
METRO

Rapid transit aka METRO

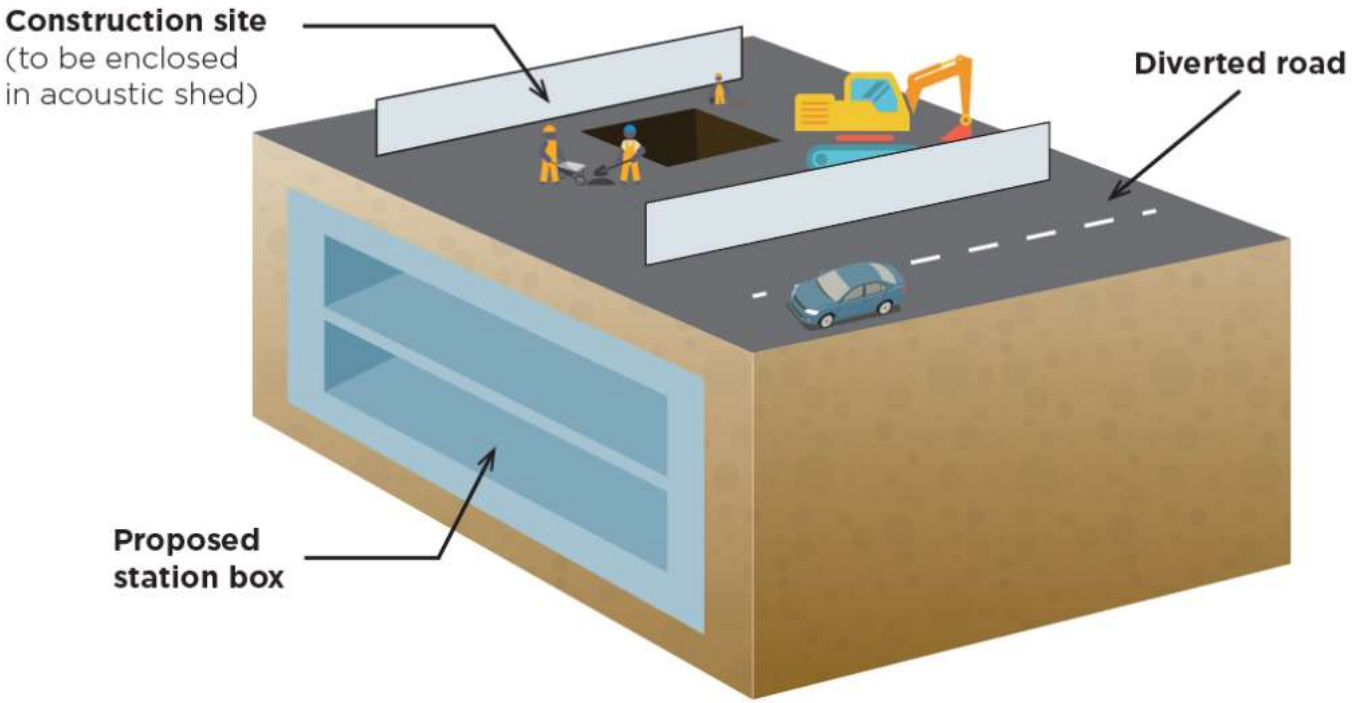
- **Rapid transit** or **mass rapid transit** (**MRT**), also known as **METRO**, **SUBWAY**, is a type of high-capacity public transport found in urban areas.

- Rapid transit systems can trace their roots back to what is now called the London Underground. In 1890, the London City & South London Railway started using electric traction systems, which led to cities like New York, Berlin, Paris and many more to implement their own rapid transit systems by 1904.
- The term was originally from France when "the Metro" transit system was constructed in Paris in 1900. It was regionally known as "Chemin de Fer Metropolitain de Paris" and covered a span of ten kilometers.
- The metro has a unique design known as the **cut-and-cover** method of construction, which was designed by Fulgence Bienvenue.

CUT AND COVER METHOD

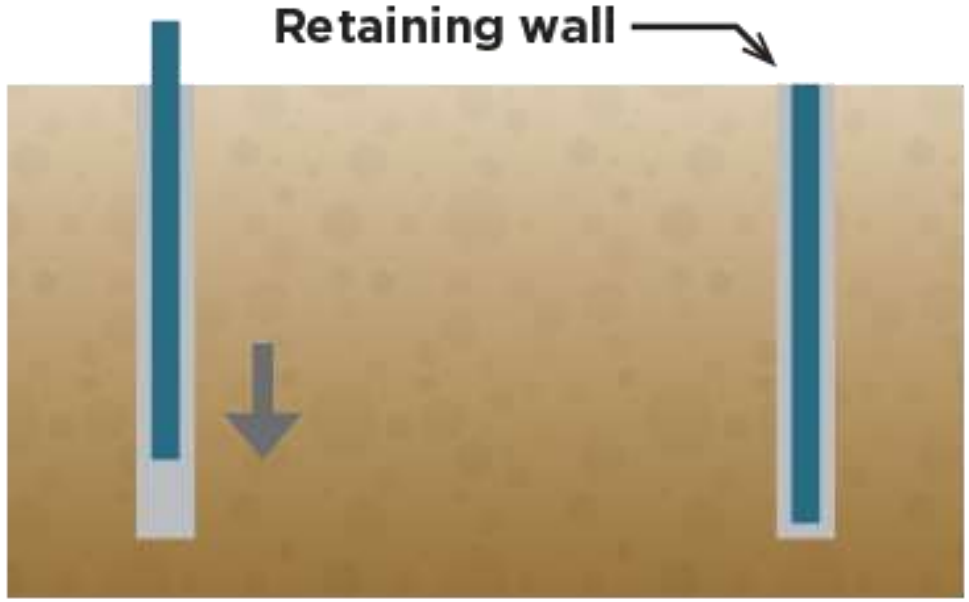
Cut and cover construction involves using excavation equipment to dig a large trench or rectangular hole in the ground which is then covered by a concrete deck.

During construction of the stations, poured concrete or pre-cast panels are used to form the various levels and internal structures, similar to the construction of the underground basements of high rise buildings.



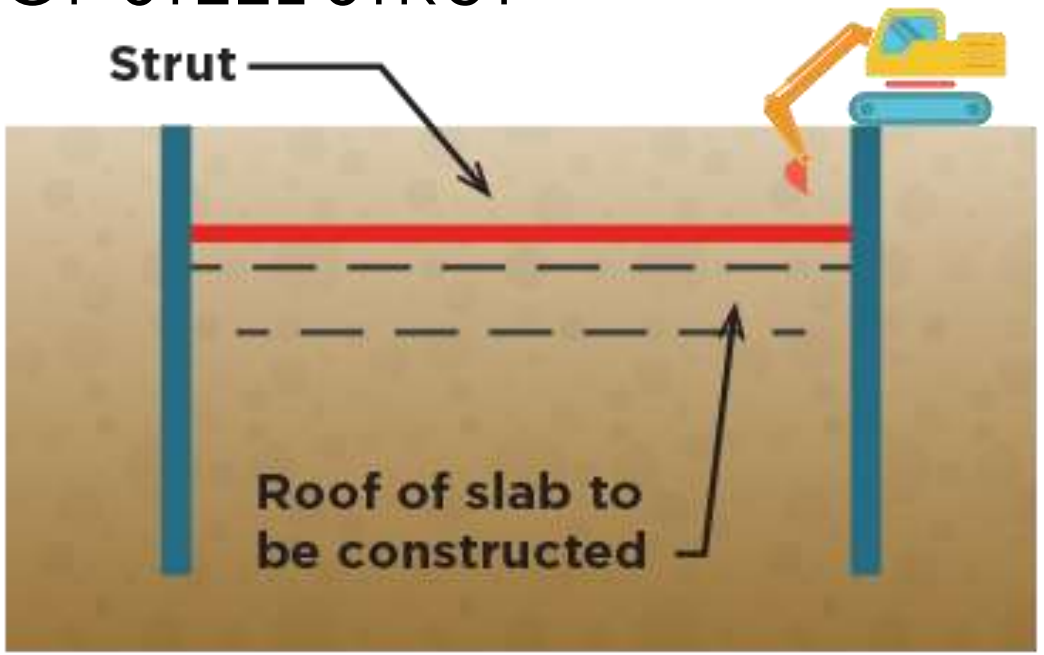
STEPS OF CUT AND COVER METHOD:-

1. INSTALLATION OF RETAINING WALL



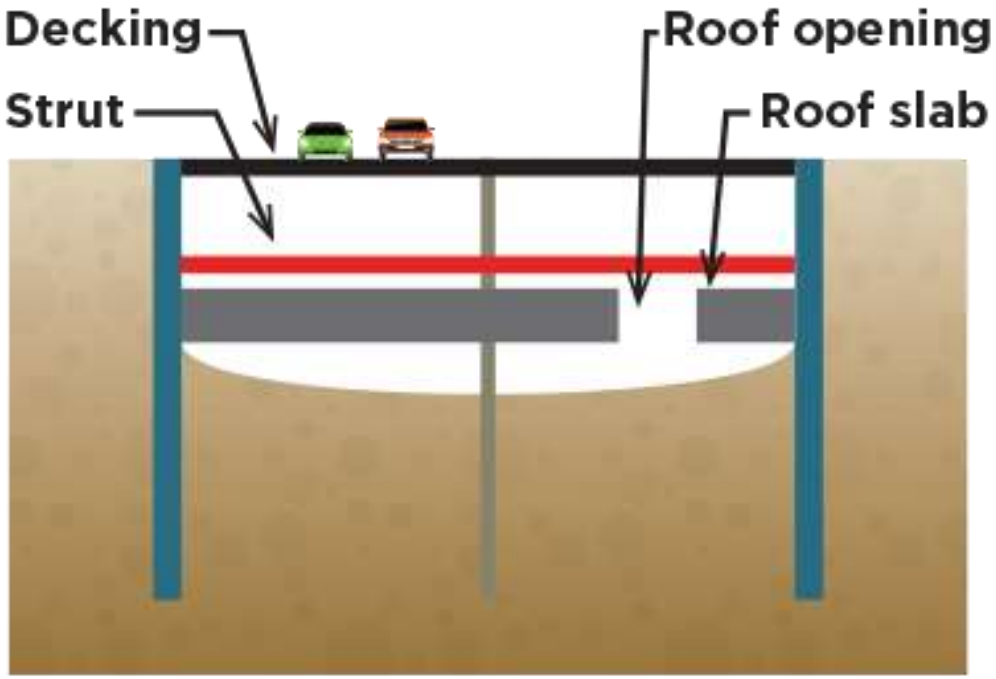
The underground retaining wall, which is usually a concrete diaphragm wall, is installed before excavation commences.

2. EXCAVATION AND INSTALLATION OF STEEL STRUT



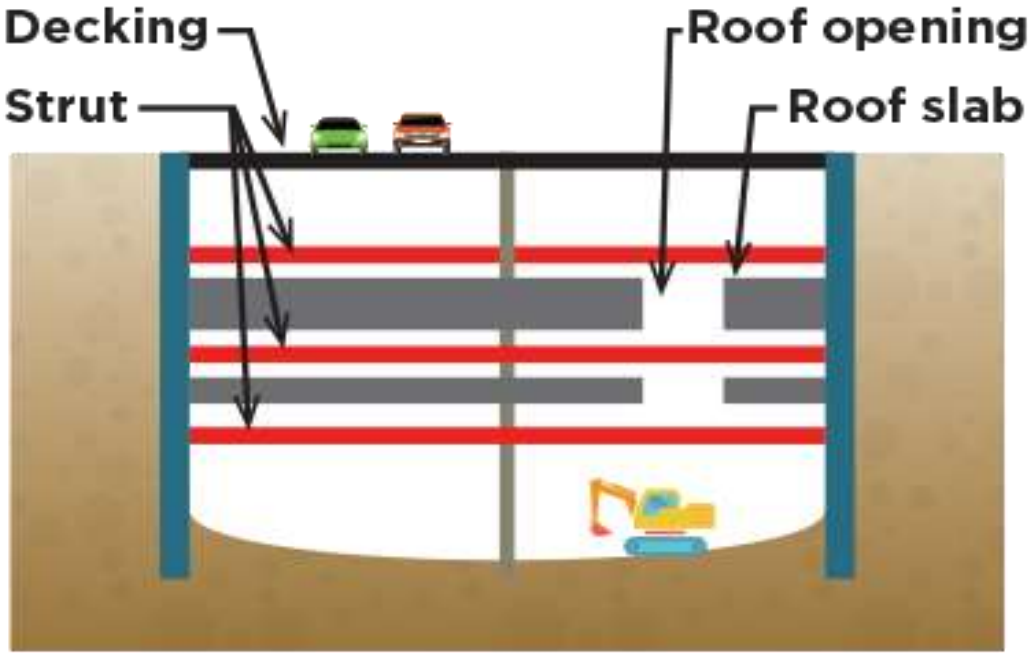
The soil is excavated to just below the roof slab level of the underground structure. Struts are installed to support the retaining walls, which in turn support the soil at the sides.

3. INSTALLATION OF DECKING AND ROOF SLAB



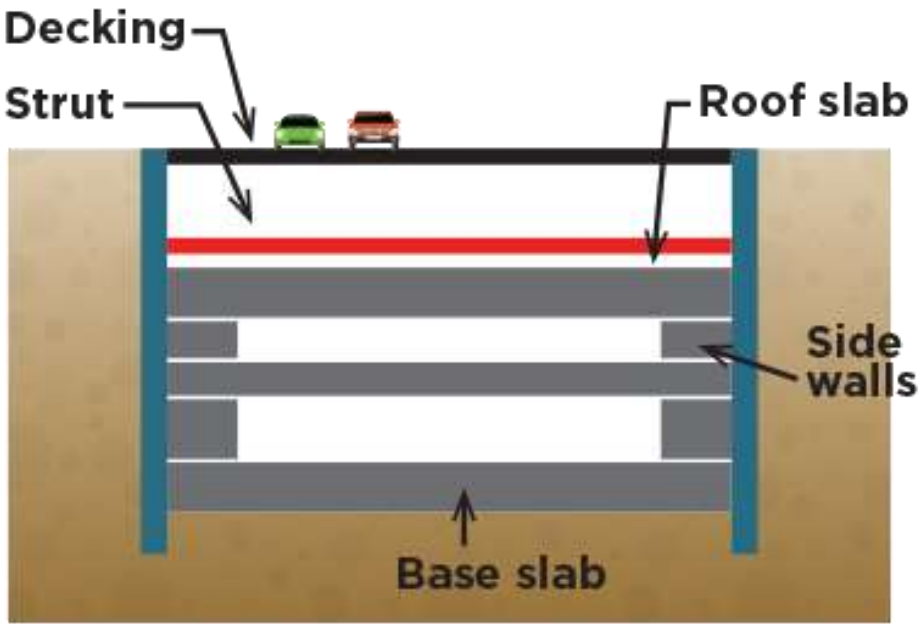
The roof slab is constructed and decking installed at ground level. The roof slab not only provides a massive support across excavation, it also acts as a noise barrier.

4. CONSTRUCTION OF STATION BOX



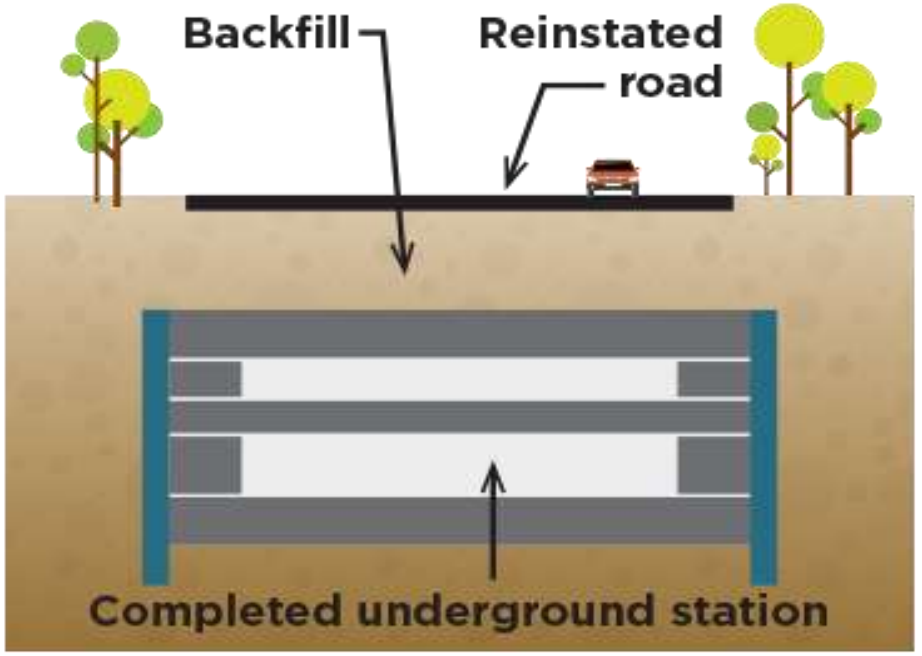
The next level of slab is constructed, and the process progresses downwards until the base slab is completed.

5. INSTALLATION OF SIDE WALLS AND BASE SLAB



The side walls are constructed upwards, followed by removal of the intermediate struts. The access openings on the roof slab are then sealed.

6. BACKFILLING AND REINSTATEMENT



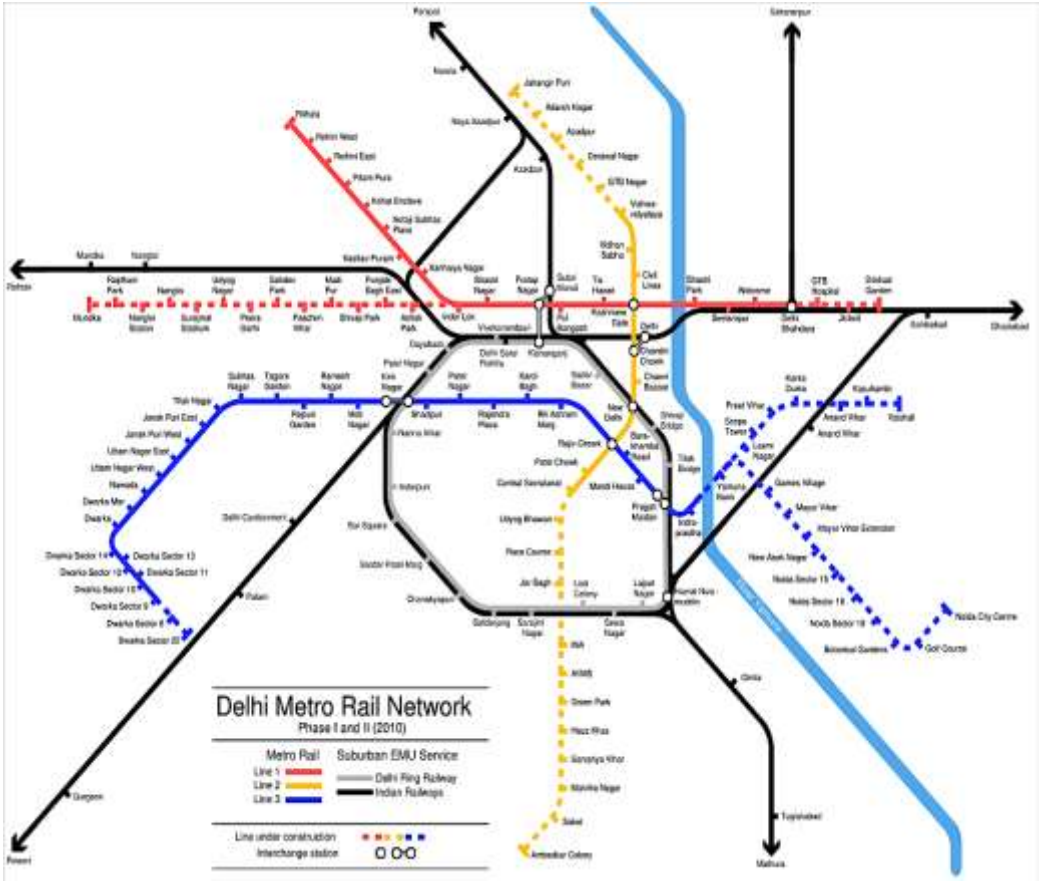
The soil is then backfilled to the top strut level before the strut is removed. This is followed by backfilling the top of the underground structure and reinstating the surface area.

WHAT MAKES METRO, METRO?

- A metro train is a train that is specifically designed to run in metropolitan cities and transports large numbers of people often short distances at a high frequency.
- Rapid transit is distinguished from other forms of mass transit by its operation on exclusive right-of-way, with no access for other vehicles or for pedestrians.
- **LINES**
- **NETWORK TOPOLOGIES**

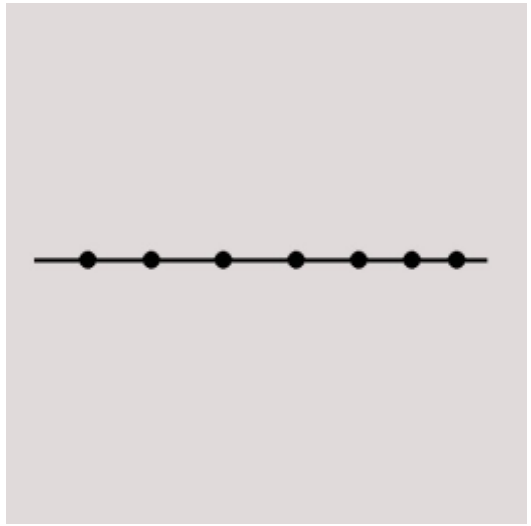
LINES

Rapid transit systems rely on the concept of ‘lines’ for operations. They’re basically multiple paths in the system between multiple stations and allow splitting of paths for more efficient travel. It can also be explained as track sharing, where alternate trains take different paths. These stations and lines are then color coded to make it easier for commuters to understand.

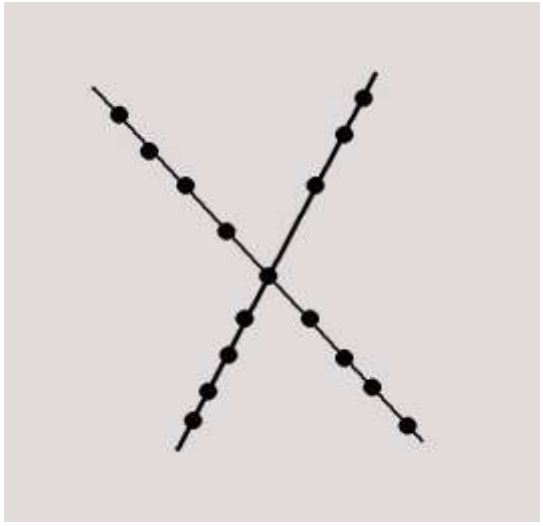


NETWORK TOPOLOGIES

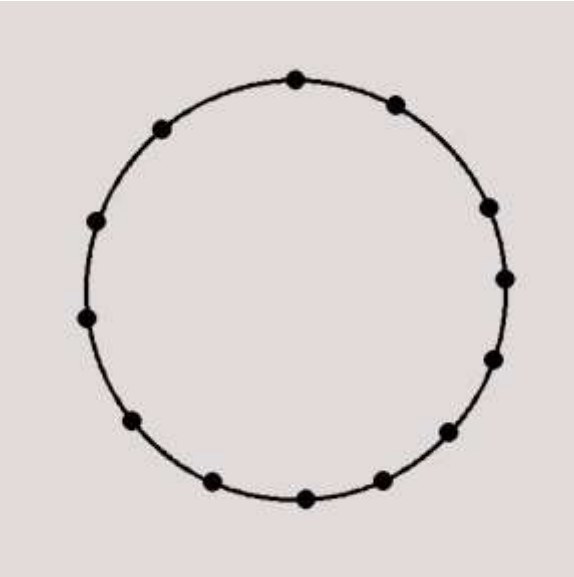
- They’re basically the layout of the system, and can be very specific to a city, or just standard shapes.
- A transit system is expected to serve an *area* of land with a set of *lines*, which consist of shapes summarized as "I", "U", "S", and "O" shapes or loops.
- Various Network Topologies are:-



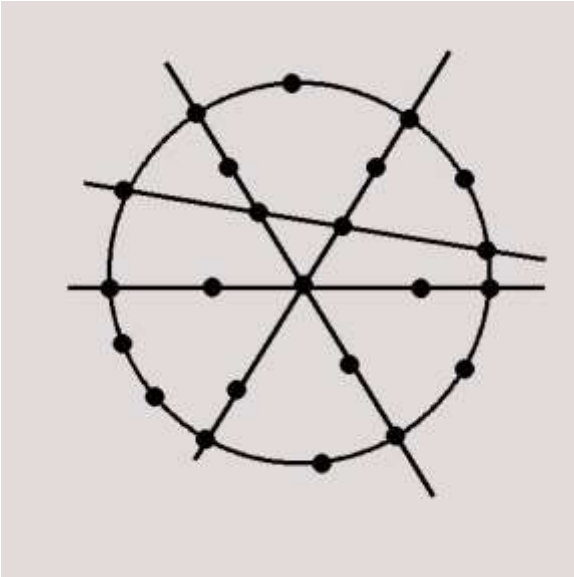
LINE
Cleveland, Granada, Hiroshima, Miami, Mumbai, Sydney



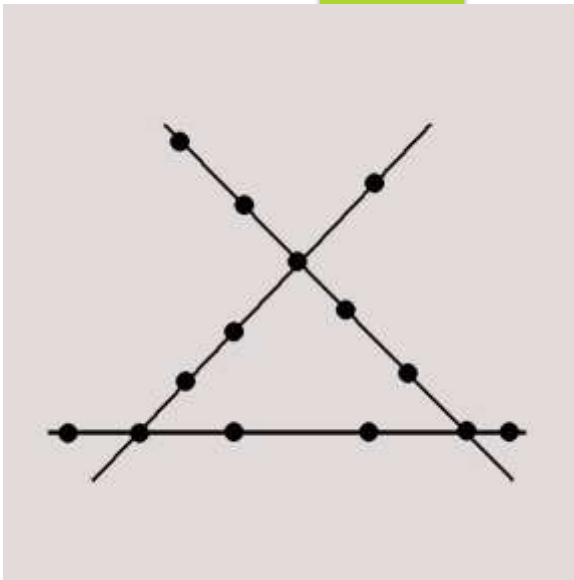
Cross
Atlanta, Bangalore, Minsk, Philadelphia, Rotterdam



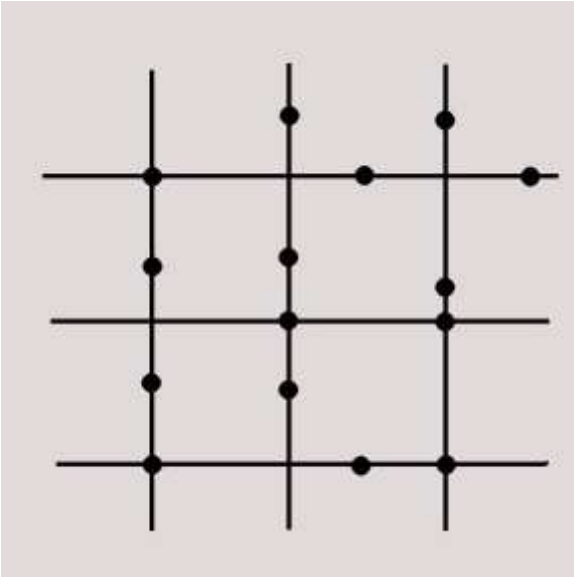
Circle System (Used in Glasgow)



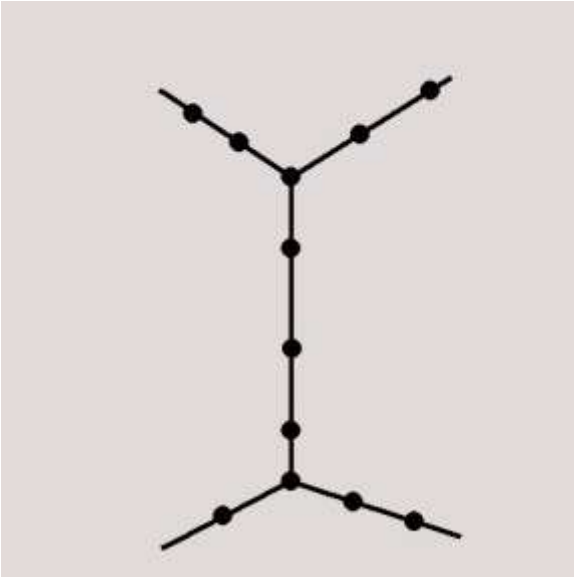
Circle-Radial System (Used in London, Tokyo, Beijing)



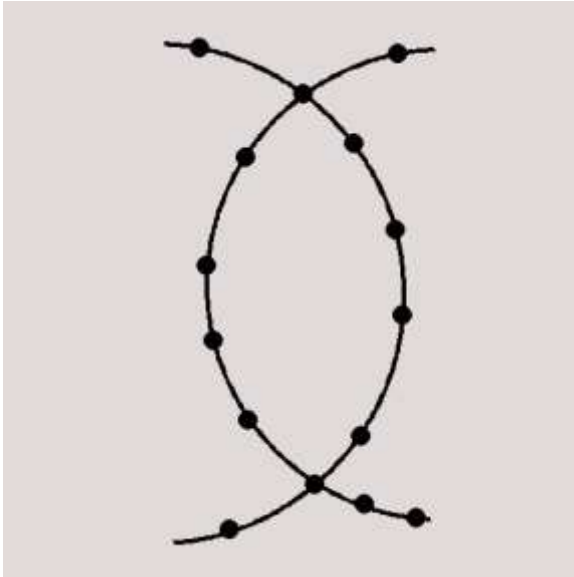
Secant System (Used in Athens, Prague, Munich)



Complex Grid System (Delhi, New York, Berlin)



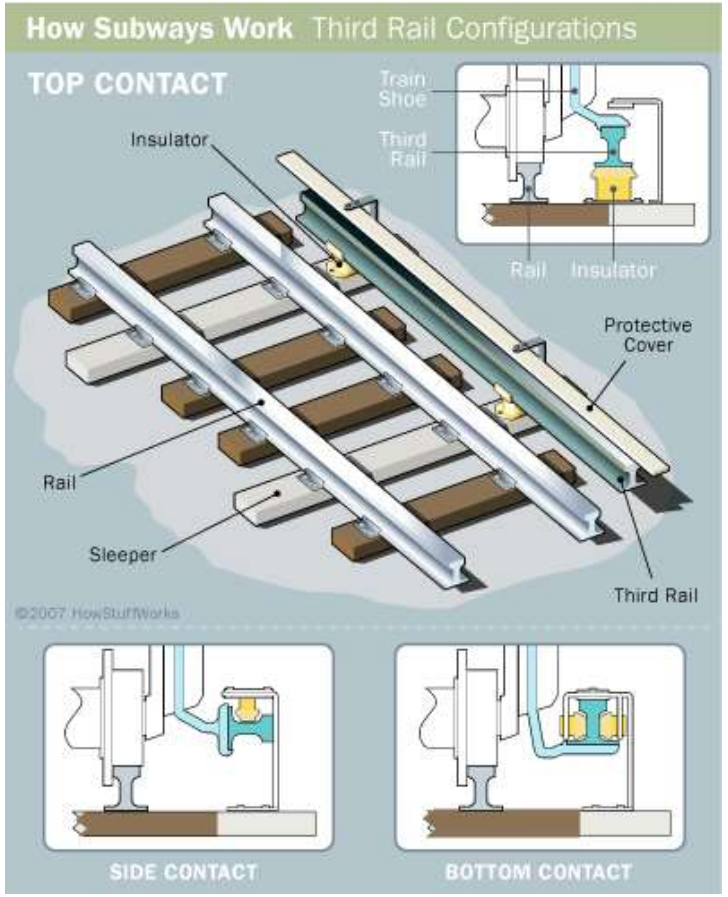
X System (Used in Oslo, San Francisco, Amsterdam)



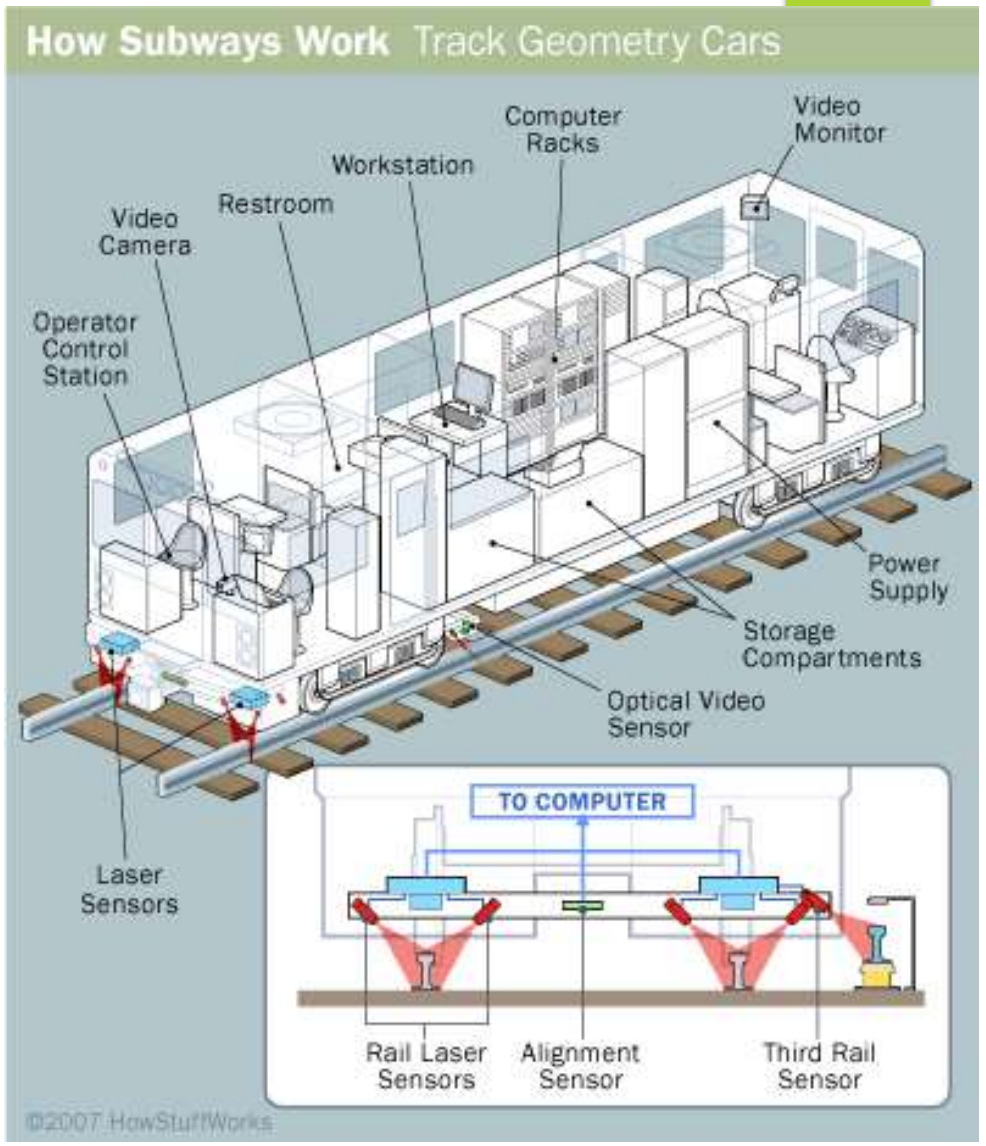
Air Bladder System (Used in Cairo and Milan)

WORKING OF A METRO

- The trains, tunnel lights and station equipment all run on **electricity**. Overhead wires or an electrified rail known as the **third rail** supplies power to the trains. The third rail lies outside or between the subway tracks, and a wheel, brush or sliding shoe carries the power from the rail to the train's electric motor side lines required their own power plant to operate



The braking systems on many metros and rapid-transit cars made use of electromagnetic induction and eddy currents.
An electromagnet attached to the train is positioned near to the steel rails.
When a large current is passed through the electromagnet, a strong magnetic field is set up near the rails.
The relative motion of the rails and the electromagnet will induce eddy currents in the rails.
By Lenz's law, these eddy currents will flow in a direction to oppose the changing flux.
Hence, there will be a retarding force on the train.
As the eddy currents decreases steadily in magnitude as the train slows down, the braking effect feels smooth to the passenger.



ADVANTAGES RAPID TRANSIT

Rapid transit systems have a host of benefits, and positively impact not only the environment, but also things like traffic congestion. It's more like one of those things that indirectly affects the area around it. Here's some of the advantages and benefits of a rapid transit system:

- Easier and more efficient public transport
- Less environmental impact
- Low costs for commuters
- Helps with curbing traffic congestion
- Provides job opportunities
- Increases importance of tertiary areas if connected
- Far safer than conventional transport

DISADVANTAGES OF RAPID TRANSIT

- High initial costs
- Requires extensive planning and development
- Development phase might deter daily life
- May cause welfare loss and demolishing of property
- Might have high maintenance costs, depending on system types

REFERENCES

- https://en.wikipedia.org/wiki/Rapid_transit
- https://science.howstuffworks.com/engineering/civil/subway3.htm

THANK YOU