

# UNIT-3

## VERTICAL TRANSPORTATION IN A BUILDING:

- Vertical transportation is a phrase used to describe the various means of travelling between floors in a building.
- All buildings with more than one storey of course have at least one set of stairs.
- The provision of stairs is a very important consideration when designing buildings in order to ensure all the occupants of the building can escape safely in the event of a fire.
- In buildings with more than four storeys, a lift (commonly known as an elevator in the US) is desirable as there is a limit to how far people are willing to walk up stairs.
- In addition to this, stairs are unsuitable for infirm and mobility impaired persons so buildings with only two storeys are sometimes fitted with a lift.
- A third option is the escalator which is ideally suited for high volume applications such as shopping malls and airports but not practical for high rise buildings as they take up a lot of space.

## Building Transport System

Most multi-storied hotels have many floors above the ground floor and also one/two floors below the ground floor. Hence appropriate and efficient building transport systems are not only important but necessary also for operation. The systems should be a mix of manual and automatic operations.

There are two types of building transport system namely Vertical Transport System and Horizontal Transport System.

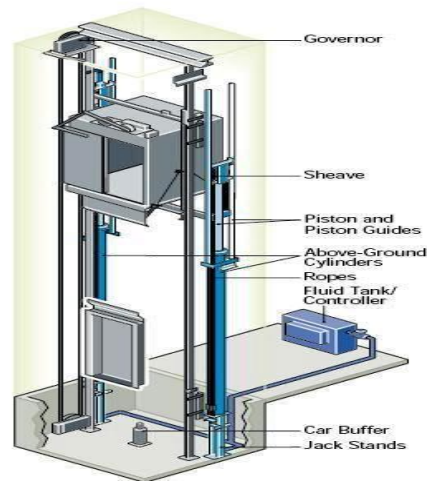
## Vertical Transport System

Vertical transportation in a building refers to the systems and equipment used to move people and goods between different levels of a structure. This includes elevators, escalators, and sometimes staircases. Elevators are the most common form of vertical transportation, offering efficient and safe means of moving between floors in tall buildings. Escalators are often used in retail and transit settings. The design and efficiency of these systems are crucial for the functionality and accessibility of multi-story buildings.

- Stairs
- Elevators / Lifts
- Escalators (Moving Stairs)
- Gravity Chutes (for goods)

## Elevators

An elevator is a transportation device used to transport people and goods vertically. Elevators are generally automatic safety units for up and down transport purpose. It consists of a platform travelling in vertical guides in a shaft with hoisting and lowering mechanism and a source of power. The enclosure moving up and down in the guides is known as car. There are two types of lift systems.



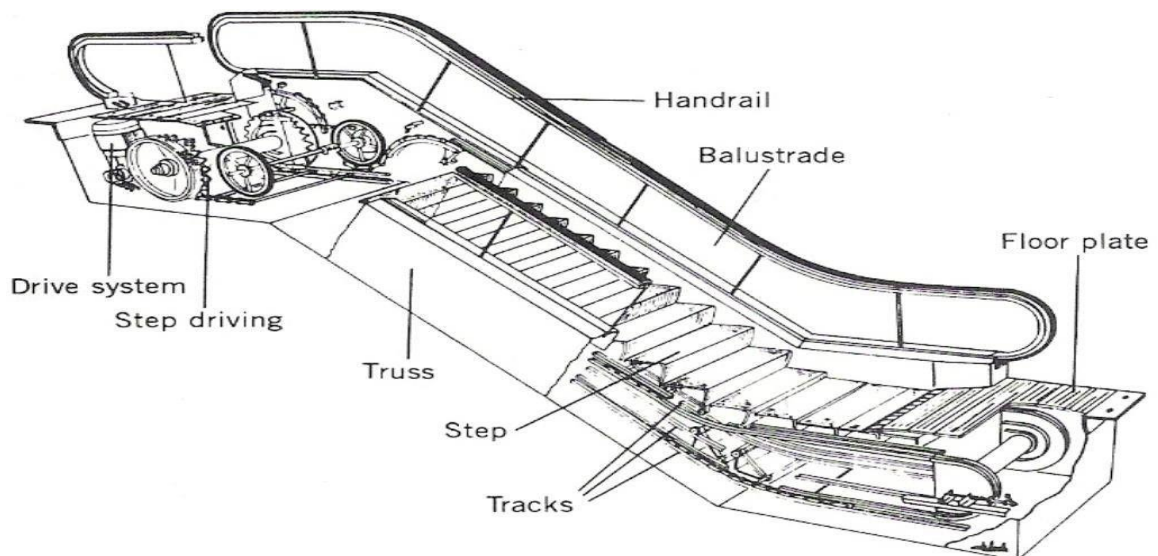
- **Cable elevators** – They are more common because they are fast, smooth and quite.
- **Hydraulic elevators** – are elevators which are powered by a piston that travels inside a cylinder. An electric motor pumps hydraulic oil into the cylinder to move the piston. The piston smoothly lifts the elevator cab/car. They are used when the number of floors to be serviced is less.

The elevators require regular inspection and maintenance and generally have a life of 20 years.

## Escalators

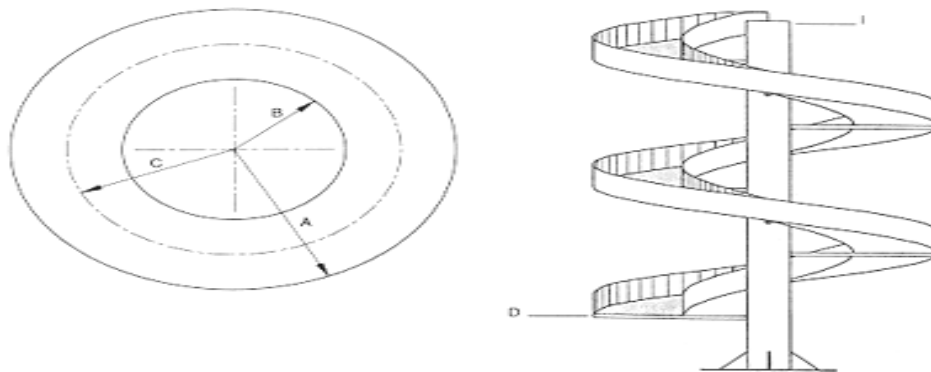
The term escalator is a combination of elevator and “scala” the latin word for steps. Escalators are the moving step type lifts operating at constant speed between two levels in an inclined course for moving large number of people in a short time. It consists of a staircase whose steps move up and down on tracks which keep them horizontal. Most escalators also have a moving handrail which approximately keeps pace with the movement of the steps. The direction of movement (up and down) can be permanently the same or can be controlled by operators according to the requirement.

Generally two units are required side-by-side at each level, one moving upward and the other downward.



## Gravity Chutes

Gravity chutes are used by hotels for transporting soiled linen, garbage and waste from different floors of the hotel to an outlet point (generally kept on the ground floor). It is an efficient system as minimum power is involved in operating it. Gravity chutes save workers motion, time and increase their productivity.

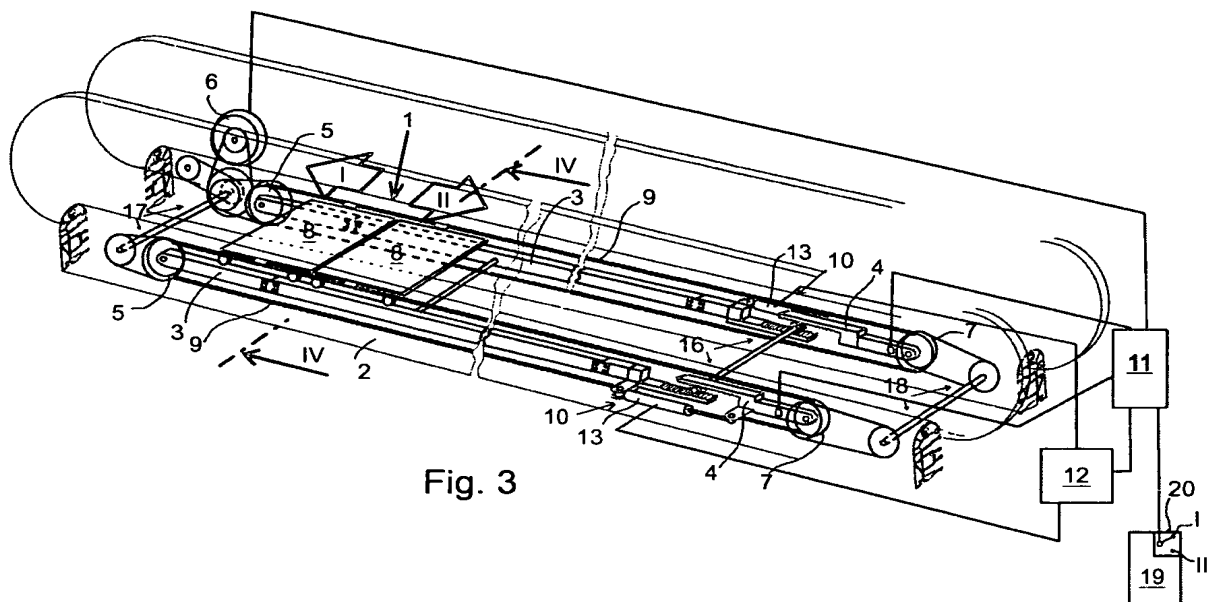


## Horizontal Transport System

- Conveyor belts (moving sidewalk, moving walkway or traveller)
- Electric cars
- Manual trolley for transportation of luggage.

### 1. Travellers (Moving pavements)

Travellers also is known as horizontal moving sidewalks, moving walkways is a slow speed conveyor belt to transport people, they can walk along or stand on it. They are often installed in pairs, for movement in the opposite direction. Travellers may be used when there is a substantial distance between the hotel entry point and the reception point.



### 2. Electric Cars

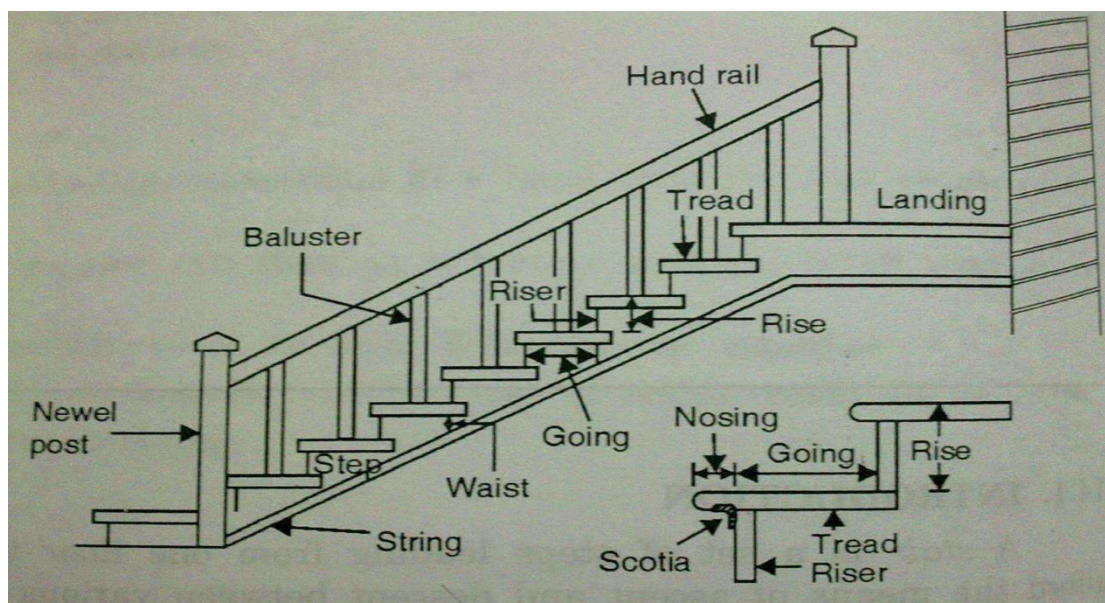
An electric car is an electrically operated open car with 6 to 8 seats. This is an alternative to travellers and particularly very useful for disabled persons.

### 3. Manual Trolley

A manual trolley is used for transportation of luggage of guest.

## TECHNICAL TERMS

- ▲ **STEP:-** It is a portion of stair which permits ascent or descent. A stair is composed of a set of steps. □
- ▲ **TREAD:-** It is a upper horizontal portion of a step upon which foot is placed while ascending or descending. □
- ▲ **RISER:-** It is a vertical portion of a step providing support to the tread.
- ▲ **LANDING:-** It is level platform at the top or bottom of a flight between the floors.
- ▲ **FLIGHT:-** This is an unbroken series of steps between landing.
- ▲ **RISE:-** It is a vertical distance between two successive tread faces.
- ▲ **GOING:-** It is a horizontal distance between two successive riser faces.
- ▲ **NOSING:-** It is the projecting part of the tread beyond the face of riser.
- ▲ **SCOTIA:-** It is a moulding provided under the nosing to provide strength to nosing. □
- ▲ **SOFFIT:-** it is the underside of a stair. □
- ▲ **PITCH OR SLOPE:-** It is the angle which the line of nosing of the stair makes with the horizontal.
- ▲ **STRINGS OR STRINGERS:-** These are the slopping members which support the steps in a stair.
- ▲ **NEWEL POST:-** Newel post is a vertical member which is placed at the ends of flight to connects the ends of strings and hand rail.
- ▲ **BALUSTER:-** It is vertical member of wood or metal, supporting the hand rail.
- ▲ **HEAD ROOM:-** It is the clear vertical distance between the tread and overload structure.



## CLASSIFICATION OF STAIRCASE

- ✓ Straight Staircase
- ✓ Turning Staircase

- (a) Quarter Turn
- (b) Half Turn (Dog-Legged & Open well Staircase)
- (c) Three-Quarter Turn Staircase
- (d) Bifurcated Staircase
- ✓ Continuous Staircase
  - (a) Circular Staircase
  - (b) Spiral Staircase
  - (c) Helical Staircase
- ✓ Ladders

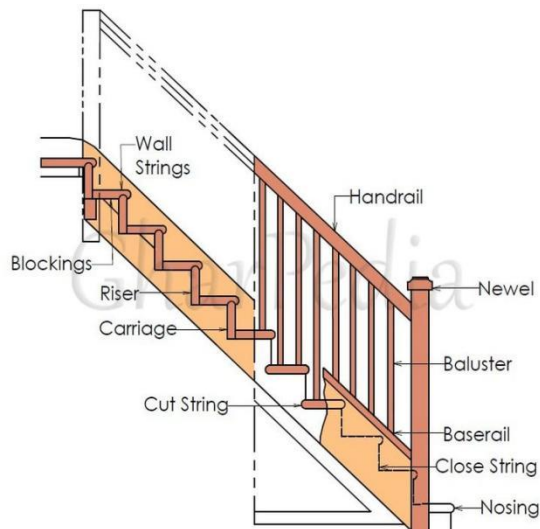
## 1. Straight Stairs

- ❖ Literally, as its name, it has no bends. It qualifies for a linear flight with no change in direction. A straight staircase is the most common and affordable type of staircases.
- ❖ The design does not need any support, an attachment at the bottom and the top is all it needs.
- ❖ The bonus point of this design is its ease to install of railings and handrails. It is easy to move on them and it is friendly for toddlers and the aged due to its non-steep nature.
- ❖ Its simple appearance makes it suitable for minimal designs.
- ❖ They are certainly one of the most common types of stairs found in both residential and commercial properties.

**Examples** of straight floating stairs made with a variety of stringer styles, railing types, and wood species.

On longer flights of stairs, a landing is inserted to break up the flight.

Building codes require this for floor heights above 12 feet. Especially in commercial buildings, straight stairs often have platforms halfway up the run of the stairs.



## Straight Stairs with a Central Landing

- ❖ A high ceiling room or a staircase with more than 16 risers will require a staircase that is 12 feet high with a special landing.

- ❖ Its drawback is that it requires a larger space hence is applicable in commercial buildings than in private ones.

### **Advantages of Straight Stairs:**

- Straight stairs tend to be the easiest to go up and down, or, ascend/descend, as we say in the industry.
- They are typically the easiest to build, however, this depends a lot on the level of detail in the design.
- Straight stairs only need to be connected at the top and the bottom (no intermediate supporting structure is required).
- They work well with minimalist designed homes due to their inherent simplicity.
- By selecting thinner treads, open risers, and thin metal stringers, straight stairs can be made more transparent than other types of stairs, allowing less obstruction to the view beyond.
- No landing is required if the number of risers is kept under 16 or the overall vertical height is less than 12 feet.
- It's relatively easy to build railings and handrails for straight stairs.
- Measuring for railings for straight stairs is simpler than for other stair designs.

### **Disadvantages of Straight Stairs:**

- Straight stairs use up a fair amount of linear space, which has to be planned for in your design.
- Some of the other stair types create a privacy barrier between the floors of your home. Straight stairs do not offer this privacy.
- A stair 12-feet high requires a landing to break up the span. The addition of a landing will use up a lot more space and therefore these types of stairs are seldom used in residential construction. You will see these more frequently in large commercial buildings.

## **2. Turning Staircase**

### **(A) Quarter Turn**

- ❖ The Quarter Turn shaped stair is a variation of the straight stair with a bend in some portion of the stair.
- ❖ This bend is usually achieved by adding a landing at the transition point.
- ❖ The bend is often 90 degrees, however, it does not have to be.
- ❖ If the landing is closer to the top or bottom of the stairs it is sometimes referred to as a **long L stair or a quarter turn stair.**

### **Advantages of quarter Turn Stairs:**

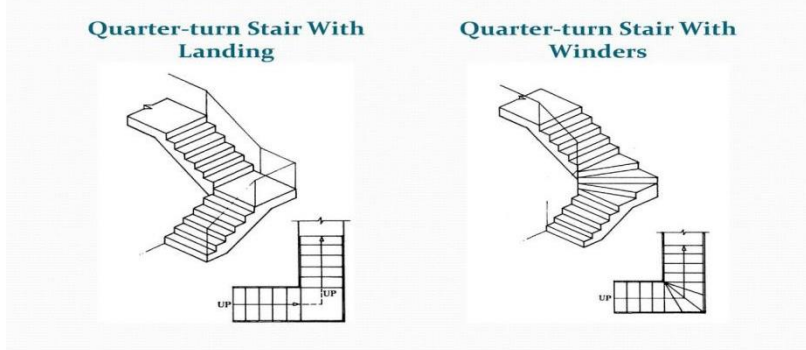
- L shaped stairs can be more visually interesting.
- They provide a visual barrier between floors so, they can add some privacy.
- L shaped stairs can help somewhat with sound transmission between floors if the stairs are contained within walls.
- Some believe they are safer than straight stairs as the central landing reduces the number of treads one could fall in a given flight.
- The landing can provide a place to stop and rest while ascending.
- They can be located in a corner of a room if this works better for your design.

### **Disadvantages of L Shaped Stairs:**

- L shaped stairs are a bit more difficult to build than straight stairs.

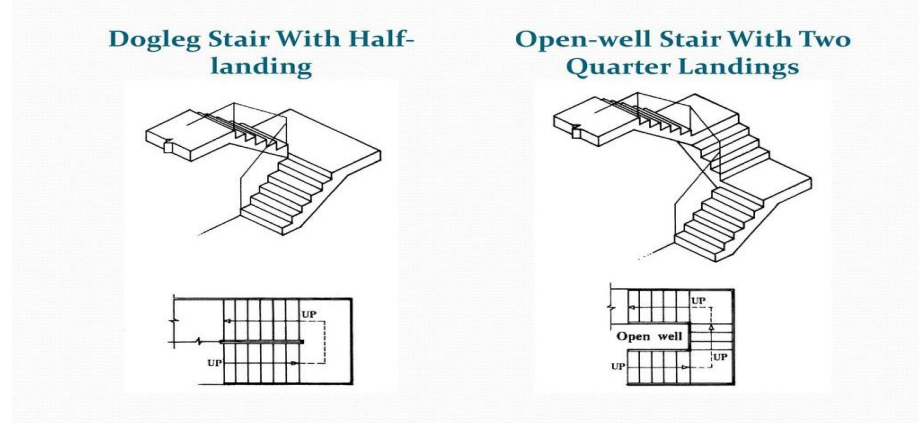


- A support is typically required for the landing in an L type stair. Often, this is bHandrails for these types of stairs require more skill and planning to construct than handrails for straight stairs.
- In climates where basements are used, stairs are typically stacked over each other for efficient use of space. Since basements are often used for storage, large items can be difficult to move in and out of the basement.



### (B) DOG-LEGGED STAIRCASE

- ❖ It consists of two straight flights with 180° turn between the two.
- ❖ They are very commonly used to give access from floor to floor.
- ❖ Photograph shows the arrangement of steps in such stairs.
- ❖ **DOG-LEGGED** staircase also known as **u-shaped stair case**
- ❖ The number of steps in each flight should not be greater than 12
- ❖ The pitch of the stair should not be more than 38 degrees
- ❖ The head room measured vertically above any step or below the mid landing shall not be less than 2.1 m
- ❖ Tread (T) : 220 mm to 250 mm for residential buildings
- ❖ 0.8 m to 1 m for residential building and 1.8 m to 2 m for public building



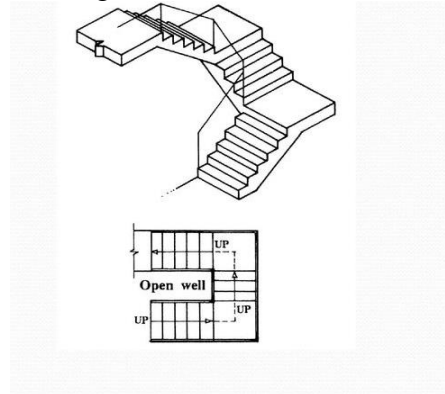
### (C) OPEN WELL OR NEWEL STAIRCASE

- ❖ It differs from dog legged stairs such that in this case there is 0.15 m to 1.0 m gap between the two adjacent flights.

### (D) Three-quarter stairs

- ❖ stairs that make a 180-degree turn, completing three-quarters of a full circle.
- ❖ These stairs are commonly used when space is limited or to provide a more aesthetically pleasing and efficient design.

- ❖ The design involves landings at each turn, offering users a resting point and contributing to safety.
- ❖ Engineers consider factors such as building codes, user comfort, and efficient use of space when designing three-quarter stairs for various architectural applications.
- ❖ It differs from dog legged stairs such that in this case there is 0.15 m to 1.0 m gap between the two adjacent flights.



#### Advantages of U Shaped Stairs:

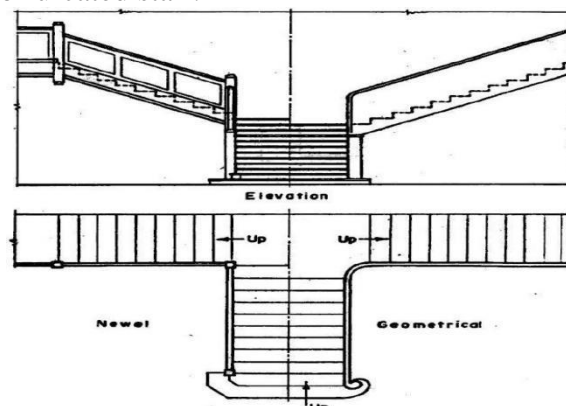
- U shaped stairs can be easier to fit into an architectural plan.
- They offer some architectural interest.
- The landing(s) can offer a resting point partway up the stairs.

#### Disadvantages of U Shaped Stairs:

- These types of stairs are a bit more difficult to build than simpler stair types

### (E) BIFURCATED STAIRCASE

- ❖ Apart from dog legged and open newel type turns, stairs may turn in various forms.
- ❖ They depend upon the available space for stairs. Quarter turned, half turned with few steps in between and bifurcated stairs are some of such turned stairs.
- ❖ **Split Stairs are also known as bifurcated stairs** typically have a wide set of stairs starting at the bottom that ends at a landing partway up the flight.
- ❖ The stairs split at the landing into two narrower sets of stairs leading in opposite directions.
- ❖ Figure shows a bifurcated stair.



#### Advantages of bifurcated staircase:

- Split stairs allow one staircase to function as two, by leading up to different sections of the building making each end of the upper level easily accessible.
- They add an impressive architectural design statement to the building.



- Typically used in large homes or commercial buildings as a Grand Entry.  
They are suitable for interior or exterior locations.

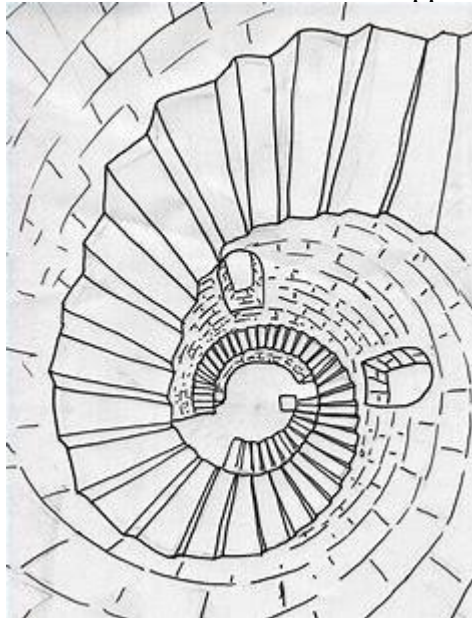
#### **Disadvantages of bifurcated staircase**

- Split stairs require a significant amount of space. This space requirement will need to be considered in the design of the building.
- Split staircases are more expensive than most stairs.

### **3. Continuous staircase**

#### **A. Circular staircase**

- ❖ A circular staircase resembles a circle in plan.
- ❖ The steps wind similar to a spiral staircase, but there is no support pole in the middle.
- ❖ A circular staircase may have a very narrow diameter like the one seen in this picture or a wide curve giving it a very grand appearance.
- ❖ Using different materials, you can create different types of circular stairs.
- ❖ Circular stairs are similar to spiral stairs, but unlike spiral stairs which wind around a pole, the circular stairs do not have a central support.



#### **B. Spiral staircase**

- ❖ These stairs are commonly used as emergency exits.
- ❖ It consists of a central post supporting a series of steps arranged in the form of a spiral.
- ❖ At the end of steps continuous hand rail is provided.
- ❖ Such stairs are provided where space available for stairs is very much limited.
- ❖ Figure shows a typical spiral stair. Cast iron, steel or R.C.C. is used for building these stairs.
- ❖ Spiral stairs follow a helical arc. They usually have a very compact design and the treads radiate around a central pole.



### **Advantages of spiral staircases:**

- ❖ Less space: than normal staircases and can be introduced into the tiniest spaces.
- ❖ Cheap: Easier to install than normal staircases.
- ❖ Pre-assembled: These offer a wider variety of materials and shapes and sizes.
- ❖ Add value: They are great as second staircases and also they add value to your home

### **Disadvantages of spiral staircases:**

- ❖ Steep: because they take so little space. This makes them almost impossible to use by elders and larger people.
- ❖ Head room: When you install them you should make sure that you have adequate

head room as you climb up, otherwise they are not usable.

- ❖ Expensive: Pre-assembled stairs are usually more expensive than normal staircase and will surely add to the costs.

### **C. Helical staircase**

- ❖ A helical staircase is a type of staircase that has a curved or spiral shape, rather than the traditional straight or angular design.
- ❖ This type of staircase is often used in architectural designs to add a sense of elegance and sophistication to a space.



- ❖ Helical staircases are typically more complex to construct than traditional staircases, but they can also be more visually appealing and space-efficient.
- ❖ They are often used in homes, offices, and other public buildings.

### **Advantages of helical staircases:**

- ❖ They can be very visually appealing and add a sense of drama to a space.
- ❖ They can be more space-efficient than traditional staircases, especially in tight spaces.
- ❖ They can be easier to ascend and descend than traditional staircases, especially for people with mobility impairments.

### **Dis-Advantages of helical staircases:**

- ❖ They can be more expensive to construct than traditional staircases.
- ❖ They can be more difficult to navigate for people who are unfamiliar with them.
- ❖ They may not be as safe as traditional staircases, especially for young children and elderly people.

## **4. Ladders**

- ❖ Ladders, like stairs, can serve as a means of access.
- ❖ However, building codes do not allow ladders to serve as a primary means of access.
- ❖ Keuka Studios can design custom ladders for applications such as libraries, lofts, and docks.

## **Planning of stairs**

Stair is the means of vertical transportation between the floors. It should, therefore, be designed so as to provide easy, quick and safe mode of communication between the floors. Following are the general requirements which a stair should fulfil.

### **1. Location:**

- ⤴ It should be so located as to provide easy access to the occupants of the building.
- ⤴ It should be so located that it is well lighted and ventilated directly from the exterior.
- ⤴ It should be so located as to have approaches convenient and spacious.
- ⤴ In multi-story buildings, consider the integration of stairs with elevators to provide multiple options for vertical circulation. This is especially important for accessibility.

### **2. Width of stair:**

- ⤴ It should be wide enough to carry the user without much crowd or inconvenience.
- ⤴ Width of stairs depends up to its location in the building and the type of building itself. In a domestic building, a 90 cm wide stair is sufficient while in public building 1.5 to 1.8 m width may be required.

### **3. Length of flight:**

- ⤴ From comfort point view, the number of steps are not more than 10 to 12 feet and not less than 3 (3 to 3.6 meters) for residential stairs.
- ⤴ This provides a comfortable and manageable ascent or descent. Commercial and public building codes may have specific requirements, and they can vary by jurisdiction.

- ▲ It's important to note that longer flights of stairs may require landings or intermediate platforms for safety and ease of use, especially if the total rise (vertical distance) is substantial. This helps break up the climb and provides resting points.

#### **4. Pitch of stair.**

- ▲ The pitch of the stairs should match with the French theory: 'the labour of moving vertically is about twice that of moving horizontally' if the average human stride is taken as 23 inches.
- ▲ If the rise and going are measured in inch units, the best pitch of the stairs is that inclination which by doubling the rise and adding the going equals 23.
- ▲ When measured in cm units, a comfortable slope is achieved when twice rise plus going is equal to 60 approximately. Pitch should however, be limited to 30° to 45°.

#### **5. Head room:**

- ▲ The clear distance between the tread and soffit of the flight immediately above it should not be less than 2.1 to 2.3 m, so that even a tall person can use the stair with some luggage on its head.
- ▲ Headroom requirements are typically specified in local building codes, and these codes may vary by jurisdiction. Commonly, a minimum headroom clearance of 6 feet 8 inches (203 cm) is required, but it's essential to check the specific requirements in your area.

#### **6. Balustrade:**

- ▲ Open well stair should always be provided with balustrade, to provide safety to the users. Wide stair should have hand rail to both the sides.
- ▲ Balustrades, also known as railings, play a crucial role in the safety and aesthetics of staircases. Here are some requirements for a good balustrade in a staircase.
- ▲ A minimum height of 36 inches (91 cm) is required for residential staircases.
- ▲ The handrail should be between 34 to 38 inches (86 to 97 cm) above the tread nosing. It should also be of a size and shape that allows for a secure grip.

#### **7. Step dimensions:**

- ▲ The rise and going should be of such dimensions as to provide comfort to the users.
- ▲ Their proportion should also be such as to provide desirable pitch of the stair.
- ▲ The going should not be less than 25 cm, though 30 cm going is quite comfortable.
- ▲ The rise should be between 10 cm (for hospitals, etc.) to 15 cm. The width of landing should not be less than the width of stair.

#### **8. Material**

##### **Materials of construction:**

- ▲ The material used for the construction of stair should be such as to provide
  - sufficient strength, and
  - fire resistance.

#### **Lifts**

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Lifts and elevators have become an essential part of everyday life, particularly for those who work or live in high-rise buildings. There are many different **types of lift** which can be used in different applications, serving different purposes.

### **Platform lifts**

Platform lifts can take a number of different forms, but due to their design they are limited to use in low-rise buildings where they will only travel a few floors at most. This means they tend to move more slowly than passenger lifts and are often used for disabled access in buildings where most people will take the stairs.

### **Passenger lifts**

Passenger lifts are designed to carry people and can come in a variety of forms. As these lifts carry passengers, they should meet specific requirements and standards to ensure that they are safe. They can come in a range of sizes, transporting different numbers of passengers.

These lifts can be customised with different designs, both inside and outside of the cabin, so they can fit in with the design and style of the space around it. These lifts appear in a variety of settings, from shopping centres to private residences. They also tend to travel faster than other lift types as they are often used in high-rise buildings where passengers may be travelling through multiple floors.

### **Glass lifts**

Glass lifts are a type of passenger lift that have glass walls and doors. They can't always be used in any situation that a regular passenger lift would be used in, but in the right situation, they can offer a stylish alternative. They are often chosen for their aesthetics and can provide a way of maintaining the style of a building whilst providing a means of transportation.

### **Goods lifts**

More robust lifts designed to carry a wide range of goods. These can also be permitted to carry passengers as they are fitted with appropriate safety gear. Goods lifts are designed to carry loads from a few hundred Kg. to many tonnes.

Some goods lifts can be extremely specialised and designed to suit the industrial environment they are used in. They can be part of an assembly line system and can be designed to resist knocks from fork lift trucks etc.

Elevator, Also Called Lift, Car That Moves In A Vertical Shaft To Carry Passengers Or

Freight Between The Levels Of A Multistorey Building. Most Modern Elevators Are Propelled By Electric Motors, With The Aid Of A Counterweight, Through A System Of Cables And Sheaves (Pulleys). By Opening The Way To Higher Buildings, The Elevator Played A Decisive Role In Creating The Characteristic Urban Geography Of Many Modern Cities, Especially In The United States, And Promises To Fill An Indispensable Role In Future City Development.

The Practice Of Lifting Loads By Mechanical Means During Building Operations Goes Back

At Least To Roman Times; The Roman Architect-Engineer Vitruvius In The 1st Century Bc Described Lifting Platforms That Used Pulleys And Capstans, Or Windlasses,

Operated By Human, Animal, Or Water Power. Steam Power Was Applied To Such Devices

In England By 1800. In The Early 19th Century A Hydraulic Lift Was Introduced, In Which

The Platform Was Attached To A Plunger In A Cylinder Sunk In The Ground Below The Shaft To A Depth Equal To The Shaft's Height. Pressure Was Applied To The Fluid In The Cylinder By A Steam Pump. Later A Combination Of Sheaves Was Used To Multiply The Car's Motion And Reduce The Depth Of The Plunger. All These Devices Employed Counterweights To Balance The Weight Of The Car, Requiring Only Enough Power To Raise The Load.

## **Ramps**

Ramps are sloped pathways used both inside and outside buildings used to provide access between vertical levels. Ramps provide an alternative to stairs for wheelchair users, people with mobility issues and people with prams, bicycles and other wheeled items.

The gradient, slope or steepness of a ramp is the angular relationship between its rise (vertical height) and its horizontal projection or length (run), often expressed as a ratio. The rise may be set at a unit of one, so that, for example, a slope of 1:20 means that as each dimensional unit of height rises or falls, the dimensional unit of length runs out by 20 units. A ramp that has too steep a slope will prove difficult for people to use and could even be unsafe, whilst a ramp with too shallow a slope can require excessive length.

## **External ramps**

- Gradients should be as shallow as is practicable.
- The surface should be firm and even.
- Stairs should also be provided as adverse weather conditions can increase the risk of slipping on a ramp.
- Landings should be at least 1.2 metres long at both the foot and head of the ramp.



- Support in the form of handrails should be provided on both sides of the ramp.
- The approach to the ramp should be clearly marked.
- Flights should have a going of less than 10 metres and a rise of less than 500 mm.
- The surface width of a ramp between walls, upstands or kerbs must be at least 1.5 metres.
- The surface of the ramp must be slip resistant and of a colour that contrasts visually with that of the landings. However, the frictional characteristics of the ramp and landing should be similar.
- Landings should be provided as passing places (at least 1800 mm wide x 1800 mm long) when it is not possible to see from one end of the ramp to the other, or where the ramp has 3 or more flights.
- All landings should be level, subject to a maximum gradient of 1:60 along the length, and a maximum cross-fall gradient of 1:40.

## **Internal ramps**

The design considerations for internal ramps are the same as those above for external ramps, excluding issues relating to the external environment.

Steps should be provided as well as a ramp unless one of the following criteria can be fulfilled:

- The ramp is sufficiently short.
- The ramp has a shallow gradient.
- The rise is no more than the minimum that can be provided by two risers.

## **The following are the significant characteristics and uses of a ramp:**

1. The ramps are sloped usually at 1 in 10 to 1 in 15. This method of providing a means of ascent and descent needs a lot of space.
2. The ramp floor should not be too smooth, because it may be a cause for the slippage of users. The finishing of ramp floors is usually provided with non-slippery tiles.
3. The shape of the ramp does not need to be straight. It can be of any geometric shape.
4. The ramp should be provided with handrail on both sides.
5. Ramps are mainly constructed in government buildings (such as hospitals, government offices, school buildings, colleges, etc.) where people's movement is huge. Successfully ramps have been provided almost in all the governmental buildings at Chandigarh.

## **Escalator**

- An escalator is a moving staircase which carries people between floors of a building or structure.
- It consists of a motor-driven chain of individually linked steps on a track which cycle on a pair of tracks which keep the step tread horizontal.

- Escalators are often used around the world in places where lifts would be impractical, or they can be used in conjunction with them.
- Principal areas of usage include department stores, shopping malls, airports, transit systems (railway/railroad stations), convention centers, hotels, arenas, stadiums and public buildings.
- Escalators have the capacity to move large numbers of people. They have no waiting interval (except during very heavy traffic).
- They can be used to guide people toward main exits or special exhibits and may be weatherproofed for outdoor use.
- A non-functional escalator can function as a normal staircase, whereas many other methods of transport become useless when they break down or lose power.
- An Escalator is a moving staircase that moves people between different floors of a building. They are powered by motors. The steps run on tracks.
- There is a handrail that moves with the escalator, that you hold onto when riding the escalator. There is also an emergency stop button, which stops the escalator, and a key switch, that restarts the escalator, in the up or down direction.

### **Types of Escalators Step Type Escalator**

The step type escalator is the common type of escalator today. The steps are usually metal, but very old step type escalators had wooden steps. Step type escalators can also go up/down, flat, then up/down again. On Otis Next Step escalators, the escalator steps are mounted on most likely hinged circles, and the track appears to be besides the steps, visible from above the steps. This type of escalator is designed to be safer than other step type escalators.



Step-type Orenstein & Koppel escalators.



Step-type Sigma escalators.



Wooden step-type Otis escalator in Town Hall Station, Sydney, Australia.



A Mitsubishi Series Z escalator in Bandung, Indonesia with some of its steps temporarily removed for maintenance.

### **Wheelchair-accessible Escalator**

Wheelchair accessible escalators have an attendant. If someone in a wheelchair needs to use the escalator, the escalator will be stopped. Once the wheelchair is on the escalator, the escalator is put in a special mode. 3 steps will level out, forming a platform. After that, some spikes will come out of the step closest to the lower landing of the escalator of the platform made out of 3 steps, preventing the passenger's wheelchair from rolling off of the platform. After that, the escalator will start moving slowly. The attendant will ride with the passenger, possibly for safety reasons. In at least some cases, the escalator will start moving in the opposite direction that it usually moves (possibly because there might only be 1 wheelchair accessible escalator going between 2 floors in many cases). After that, the escalator will speed up. Once the passenger in the wheelchair gets close to the top, the escalator will slow down. After the passenger in the wheelchair is no longer on the escalator, the escalator is then switched back to normal operation. Wheelchair accessible escalators might have only been installed in Japan. It is unknown if wheelchair accessible escalators are still made.

### **Belt Type Escalator**

The belt type escalator was made by Piat. You stand on a flat(?) belt. This type of escalator probably doesn't exist anywhere, anymore.

### **Cleat Type Escalator**

The cleat type escalator had cleated metal, later wood treads, that are slanted. Some types of cleat type escalator look more like a belt, not an escalator (the belt type escalator?). This type of escalator is not known to exist anywhere, anymore.



Cleat type escalators.

## **Levytator**

The Levytator is a new type of escalator, the freeform escalator, that can curve multiple times, in either direction. There are 2 escalators, which share a continuous loop of steps. The 2 escalators can curve differently. A working prototype has been built, but currently the inventor is looking for a company to mass-produce, and sell the new type of escalator. The steps are uniquely-shaped.