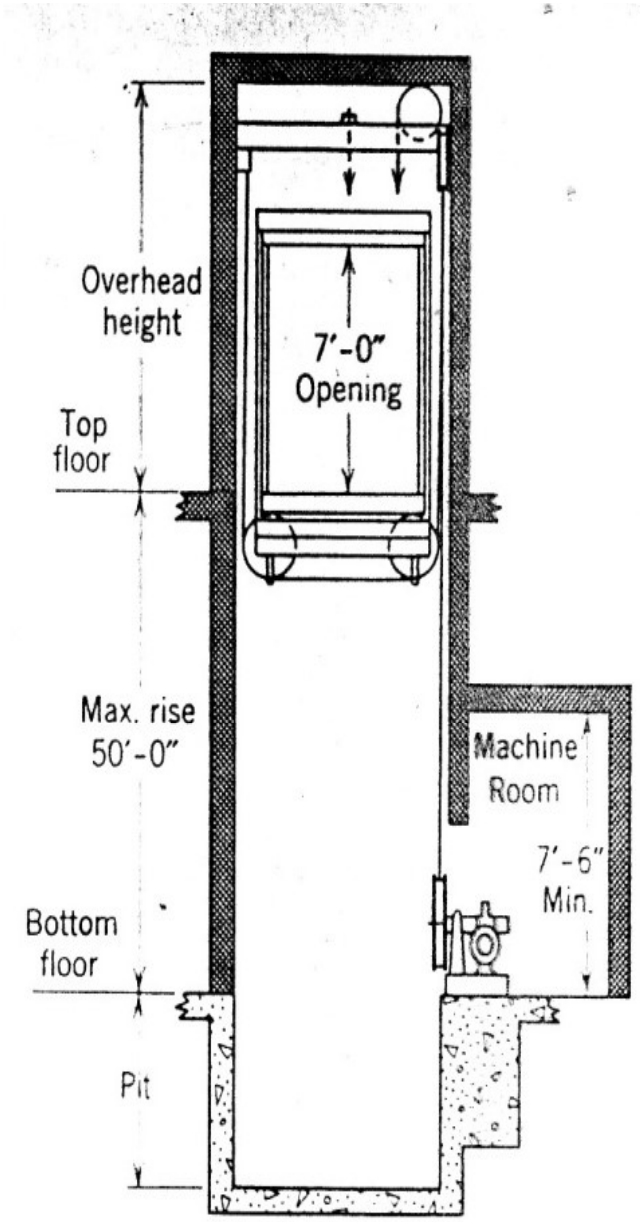
- The lift machine ,controller and all other apparatus and equipment of a lift installation shall be placed in the machine room.
- Machine room floor is provided with a trap door,
- The height of the machine room shall be sufficient to allow any portion of equipment to be accessible and removable for repair or replacement
- shall not be less than 2m clear from the floor or the platform of machine whichever is higher.

TRAP DOOR

- The trap entry opening to the machine room needs to be covered by a proper trap door. It is likely that two or three technicians may stand over it during the course of construction or maintenance work, it should be strong enough to support the weight.

POSTIONING OF MACHINE ROOM

- Placed immediately **above the lift well .**
- **If a machine room on the lift well** is impractical for architectural reasons it may be placed below the lift well on in the basement.
- If located in the basement it should be separated from the lift well by a **separation wall**.
- If machine room is placed above roof of building provision should be made for **lighting and ventilation.**



LIFT MACHINE:

- Part of the lift equipment comprising motors the control gear, reduction gear, brake and the winding drum (sheave) by which lift car is raised or brought down.

CONTROL SYSTEM:

- The system governing starting, stopping, direction of motion, acceleration,
- speed and retardation of moving members
- The equipment, arrangement and interconnections which determine the movement and performance of a single car is designated as the elevator control.
- This equipment controls travel, door operation, leveling, call buttons and floor signals.

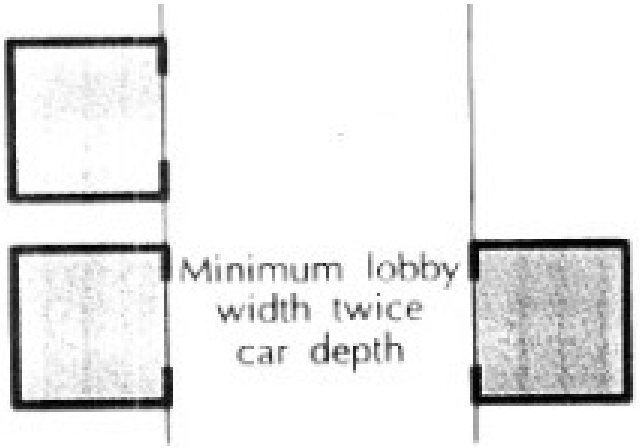
LIFT MACHINE

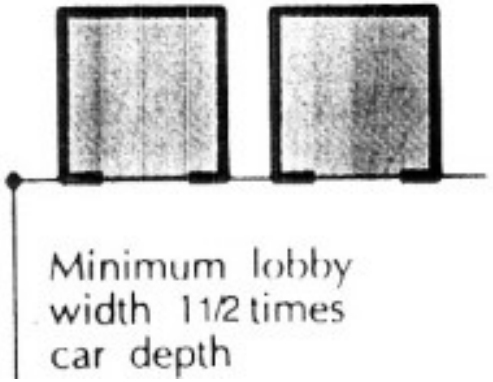
CONTROL PANEL

GROUPING OF ELEVATORS

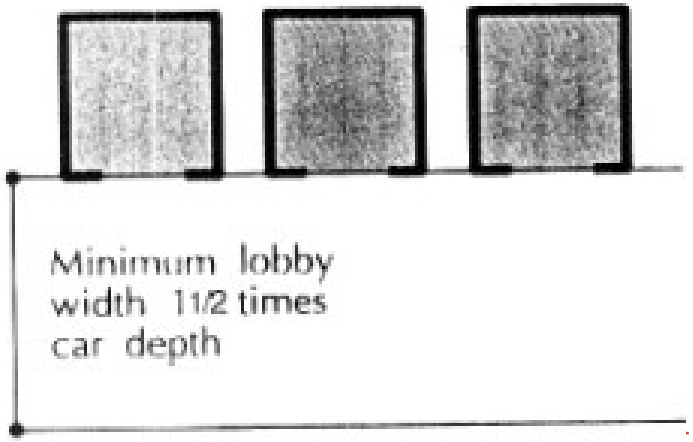
- They are located **closely** to minimize the **walking distance** between entrances.
- **Waiting passengers** can then **react quickly** and access cars swiftly.
- **Lobby areas** should **not** be in the **path of passageways**.
- **confusion** between waiting passengers and passers-by should be avoided by having **separate lobby areas.**

There are two options for grouping 2 or 3 elevators





Two car groups



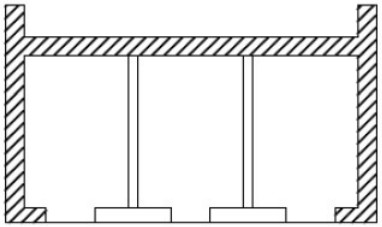
Three car groups

TYPICAL ARRANGEMENT OF LIFTS

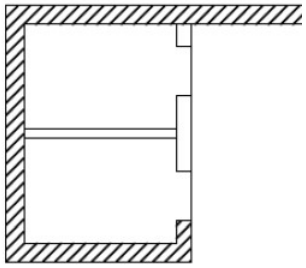
IN CASE MORE THAN THREE LIFTS, **THE ALCOVE ARRANGEMENT** IS RECOMMENDED

•The lift alcove lead off the main corridor so that there is **no interference by traffic** to other groups or to other parts of the ground floor.

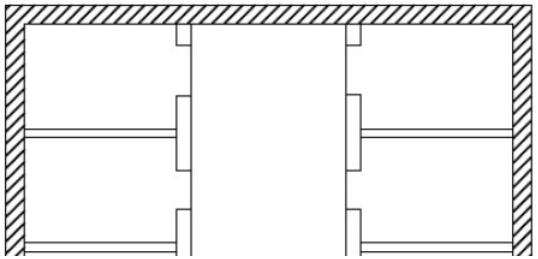
•This arrangement permits the narrowest possible corridors and saves space on the upper floors.

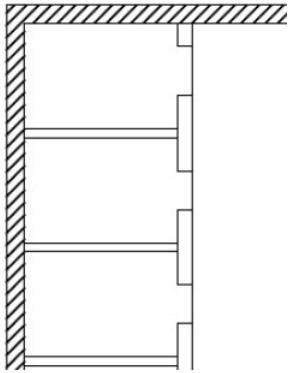


1A STRAIGHT LINE
ARRANGEMENT FOR THREE LIFTS



1B ALCOVE ARRA
FOUR





ENTRANCES TO THE LIFTS.

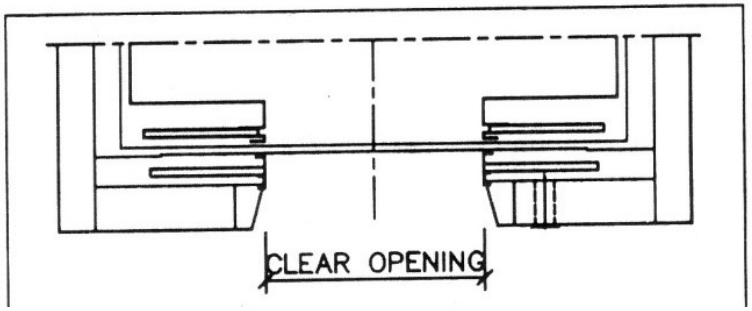
It is a major factor in overall elevator system efficiency.

Power operated entrances

a) Two panel center opening-

A usable clear opening becomes available and passengers begin to transfer, before the doors are fully opened.

Center panel doors

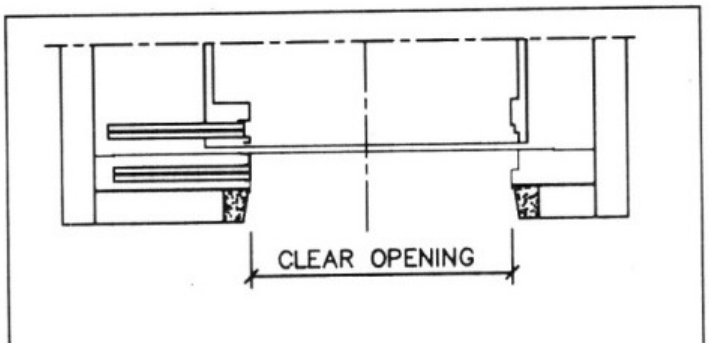


b) Two speed two panel entrances-

These are used more at hospitals and similar buildings.

They are more space effective ,but lack the operational efficiency of type a.

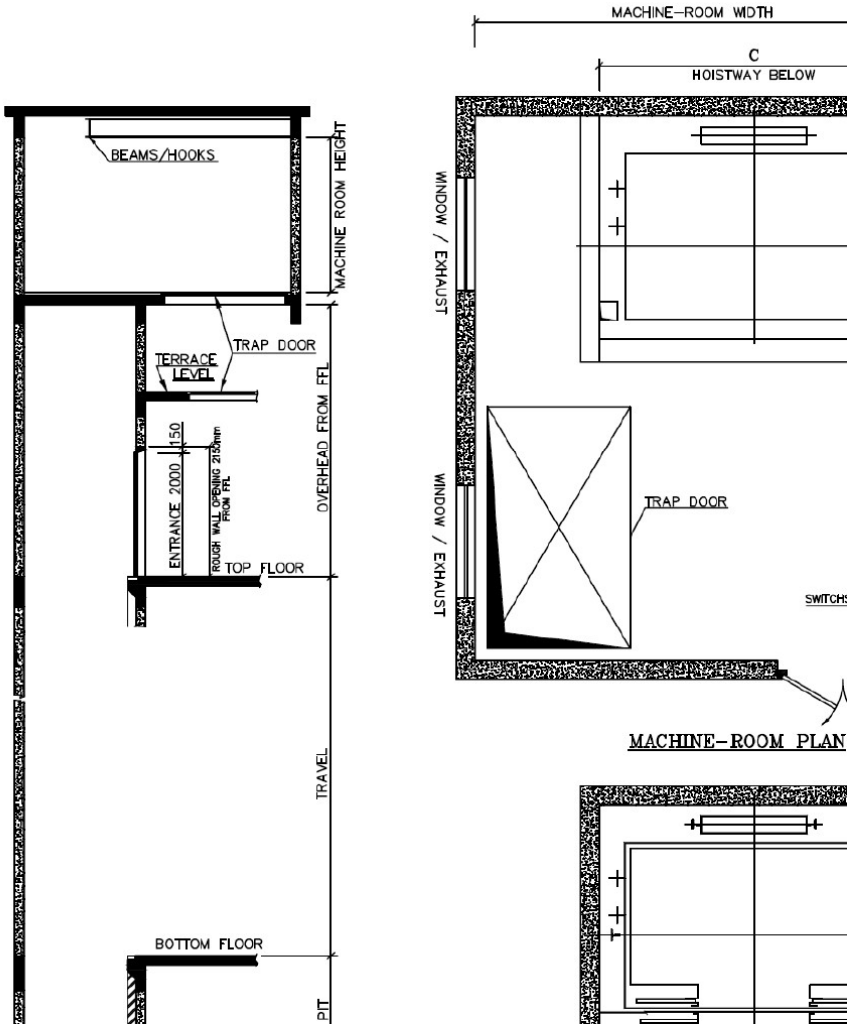
Two speed doors



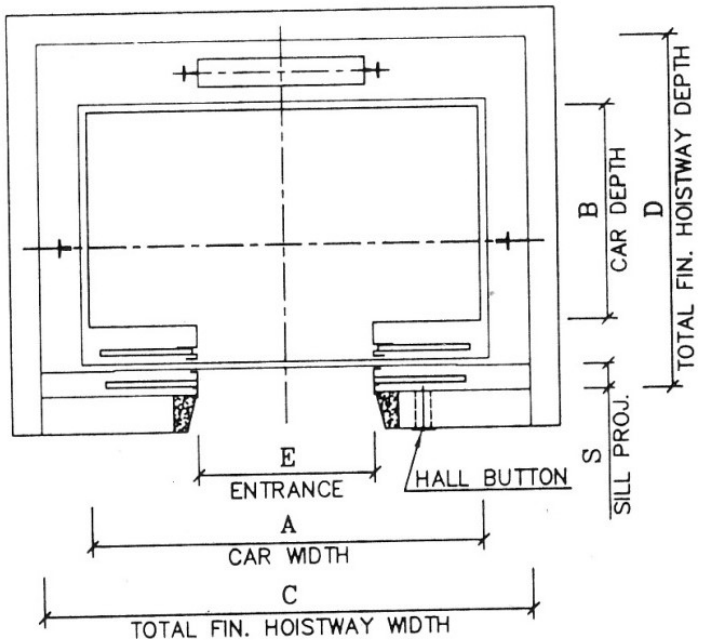
ENTRANCE PROTECTION SYSTEM

•Invisible **multi-ray infrared beams** facilitate the opening of the doors.

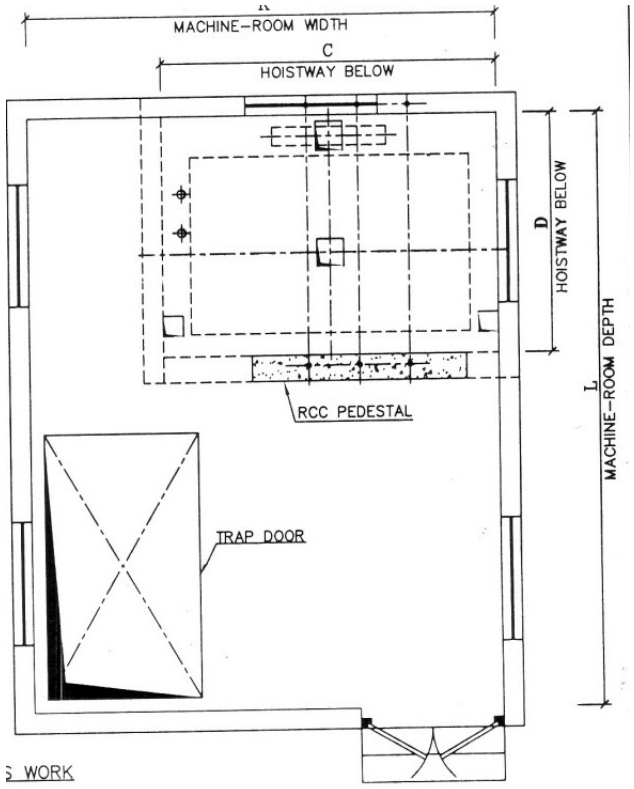
•These sensing rays **detect passengers** and objects in the path of closing doors within a traction of second and **instantly open** the doors **before they touch the passengers.**


BEAMS/HOOKS
MACHINE ROOM HEIGHT
TRAP DOOR
TERRACE LEVEL
1150
2000
ENTRANCE
ROUGH WALL OPENING 2150mm FROM FFL
OVERHEAD FROM FFL
TOP FLOOR
TRAVEL
BOTTOM FLOOR
PIT
MACHINE-ROOM WIDTH
C
HOISTWAY BELOW
WINDOW / EXHAUST
WINDOW / EXHAUST
TRAP DOOR
SWITCH
MACHINE-ROOM PLAN

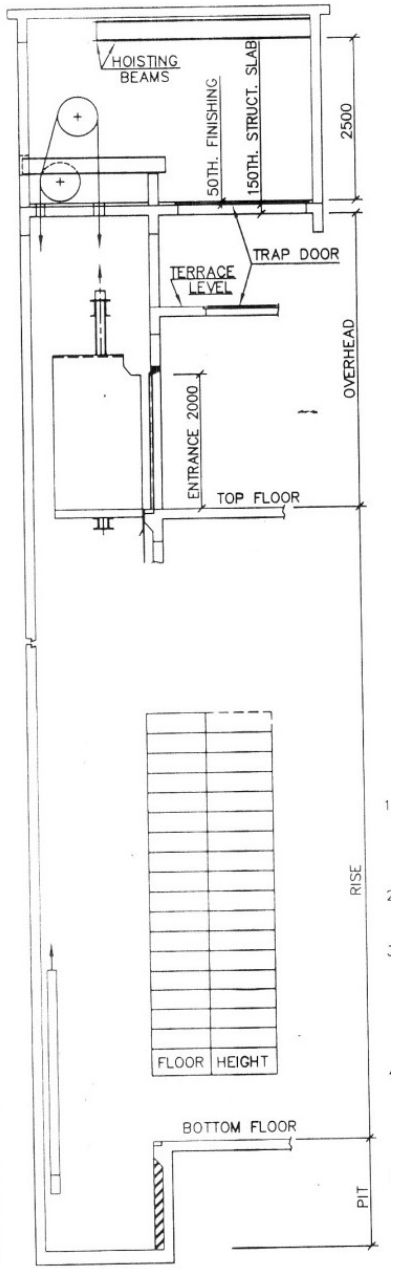
PLAN AND SECTION OF PASSENGER ENCLOSED LIFT



HOISTWAY PLAN



MACHINE ROOM PLAN

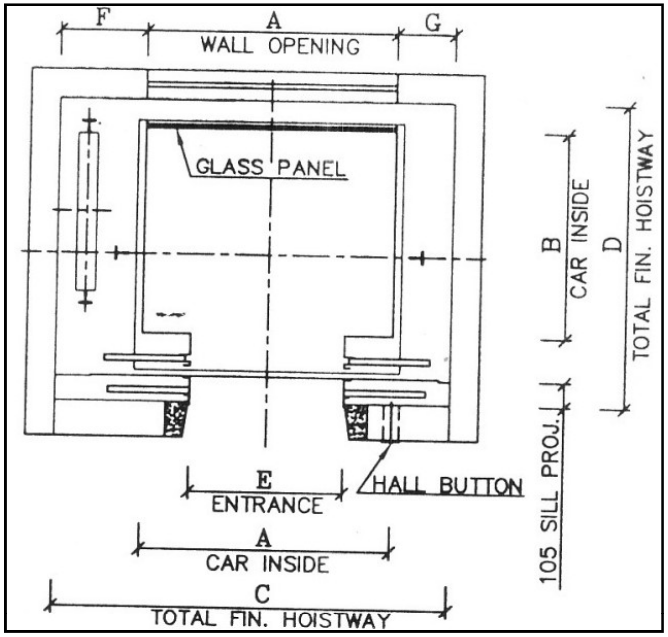


SECTIONAL ELEVATION

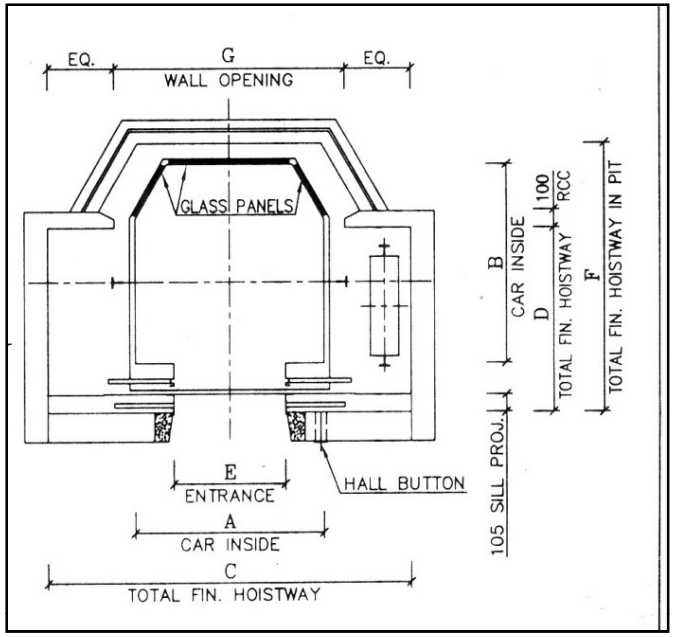
ELEVATOR SPEED

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	ABOVE 1.5 M/S

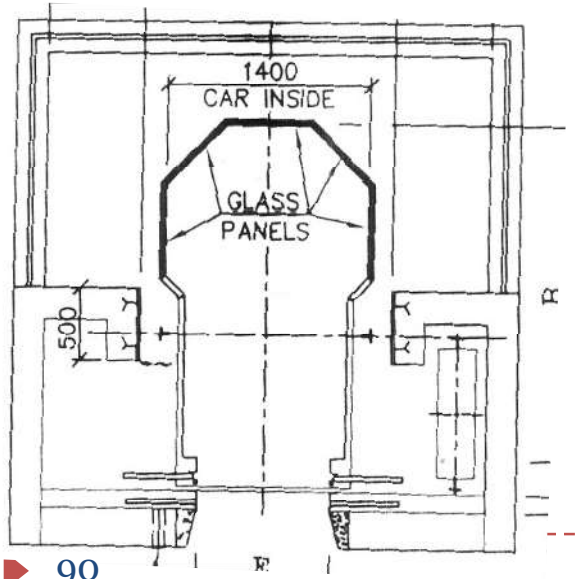
HOISTWAY PLANS AND SECTIONAL ELEVATION



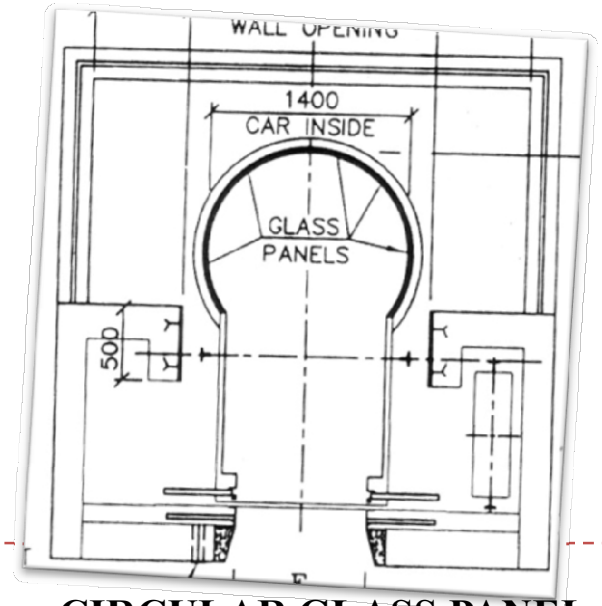
SINGLE GLASS PANEL



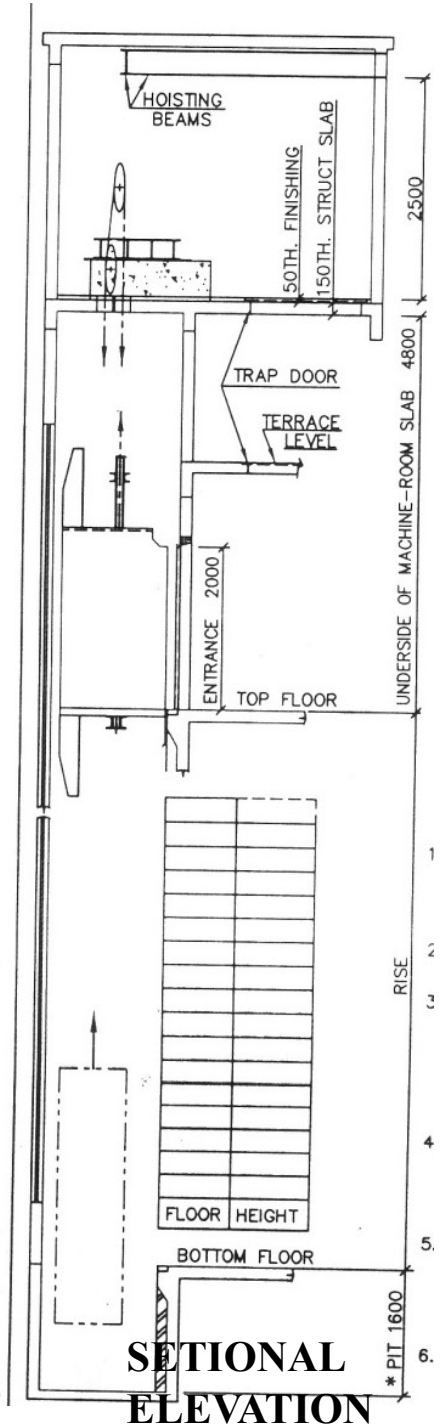
THREE GLASS PANEL



FIVE GLASS PANEL



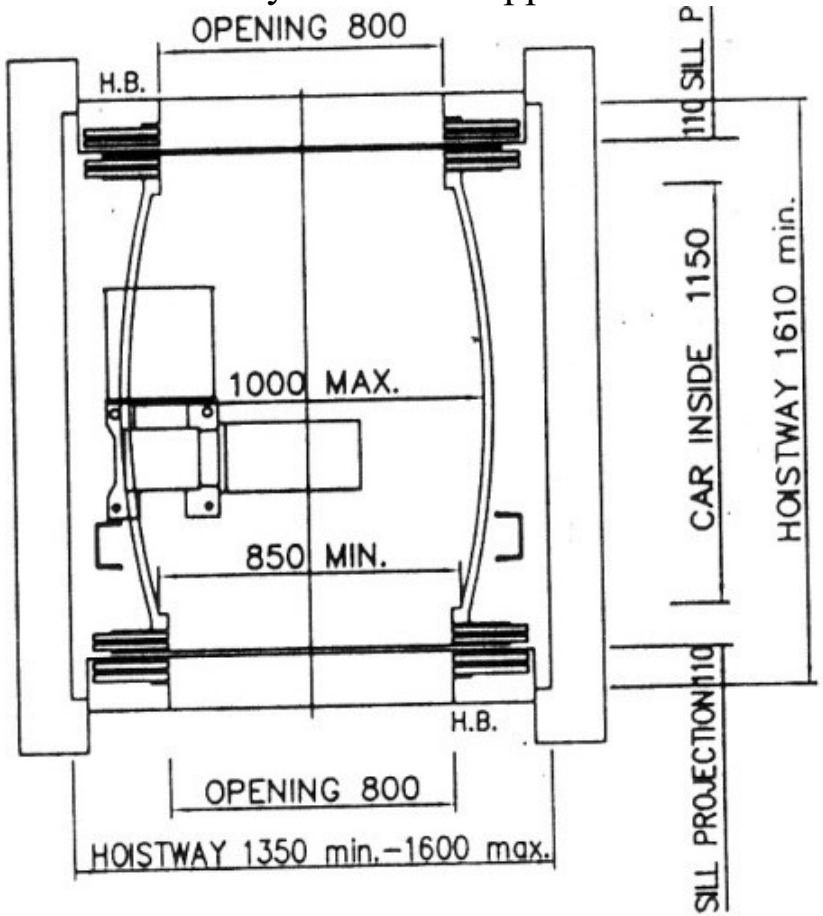
CIRCULAR GLASS PANEL



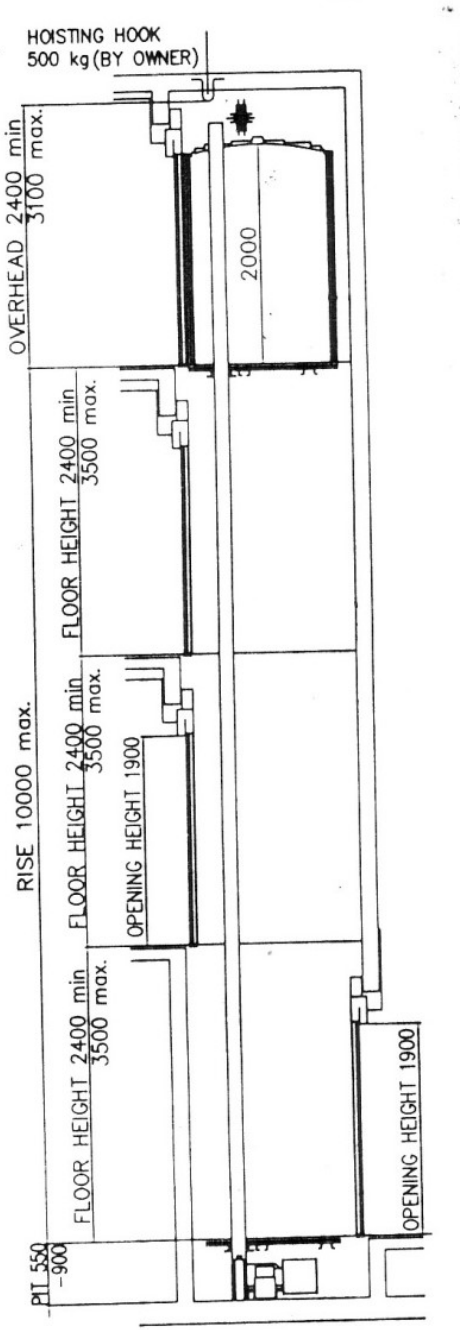
SETIONAL ELEVATION

HOME ELEVATOR

•It is a small elavator meant for two to three persons for private residential houses or bungalows
•It uses the available space very effectively.
•It has low running cost and extends facilities of comfortable living.
•It is very ideal for elderly and handicapped members of family.



HOISTWAY PLAN FROM FRONT AND REAR OPENING



FROM FRONT AND REAR OPENING

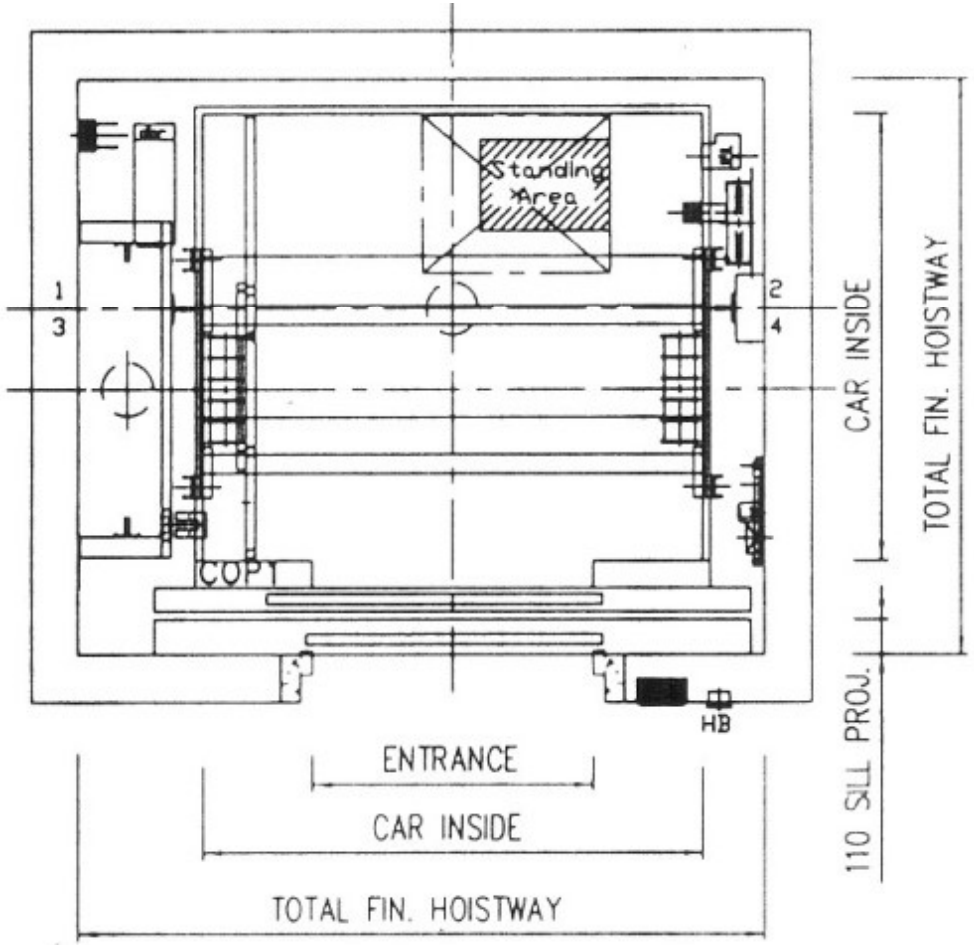
GEARLESS MRL ELEVATOR SYSTEM

•Machine room less elevator system eliminates requirement of a machine room.
•This is a gearless elevator system with speeds ranging from 1.0 mps to 1.75 mps
•capacities ranging from 8 passengers to 21 passengers.

The sophisticated and revolutionary design provides major benefits such as-

•Space saving
•Very smooth and quiet operation
•Energy efficient
•Passenger safety
•Quick installation
•Flat roofing

HOISTWAY PLAN



•This results in lower construction costs.

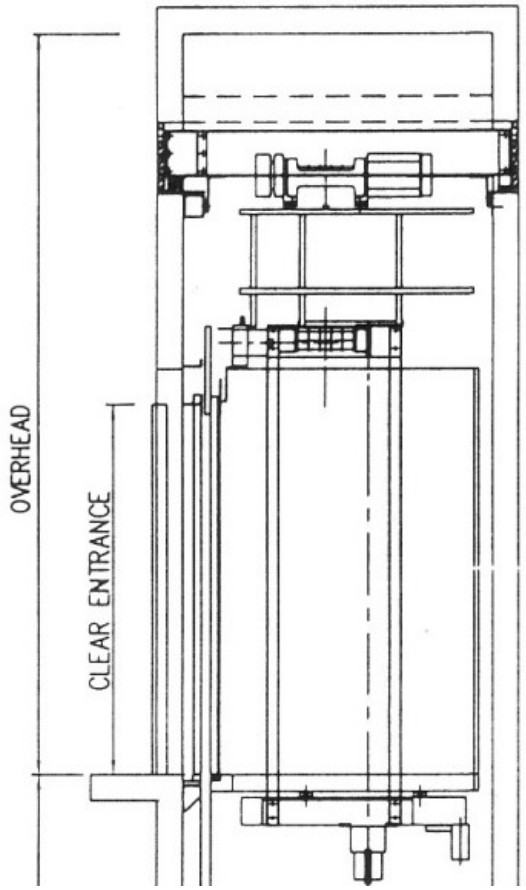
•Firstly, because there is no machine room and

secondly because the machine itself is located on the top of the guiderails.

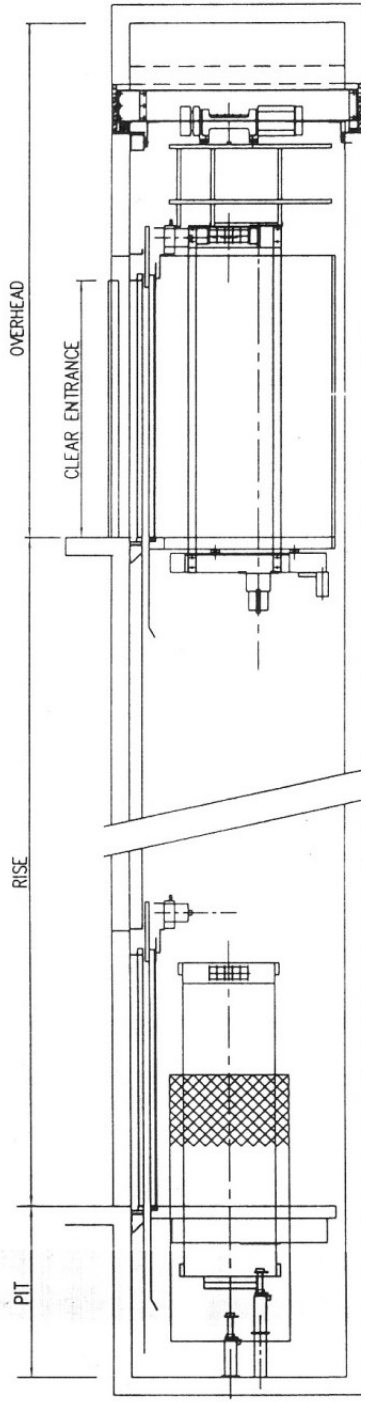
•pit depth and space provision for overhead area is significantly lesser.

•It also gives flexibilities to architects in terms of designing the roof tops.

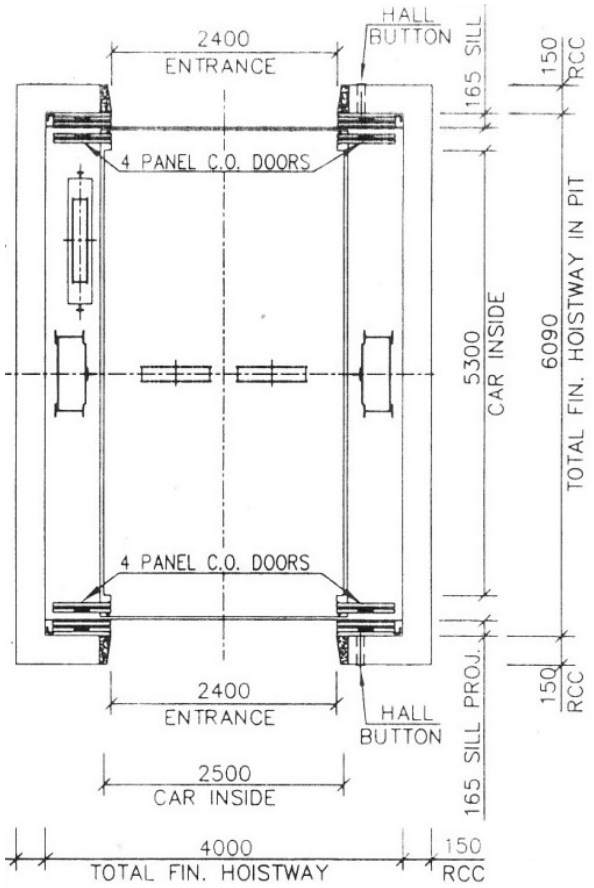
•This means that all the force is transmitted via the rails onto the pit floor.



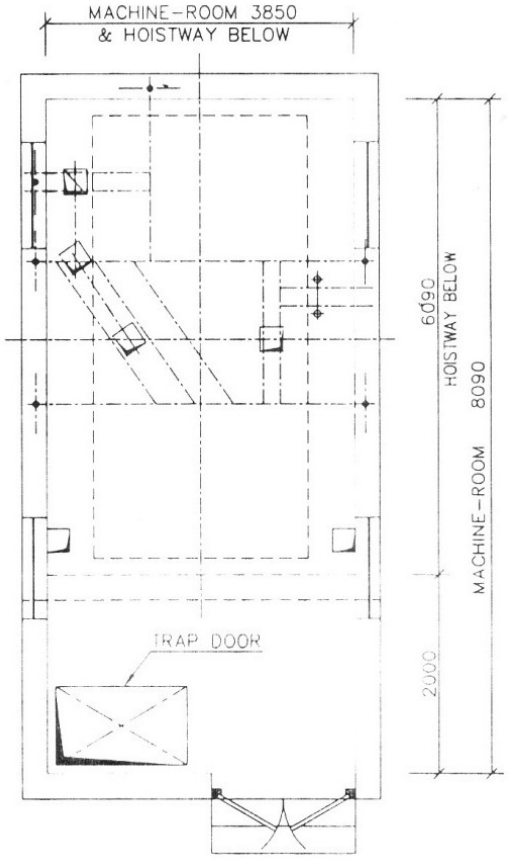
SECTIONAL ELEVATION



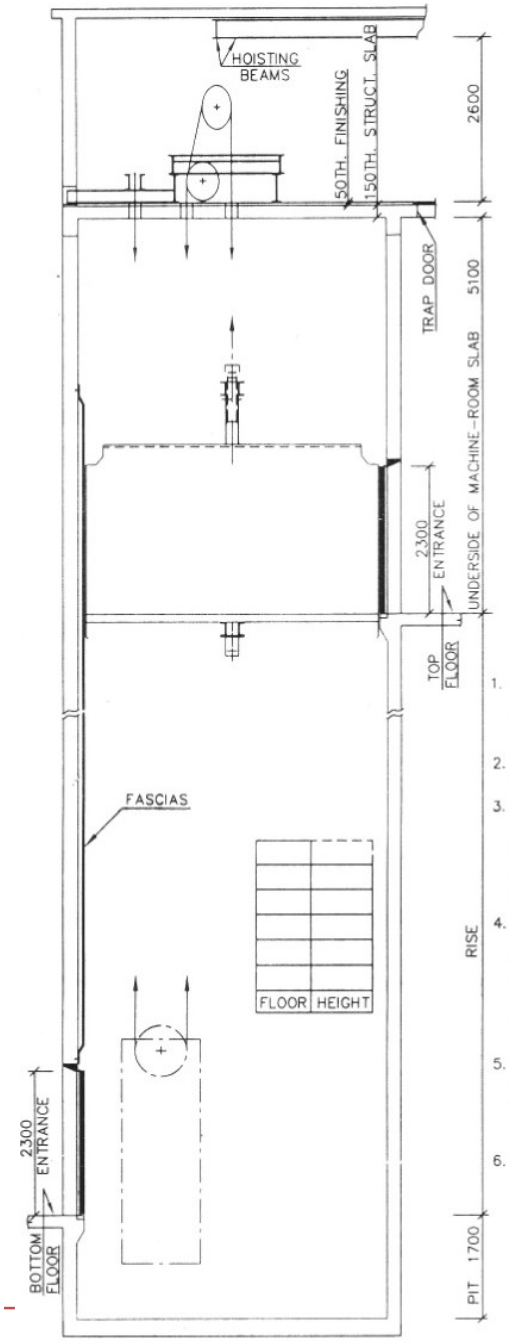
AUTOMOBILE ELEVATOR



HOISTWAY PLAN

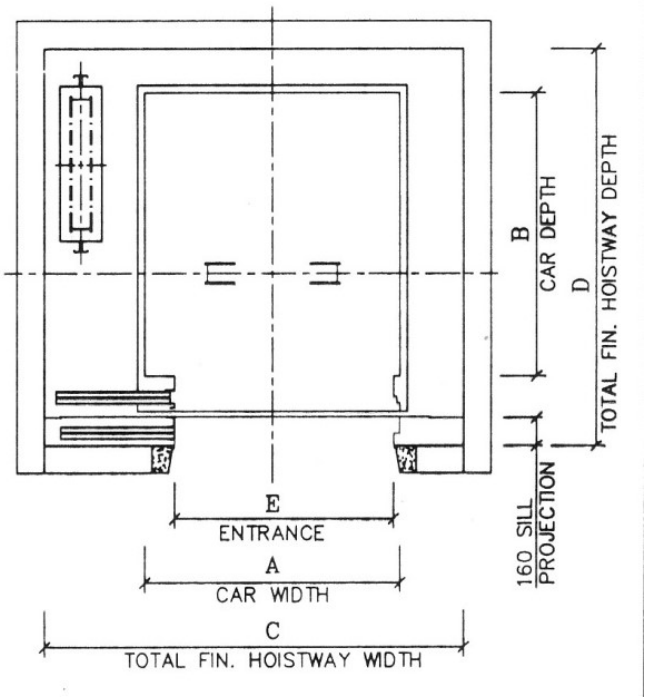


MACHINE ROOM PLAN

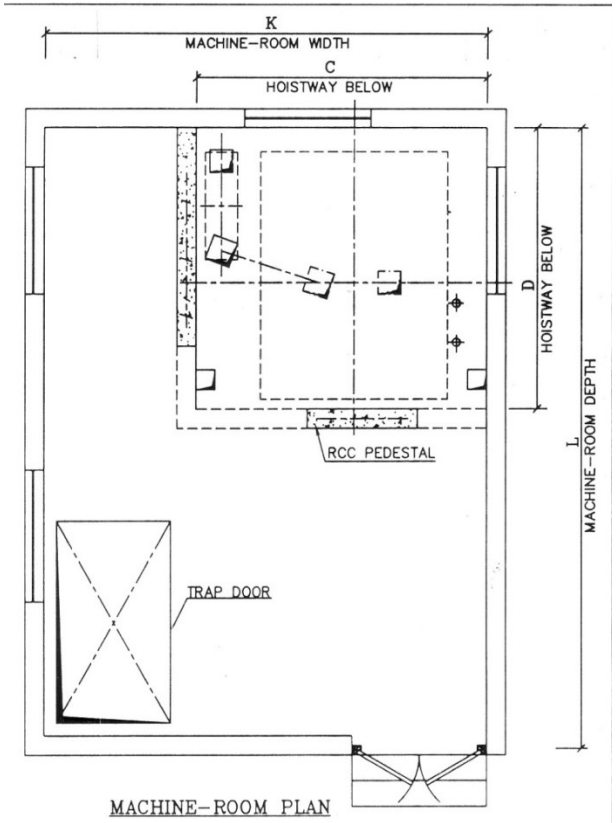


SECTIONAL ELEVATION

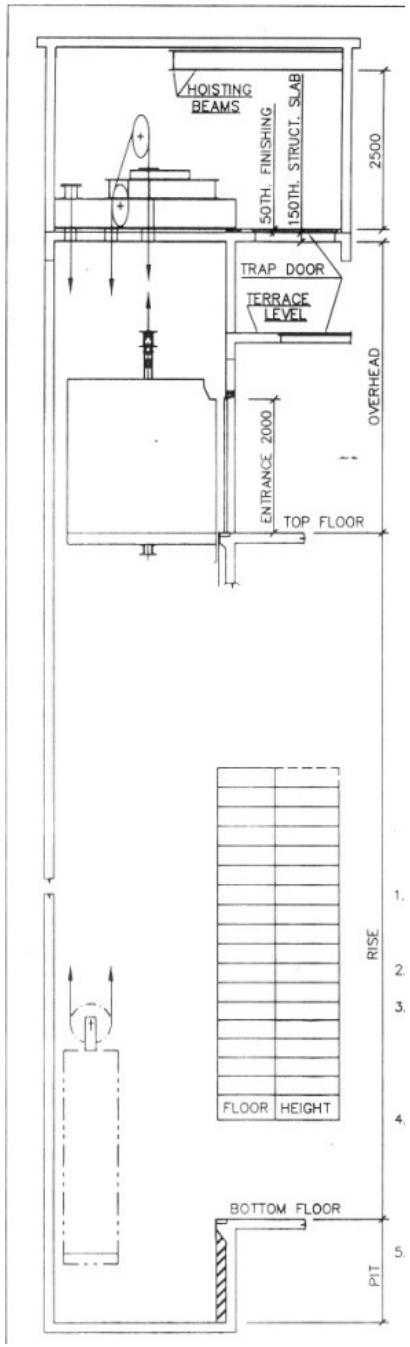
HOISTWAY PLANS AND SECTIONAL ELEVATION



HOISTWAY PLAN



MACHINE ROOM PLAN

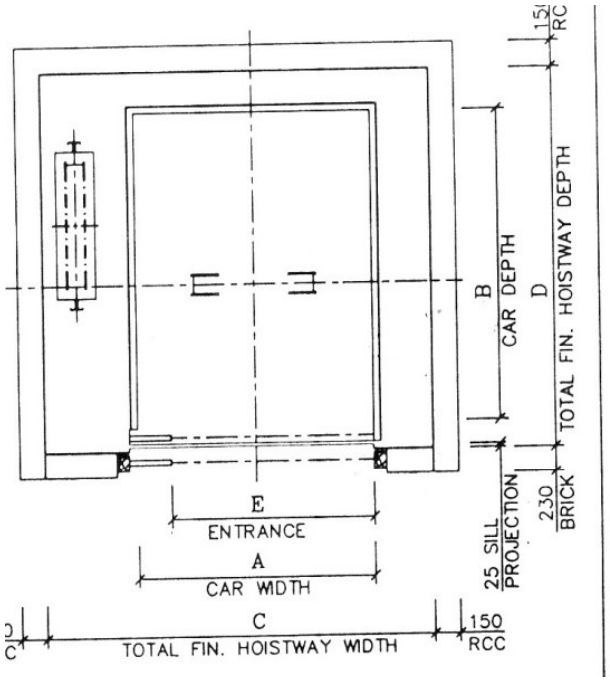


SETIONAL ELEVATION

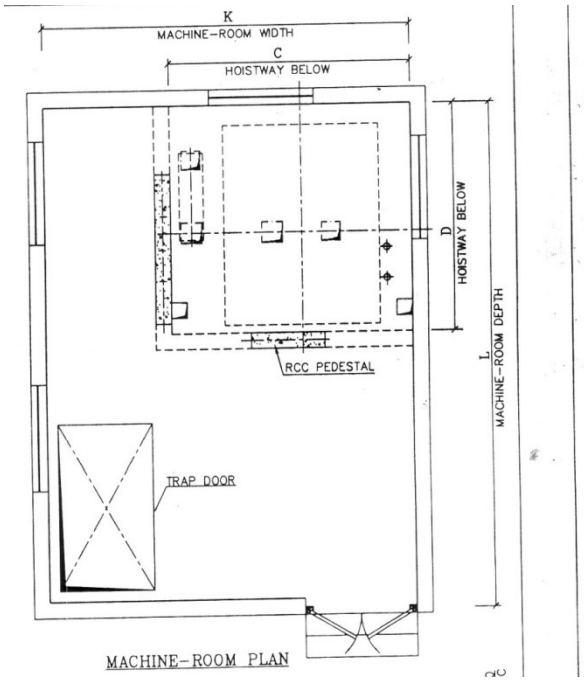
MINIMUM CIVIL DIMENSIONS FOR HOSPITAL ELEVATORS

LOAD		SPEED (M.P.S)		CAR INSIDE		LIFT WELL		ENTRANCE	MACHINE ROOM		PIT DEPTH	OVER HEAD
	K.G	OVER	UP TO	A	B	C	D	E	K	L		
15	1020	-		1000	2400	1800	3000	900	3700	5500	1600	4400
20	1360	-	1.00	1300	2400	2200	3000	1200	4200	5500	1600 1800	4400
		1.00	1.75									
26	1768	-	1.00	1600	2400	2350	3000	1200	4350	5500	1600 1800	4400
		1.00	1.75									

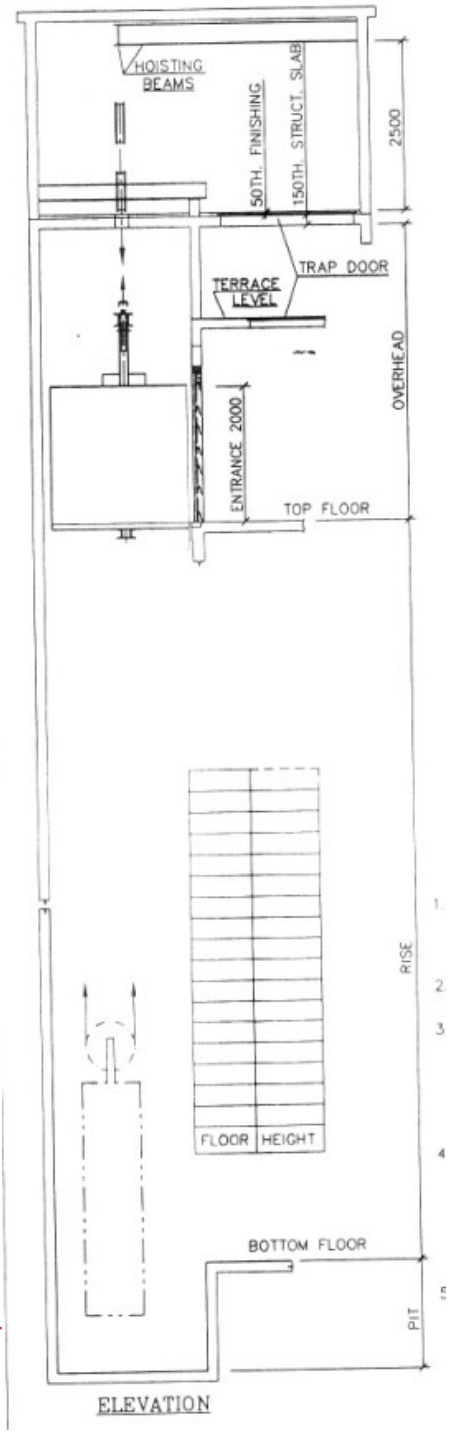
PLANS AND SECTION



HOISTWAY PLAN



MACHINE ROOM PLAN



SECTIONAL ELEVATION

MINIMUM CIVIL DIMENSIONS FOR FREIGHT ELEVATORS

LOAD	SPEED (M.P.S)	CAR INSIDE		LIFT WELL		ENTRANCE	MACHINE ROOM		PIT DEPTH	OVER HEAD
500	1.00	1100	1200	1900	1600	1000	2500	4100		
1000	.50	1400	1800	2300	2200	1300		4700		
1500	.55	1700	2000	2600	2400	1600	2600	4900	1600	4800
2000		1700	2500	2600	2900			5400		
2500	.40	2000	2500	2900	2900	1800	2900	5400		
3000	.40	2000	3000	2900	3400			5900		

SERVICE LIFT [DUMB WAITERS]

•The most convenient and economical means of transporting relatively small articles between levels.

DEPARTMENT STORES
•transport merchandise from stock areas to selling

HOSPITALS
•dumbwaiters are often utilised for transporting food, linens,.

MULTI LEVEL RESTAURANTS,
•office dining rooms, etc, these are used for delivery of food from the kitchen and for return of soiled dishes.

•The car is frequently compartmented by shelves.
•used for carrying materials and shall not carry any person.

TWO TYPES OF CONTROLS
•**call** and send controls are used.
•Gate opening may be at front or rear and doors are always half splitting type.
•Whether or not provided with fixed or removable shelves.

Traditional Service Lift (Dumb Waiter)

Service Lift Hilton Hotel Cardiff

•Dumbwaiters for kitchens are usually made of **stainless steel** so that they are not affected by steam, hot food, water, etc.

•The **capacity starts from 20 Kgs** onwards as desired.

•Only **one wall is required** to support the smaller lifts.

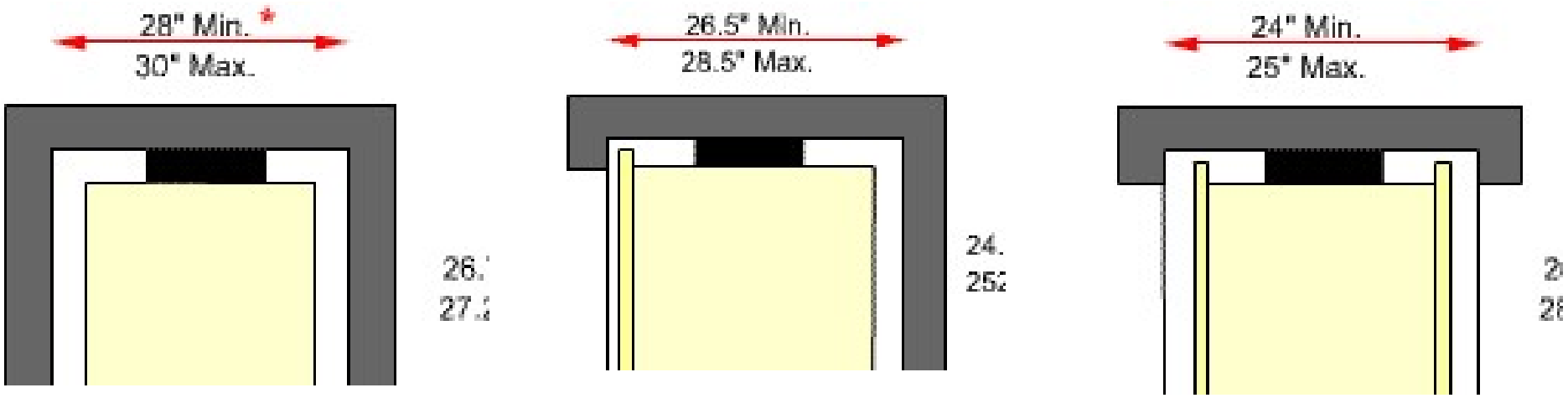
•The entrance can be protected by either **a swing window**

•Slow speed mini lift to handle only material for transportation **from 100 to 250 kg.**

•Speed varying from **0.25 m/sec to 0.5 m/sec.**

•a max. height of 4 ft.

SIZE REQUIREMENTS



Opening at front | **Right angle opening** | **opening on opposite sides**

How Do Elevators Work _ How Stuff Works _ How Devices Work in 3D _ Science For Kids - YouTube (360p).mp4

Hydraulic Passenger Lifts +919849216489 - YouTube (360p).mp4

How does an elevator work_ Pulley system explained - YouTube (360p).mp4