Urban Arteries: Civil Engineering for Metro Transportation

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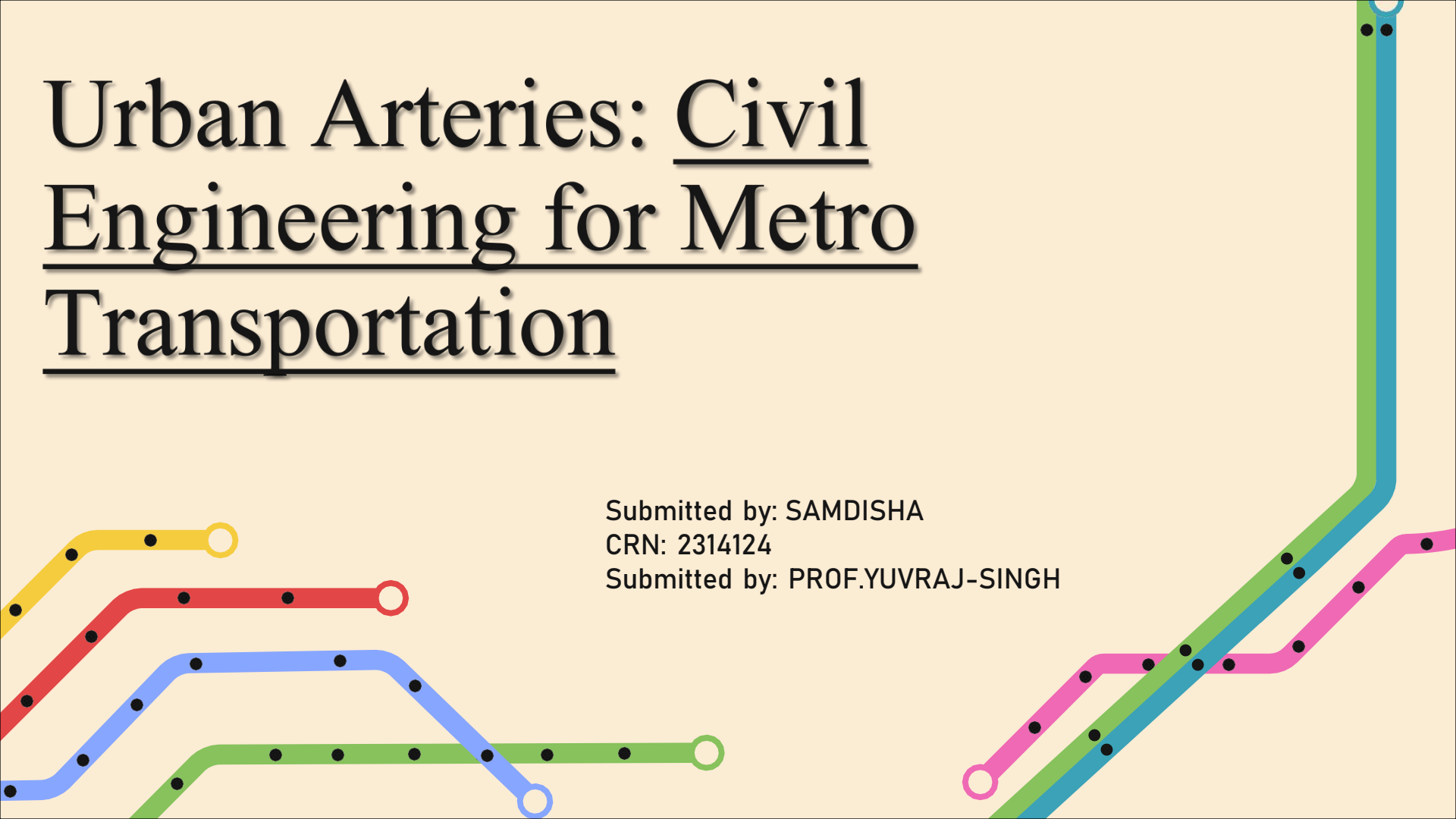

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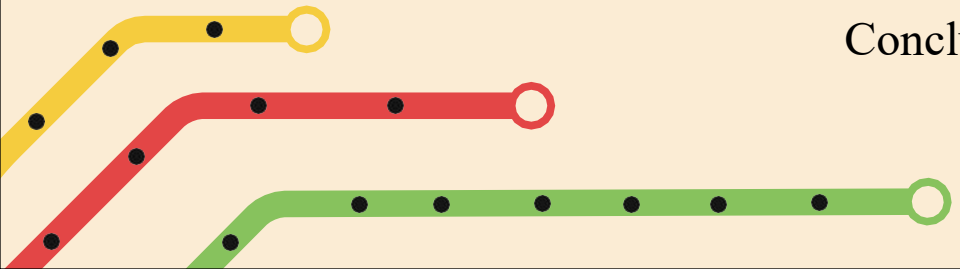
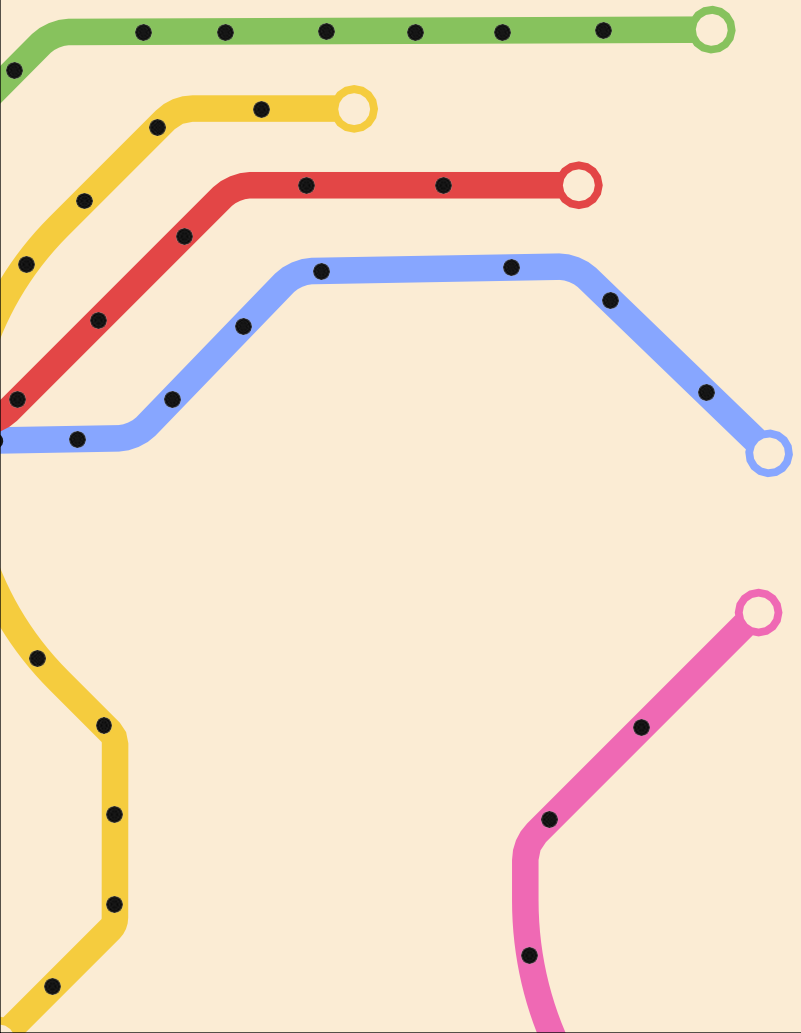




Introduction

ANATOMY OF A METRO

DELHI METRO

A metro is a high-capacity public transportation system that operates in urban areas, usually underground and is also known as a subway or underground railway.
Metros are an important part of improving urban transport systems and people's mobility.

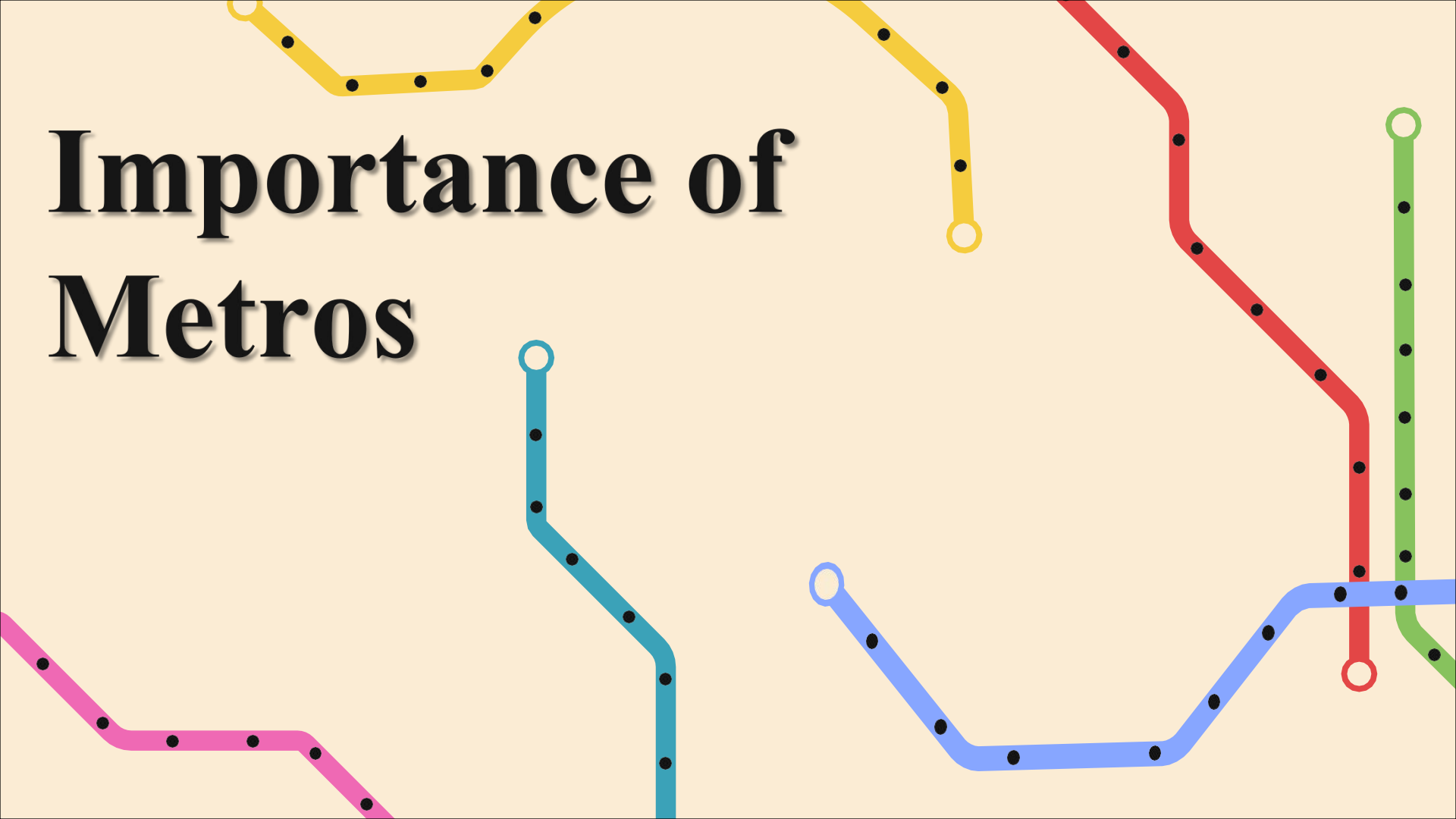
BENGLURU METRO

DID YOU KNOW??

SYSTRA is involved in 80% of Metro Projects in India.

In India, the launch of the first line of Delhi Metro Rail Corporation (DMRC) in 2002, put SYSTRA on the map as a key partner for mass transit lines in the country and initiated a longstanding partnership with DMRC.

Importance of Metros



The Metro Effect:

Global best practices

01 **Urban Mobility**

02 **Environmental Sustainability**

03 **Economic Development**

04 **Social Equity**

Regional Perspective

East India

Kolkata, with one of the oldest metro systems in Asia, continues to expand its network to improve access and mobility.

Northeast India

Guwahati and other emerging cities are exploring metro systems tomanage urban growth and improve public transport options.

North India

Cities like **Delhi** have extensive metro networks that significantly reduce travel time and traffic congestion.

West India

Mumbai's metro is vital for a city known for its heavy traffic.

South India

Bengaluru's Namma Metro aims to tackle the city's rapid urbanization and traffic woes, enhancing connectivity and supporting economic growth in the tech hub.

Delhi Metro

Mumbai Metro

Bengluru Metro

Kolkata Metro

Guwahati Metro

Compostion of Metros

INFRASTRUCTURE MAKE-UP

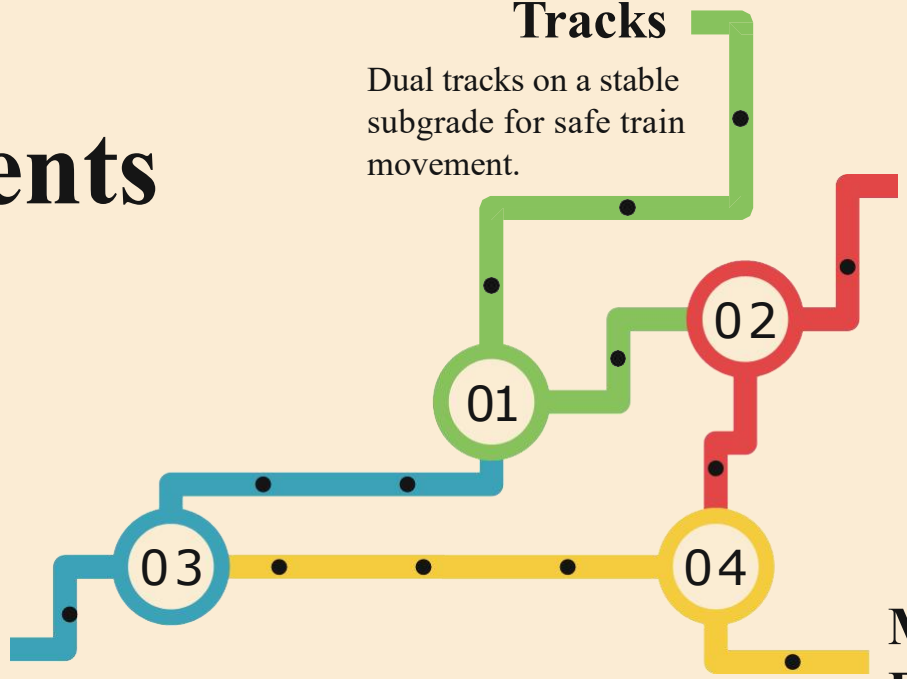
Key Components

Tracks

Dual tracks on a stable subgrade for safe train movement.

Stations

Strategically located with safety features and passenger amenities.



Signalling Systems

Advanced systems for traffic management and train safety.

Maintenance Facilities

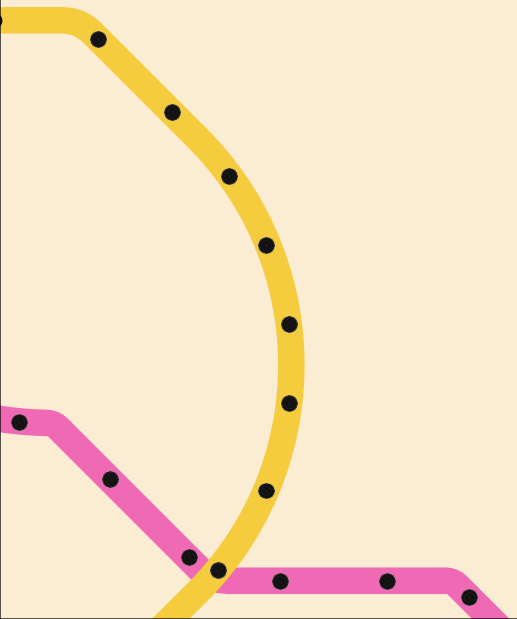
Depots and workshops for train upkeep and repairs.

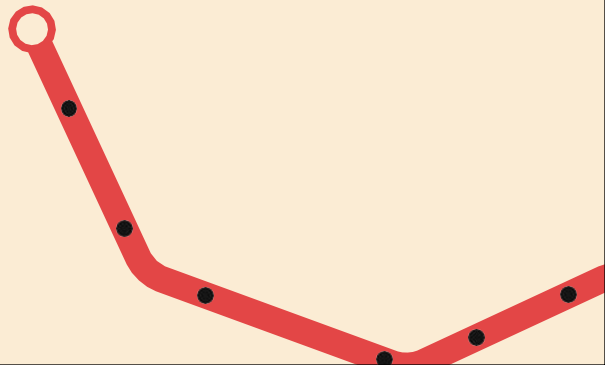
Plannings of Metro

Effective planning and design of metro networks in India necessitates a holistic approach that integrates **urban development**, **sustainability** and **technology**. By prioritizing **high-density corridors**, **optimizing routes for maximum ridership** and **incorporating smart technologies for real-time data and safety** we can enhance connectivity and reduce congestion.

Working

PRINCIPLES AND APPLICATIONS





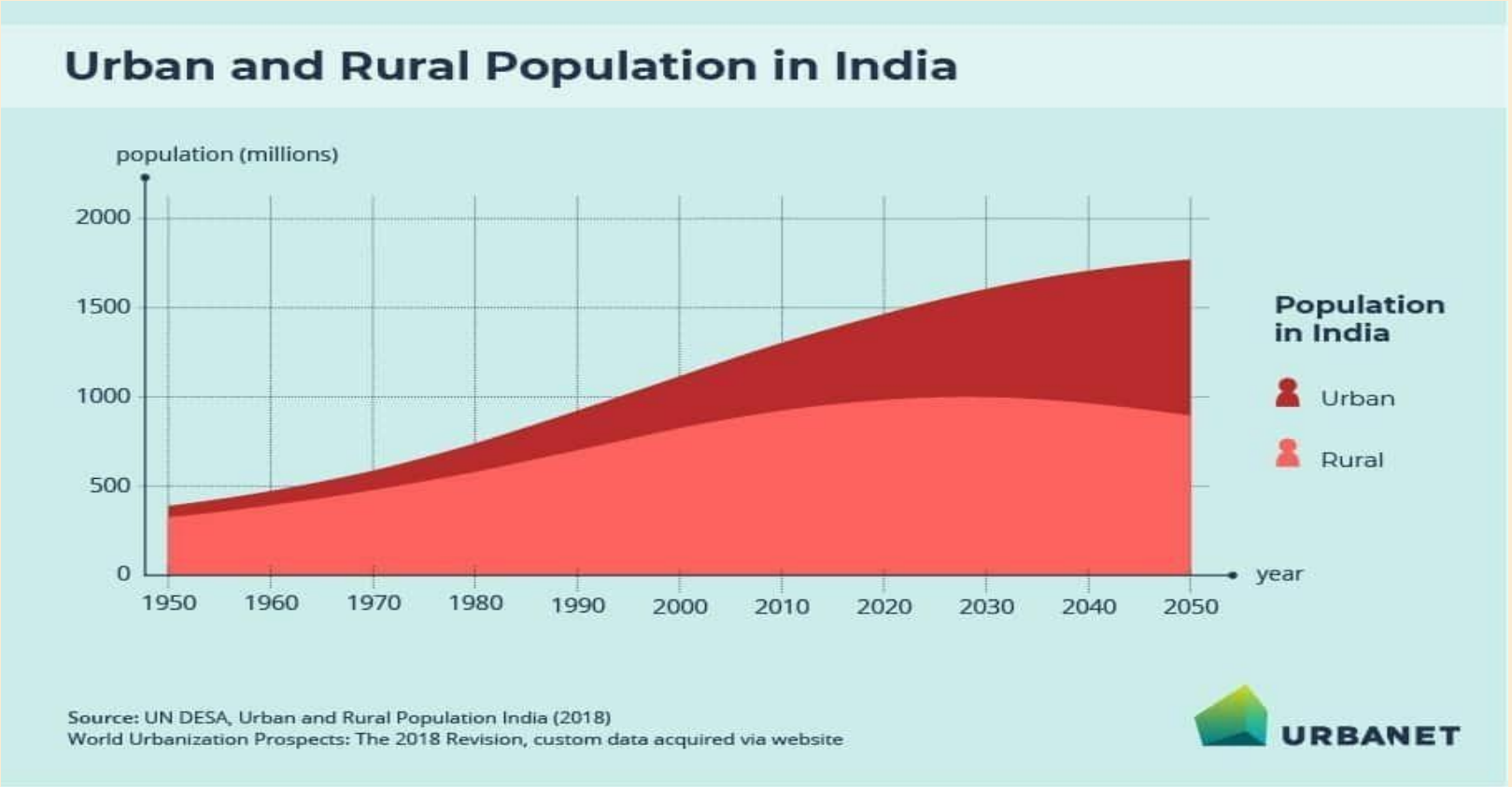
Principles

Key principles include real-time monitoring of train speeds, advanced braking systems such as **regenerative** and **dynamic braking** and the integration of predictive maintenance using IoT sensors.

Applications

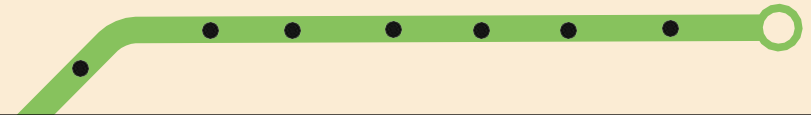
Applications of these technologies ensure precise control during emergencies, reduce wear on infrastructure and improve energy efficiency. By adopting these innovations metro systems can enhance passenger safety, minimize operational disruptions and promote sustainable urban transit solutions.

Graph for Urban and Rural cities

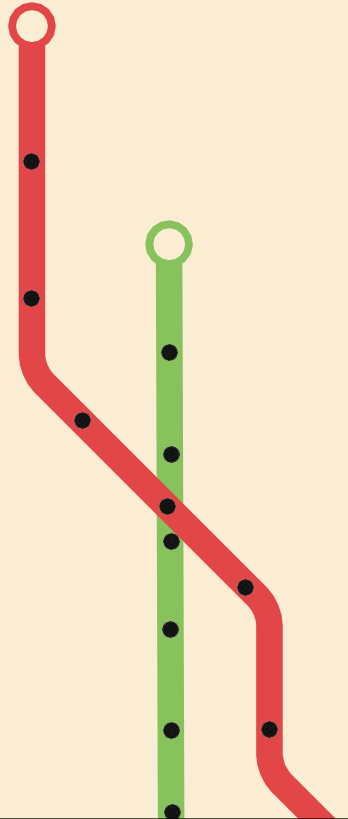


Metro Runs on Lines

DELHI METRO RAIL CORPORATION (DMRC)



The Routes and Stations



RED LINE

Rithala to Shaheed Sthal

BLUE LINE

Dwarka Sector 21 to Noida City Centre/Vaishali

YELLOW LINE

Samaypur Badli to HUDA City Centre

GREEN LINE

Inderlok to Brigadier Hoshiyar Singh

VIOLET LINE

Kashmere Gate to Raja Nahar Singh

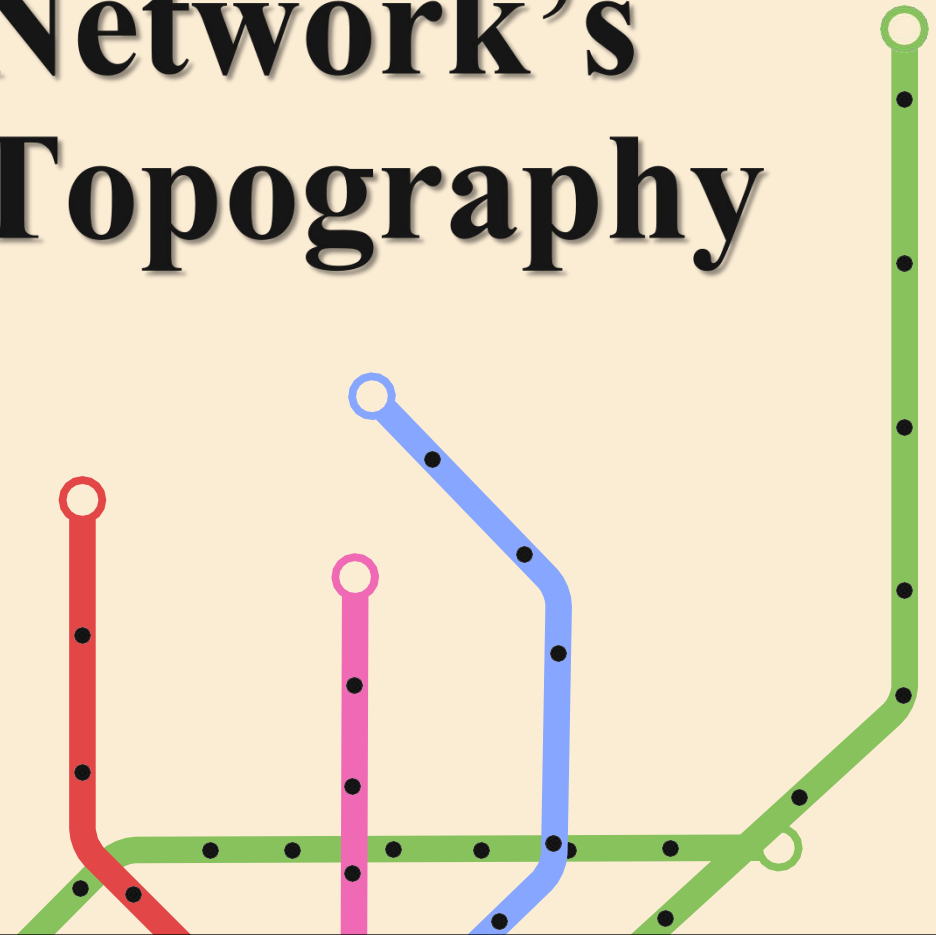
PINK LINE

Janakpuri West to Botanical Garden

DELHI LINES

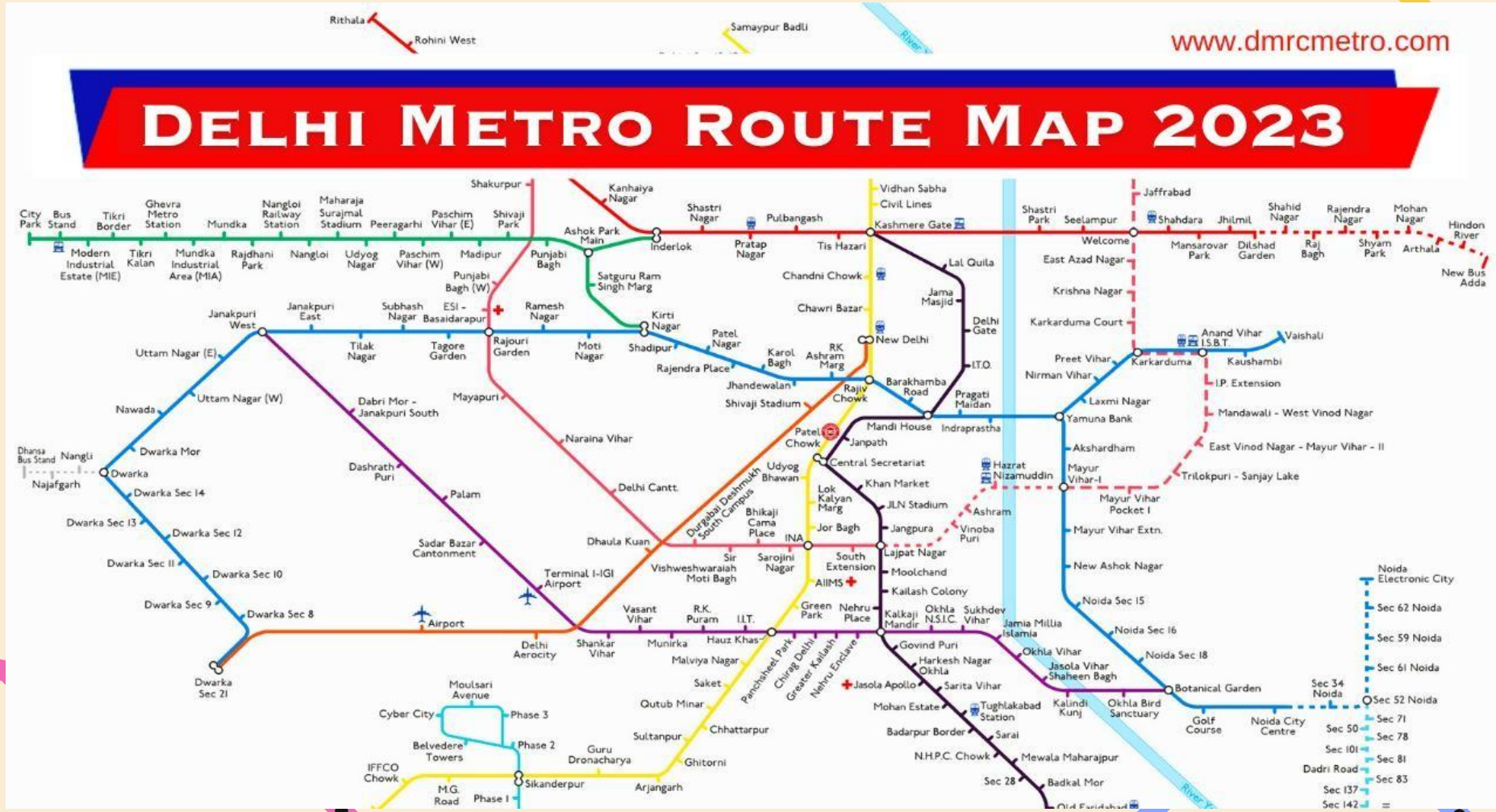

LONI
Bhenara Khurd
SHALIMAR BAGH
SHAHDARA
DILSHAD GARDEN
SAHIBABAD
PASCHIM VIHAR
KAROL BAGH
OLD DELHI
RAJOURI GARDEN
CONNAUGHT PLACE
INDIRAPURAM
JANAKPURI
New Delhi
DWARKA
LAJPAT NAGAR
Indira Gandhi International Airport
HAUZ KHAS
GREATER KAILASH
Yamuna River
Noida
VASANT KUNJ
SAKET
38
9
44
24
AH1

Network's Topography



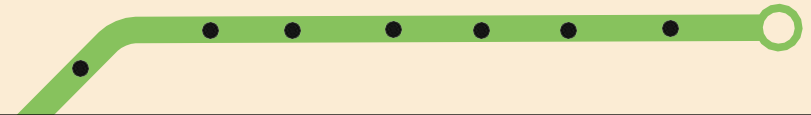
www.dmrcmetro.com

Delhi Metro Route Map 2023



Case Study-1

DELHI METROS SUCCESS STORIES



Here is the case study that highlight the success of the Delhi Metro and the lessons learned fromits implementation:

Case Study 1: Delhi Metro Phase I (2002).

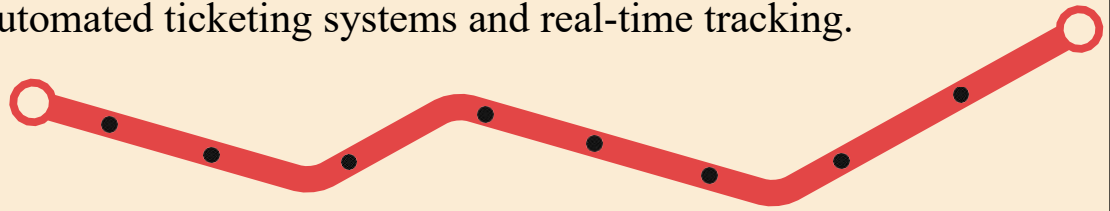
Overview: The first phase of the Delhi Metro was inaugurated in 2002, covering 65 kilometers with 59 stations. It aimed to address the growing traffic congestion in Delhi and promote public transportation.

Key Success Factors:

1.Public-Private Partnership: The Delhi Metro Rail Corporation (DMRC) adopted a unique model thatcombined public investment with private expertise, facilitating effective project execution and financial sustainability.

2.Integrated Urban Planning: The metro was integrated into the broader urban transport strategy, promoting connectivity with buses and other modes of transport.

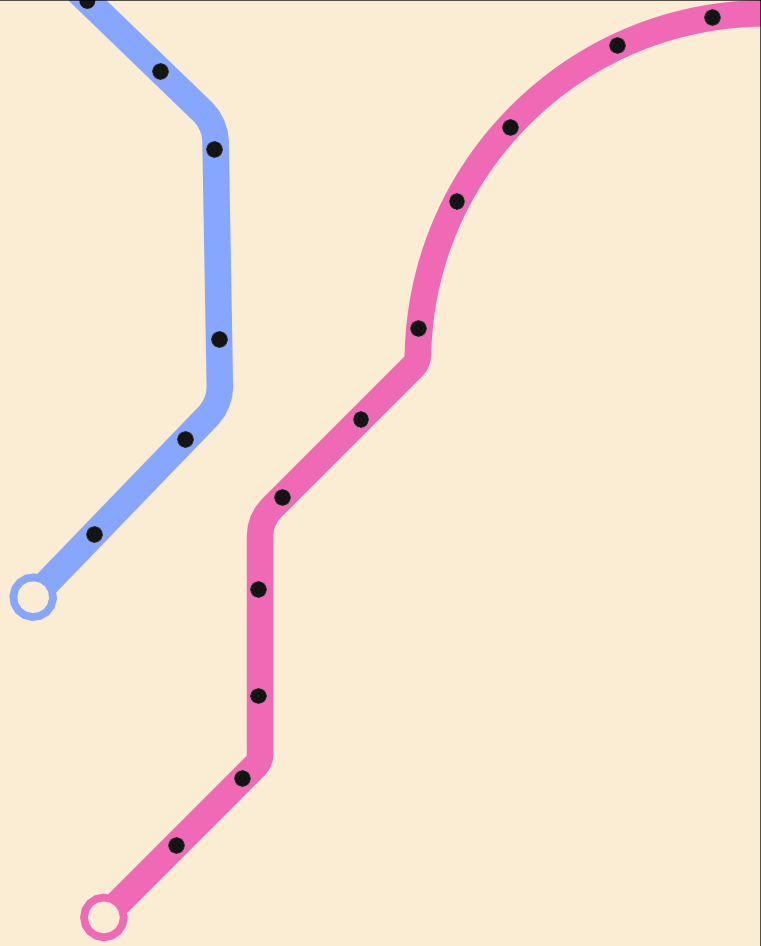
3.Technology Adoption: Use of advanced technology in construction, operations, and maintenance ensured efficiency and safety, including automated ticketing systems and real-time tracking.



CNTD::

Lessons Learned:

i. Importance of Vision and Planning: Comprehensive planning, including environmental and social assessments is crucial for addressing urban transport challenges.
ii. Stakeholder Engagement: Involving local communities and stakeholders during planning and execution fosters public acceptance and minimizes opposition.
iii. Scalability: The successful implementation of Phase I laid the groundwork for future expansions, demonstrating the importance of scalability in infrastructure projects.



33,807,403

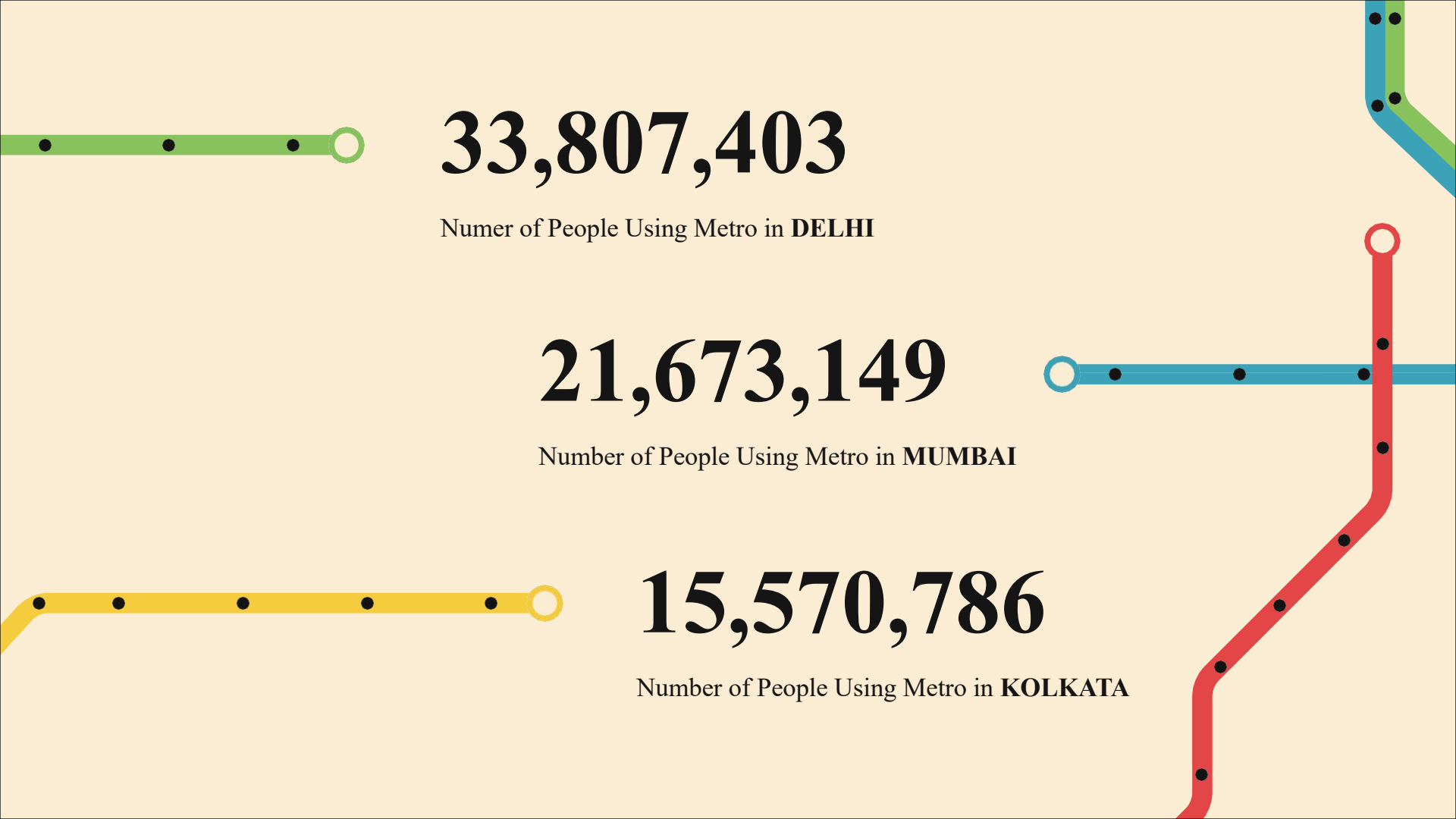
Numer of People Using Metro in **DELHI**

21,673,149

Number of People Using Metro in **MUMBAI**

15,570,786

Number of People Using Metro in **KOLKATA**



Conclusion

The Delhi Metro stands as a remarkable example of successful urban transport development, illustrating how well-planned infrastructure can significantly alleviate traffic congestion and enhance mobility. Its journey highlights several critical lessons: the importance of integrated planning, stakeholder engagement, sustainable practices, and innovative financing.

List of Resources

- https://www.systra.com/india/markets/metro/
- https://www.bfginternational.com/transportation/projects/new-delhi-metro-india
- https://www.fabhotels.com/blog/indian-metro-rail-networks/kolkata-metro/
- https://www.nbmcw.com/news/metrorail-railways/guwahati-metro-project-envisions-61-40-km-mass-rapid-transit-system.html
- https://www.researchgate.net/figure/Map-of-India-showing-statuses-of-Metro-Rail-projects_fig1_329040587
- https://loksabhadocs.nic.in/Refinput/New_Reference_Notes/English/METRO_Rail_Projects.pdf
- https://www.mapsofindia.com/maps/india/metro-rail-projects.html
- https://www.urbanet.info/urbanisation-in-india-infographics/
- https://delhimetrorail.com/network_map
- https://chatgpt.com/
- https://en.wikipedia.org/

THANKYOU FELLOWS!

for listening carefully.