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UN environment programme

Ministry of Housing and Urban Affairs
Government of India

National Institute of Urban Affairs

VARIATIONS IN TRANSIT ORIENTED DEVELOPMENT GEOGRAPHIES

BORROWING CONTEXTUAL CUES

NATIONAL INSTITUTE OF URBAN AFFAIRS
Variations in Transit Oriented Development Geohraphies:
Borrowing contextual cues
September, 2023

National Institute of Urban Affairs

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URBAN SH/FT

About UrbanShift Country Project

The Sustainable Cities Impact Program (SCIP) with the brand name UrbanShift was launched by Global Environment Facility (GEF) in 2016. Under its 7th financing round, GEF is supporting the United Nations Environment Programme (UNEP) and the National Institute of Urban Affairs (NIUA), to jointly implement the "Livable cities in India: Demonstrating Sustainable Urban Planning and Development through Integrated Approaches" project.

The project aims to support sustainable cities where knowledge exchange and capacity development inform the implementation of compact, nature-positive, climate resilient, inclusive, and gender-sensitive approaches across 4 cities in India and support scale up nationally.

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VARIATIONS IN TRANSIT ORIENTED DEVELOPMENT GEOGRAPHIES

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PREFACE

With great enthusiasm and optimism, I introduce this knowledge product on Transit-Oriented Development (TOD). In addition to presenting global examples of TOD, this knowledge product also explores the evolution of TOD, the variations of this spatial concept across the global north and south, and its significance as a tool for climate action of great relevance. Furthermore, this publication presents an indicative roadmap that cities in developing economies can adopt to enable TOD in the context of their urban areas.

Recently, India has witnessed a substantial rise in urbanisation, bringing forth both challenges and growth opportunities for our cities. The demand for innovative, sustainable, and integrated urban solutions has never been more critical. In this context, TOD emerges as a game-changing approach to better align with the challenges of modern urbanisation and climate change. With the primary objective of enhancing access to public transit, TOD promotes mitigation of traffic congestion and air pollution.

TOD embodies a vision where urban planning transcends mere infrastructure development; it seeks to enhance the quality of urban life. It envisions cities where mobility is efficient, accessibility is equitable, communities are vibrant, and the environment is sustainable. TOD, in essence, represents a paradigm shift - a transition from car-centric urban sprawl to compact, walkable, and transit-friendly communities.

As we embark on this transformation, this knowledge product marks our initial step in the GEF-UNEP-NIUA UrbanShift Country Project, which among others is focused on TOD interventions in our partner cities of Pune and Agra, and a national scale-up of TOD concepts. Capacity building is an essential component of this Project, and this compilation serves as an ideal instrument for knowledge dissemination.

I would also like to acknowledge the unwavering dedication and hard work of the entire UrbanShift team at NIUA. Their commitment to advancing urban knowledge and fostering sustainable urban development in India has brought this document to fruition and launching of the same during the Asia Forum of the UrbanShift Global Project. In conclusion, I invite you to explore the pages of this knowledge product with an open mind and a forward-looking spirit. Let us embrace Transit-Oriented Development as a powerful catalyst for shaping our cities into vibrant, resilient, and inclusive urban centres across the diverse landscape of India.

Hitesh Vaidya
Director, NIUA

FOREWORD

In the dynamic realm of urban development, Transit-Oriented Development (TOD) emerges as a powerful catalyst, propelling inclusive growth in alignment with integrated urban planning, transportation, and land use—forging a path towards a promising future for our cities.

At its essence, TOD underscores the vital integration of land use and transportation, a principle deeply rooted in the annals of urban planning history. The allure and functionality of our cities have always thrived on the seamless synergy between movement and public spaces. Regrettably, the latter half of the 20th century witnessed the erosion of this symbiotic relationship, as unregulated personal transportation and haphazard urbanisation brought an imbalance among population density, land use, and essential services.

The contemporary urban vision aspires to rectify this imbalance, rekindling the communal essence of our urban centers. It promises economic and social prosperity while nurturing environment where communities can flourish. TOD serves as the linchpin of this vision, offering a strategic blueprint for shaping urban areas and revitalising the urban fabric. Here, the harmonious coexistence of mobility and tranquillity, innovation and tradition, progress and inclusivity take center stage.

Within the pages of this knowledge product, titled "Variations in TOD Geographies: Borrowing contextual cues", the insights shared here resonate with the aspirations of the Global Environment Facility-funded UrbanShift Country Project, executed by the United Nations Environment Program (UNEP) in collaboration with the National Institute of Urban Affairs (NIUA). A key focus of this Project is enabling TOD in the partner cities of Pune and Agra in India. This compilation will serve as the foundation for crafting guidelines that will define TOD within the context of the surrounding urban environment and provide a roadmap for its successful implementation.

I extend my heartfelt gratitude to the dedicated UrbanShift team at NIUA, who have skilfully transformed numerous in-house discussions and ideas into this comprehensive book. I am also thankful to other non-UrbanShift team members at NIUA - Akruti Murhekar, Apoorv Agarwal and Raghav Kohli who jumped in to help us. As a team, we eagerly anticipate receiving your feedback on this endeavour. Together, through the UrbanShift Country Project we aim to shape a future where our cities thrive as vibrant, inclusive, and sustainable hubs of human activity.

Sarika Chakravarty

Team Lead, UrbanShift Country Project - NIUA

VARIATIONS IN TRANSIT ORIENTED DEVELOPMENT GEOGRAPHIES

BORROWING CONTEXTUAL CUES

TRANSIT
ORIENTED
DEVELOMENT

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TRANSIT
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FROM TRANSPORT

TO SUSTAINABLE TRANSPORT

The Sustainable Development Goals (SDGs) represent a global commitment to address a wide range of social, economic, and environmental challenges. Among these goals, the promotion of sustainable transport stands out as a crucial component of achieving a more equitable and environmentally responsible future. The transport sector, while essential for global connectivity and economic development, is also a significant contributor to climate change. The emissions from vehicles, infrastructure construction, and the energy sources powering transportation systems are major contributors to greenhouse gas emissions. Therefore, aligning the transport sector with sustainable practices and cleaner technologies is imperative to mitigate climate change.

1.1

TIMELINE

THE TRANSPORTATION STORY

1997

During its nineteenth Special Session in 1997, the General Assembly began the five-year assessment of Agenda 21's implementation. It was noted that during the following twenty years, transportation is anticipated to be the primary factor driving an increase in the global need for energy.

UN GENERAL ASSEMBLY 19TH SPECIAL SESSION

AGENDA 21

The United Nations Earth Summit in 1992 first acknowledged the role of transportation in sustainable development, and its result paper, Agenda 21, reaffirmed this notion.

Transport has been recognised as a crucial development concern in several chapters, including Chapter 9 on Atmosphere and Chapter 7 on Human Settlements.

1992

JOHANNESBURG PLAN OF IMPLEMENTATION

"Promote an integrated approach to policy -making at the national, regional and local levels for transport services and systems to promote sustainable development, including policies and planning for land use, infrastructure, public transport systems and goods delivery networks, with a view to
-safe, affordable and efficient transportation,
-increasing energy efficiency,
-reducing pollution, congestion and adverse health effects and
-limiting urban sprawl, taking into account national priorities and circumstances".

2002

Information Source: Extracted by Author(s) from https://sdgs.un.org/

2005

The Kyoto Protocol urges to limit and/or reduce methane emissions through recovery and use in waste management, and additionally in the production, transport, and distribution of energy. It also calls attention to the need to measure the limit and/or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol in the transportation sector.

KYOTO PROTOCOL

2012

THE FUTURE WE WANT

In recent years, the global community's focus towards transportation has not waned. At the 2012 United Nations Conference on Sustainable Development (Rio + 20), world leaders agreed that mobility and transportation were essential to sustainable development. Increased accessibility accelerated and economic growth can be achieved via sustainable transportation. Better economic integration is achieved through sustainable transportation while maintaining environmental sensitivity, enhancing social equity, health, resilience, and urban-rural interdependencies.

2014

The UN Secretary-General named transportation as a key element of sustainable development as part of his Five-Year Action Agenda. In order to achieve this, the Secretary General created and launched the High Level Advisory Group on Sustainable Transport (HLAG-ST) in August 2014. This group includes representatives from all forms of transportation, including road, rail, aviation, marine, ferry, and urban public transportation providers. In a report titled "Mobilizing Sustainable Transport for Development" that was presented to the Secretary-General at the first Global Sustainable Transport Conference in November 2016, the Advisory Group's policy recommendations were outlined.

HIGH LEVEL ADVISORY GROUP

2015

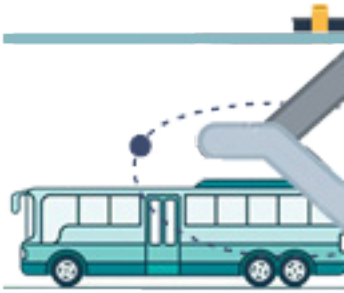
2030 AGENDA

Sustainable transport is integrated into multiple SDGs and targets in the 2030 Agenda for Sustainable Development, including those that deal with food security, health, energy, economic growth, infrastructure, cities, and human settlements. The UNFCCC further recognises the significance of transportation for climate action; the transport sector also plays a significant role in achieving the Paris Agreement given that transportation accounts for almost a quarter of all energy-related global greenhouse gas emissions and that these emissions are expected to increase substantially in the coming years.

Graphic Source: Author(s)

1.2

SDGs AND SUSTAINABLE TRANSPORT (DIRECT TARGETS)



3 GOOD HEALTH AND WELL-BEING

3.6 ROAD SAFETY

By 2030, halve the number of global deaths and injuries from road traffic accidents

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

9.1 SUSTAINABLE INFRASTRUCTURE

Develop quality, reliable, sustainable and resilient infrastructure. including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access to all.

7 AFFORDABLE AND CLEAN ENERGY

7.3 ENERGY EFFICIENCY

By 2030, double the global rate of improvement in energy efficiency.

 Information Source: Extracted by Author(s) from https://sdgs.un.org/

11 SUSTAINABLE CITIES AND COMMUNITIES

11.2 URBAN ACCESS

By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

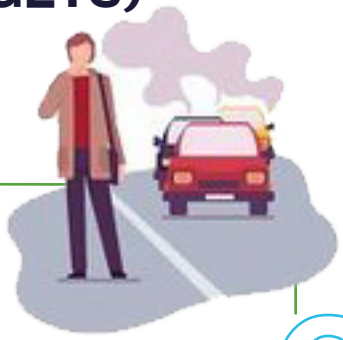
12.C FUEL SUBSIDIES

Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.

Graphic Source: Author(s)

1.3

SDGs AND SUSTAINABLE TRANSPORT
(INDIRECT TARGETS)

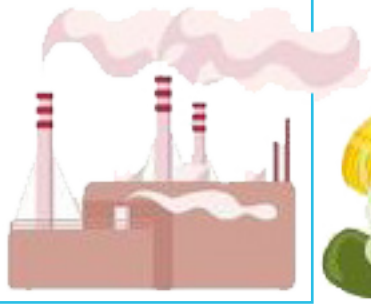


3

GOOD HEALTH AND WELL-BEING

3.6 AIR POLLUTION

Reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

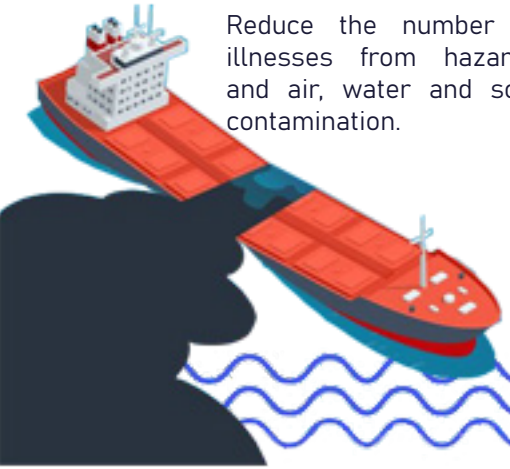


6

CLEAN WATER AND SANITATION

6.1 ACCESS TO SAFE DRINKING WATER

By 2030, achieve universal and equitable access to safe and affordable drinking water for all.



 Information Source: Extracted by Author(s) from https://sdgs.un.org/

11

SUSTAINABLE CITIES AND COMMUNITIES

11.6 AIR QUALITY

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management.

12

RESPONSIBLE CONSUMPTION AND PRODUCTION

12.3 SUPPLY CHAINS

By 2030 halve per capita global food waste at the retail and consumer level, and reduce food losses along production and supply chains including post-harvest losses.

13

CLIMATE ACTION

13.1 ADAPTATION

Strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries.

13.2 MITIGATION

Integrate climate change measures into national policies, strategies, and planning.

1.4

TRANSPORT SECTOR's CONTRIBUTION

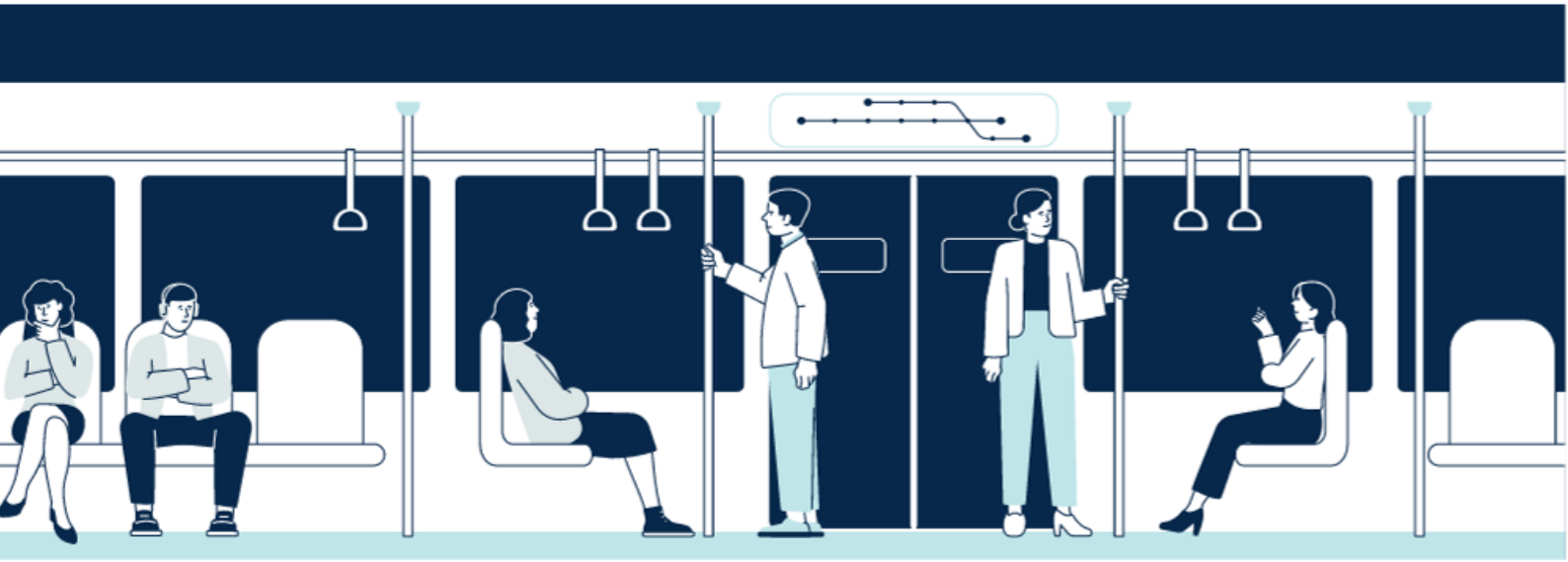
TO THE CLIMATE CHANGE NARRATIVE

One-fifth of the world's carbon dioxide (CO_2) emissions are related to transportation, while 13.5 percent of India's energy-related CO_2 emissions originate from the transport sector. India, a signatory to the Paris Agreement, has pledged to achieve net-zero emissions by 2050 and to reduce the emissions intensity of its GDP by 33 to 35 percent below 2005 levels by 2030. Actions must be redirected toward innovative planning techniques, modal shifts, policy adjustments, electrification, and the adoption of alternative fuels in order to meet this ambitious objective. The result of legislative frameworks supported by behavioural changes is crucial towards addressing sustainable mobility. Therefore, mobility should become a facilitator in the transformation of cities toward climate readiness.

The World Resource Institute's Climate Data Explorer provides data from CAIT on the breakdown of emissions by sector. In 2016, global CO2 emissions (including land use) were 36.7 billion tonnes CO2; emissions from transport were 7.9 billion tonnes CO2. Transport therefore accounted for 7.9 / 36.7 = 21% of global emissions.

Since emissions from transport are very significant, it also presents an opportunity to steer significant change. Curbing emissions in the transportation sector has a domino effect on multiple sectors, hence making it a key entry point for mitigating climate change. Reduction in emissions have an effect on the air quality and in return on urban health due to transportation-based air pollution impacts. On-road diesel vehicles contributed 60 percent of the transportation health burden in New Delhi. Since transportation is dependent on the energy sector, with road transport accounting for 90 percent of the sector's final energy consumption, shifting to renewables considerably affects energy security.

The negative environmental, economic and social impacts of the transport sector can be successfully mitigated through integrated planning, increasing usage of public transport and shared modes, facilitating active mobility (walking and cycling), effective NMT infrastructure and networks etc. Seamless and synchronised connectivity such as last-mile connectivity is an important factor in enabling greater integration and accessibility of mass transit networks to the largest number of urban residents. Mobility infrastructure should aim to be affordable, inclusive and accessible to ensure holistic development.



Graphic Source: Canva

1.5

TOD ACROSS GENERATIONS

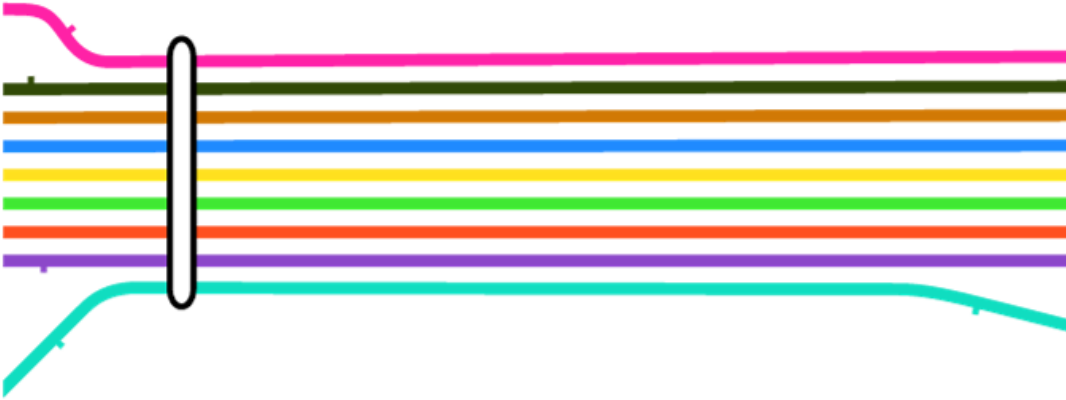
The first generation of TOD can be traced back to an economic opportunity catalysed by access. Access in the form of transit lines, improved connectivity and transportation network. The first generation indeed focused on the coercive aspects of Congestion, Commerce and Commute.

The second generation of TOD portended an era of equitable transitions. It was more socio-spatial in its outlook and promotional of facets based on affordability, accessibility and safety. The equity equation is hence a defining parameter.

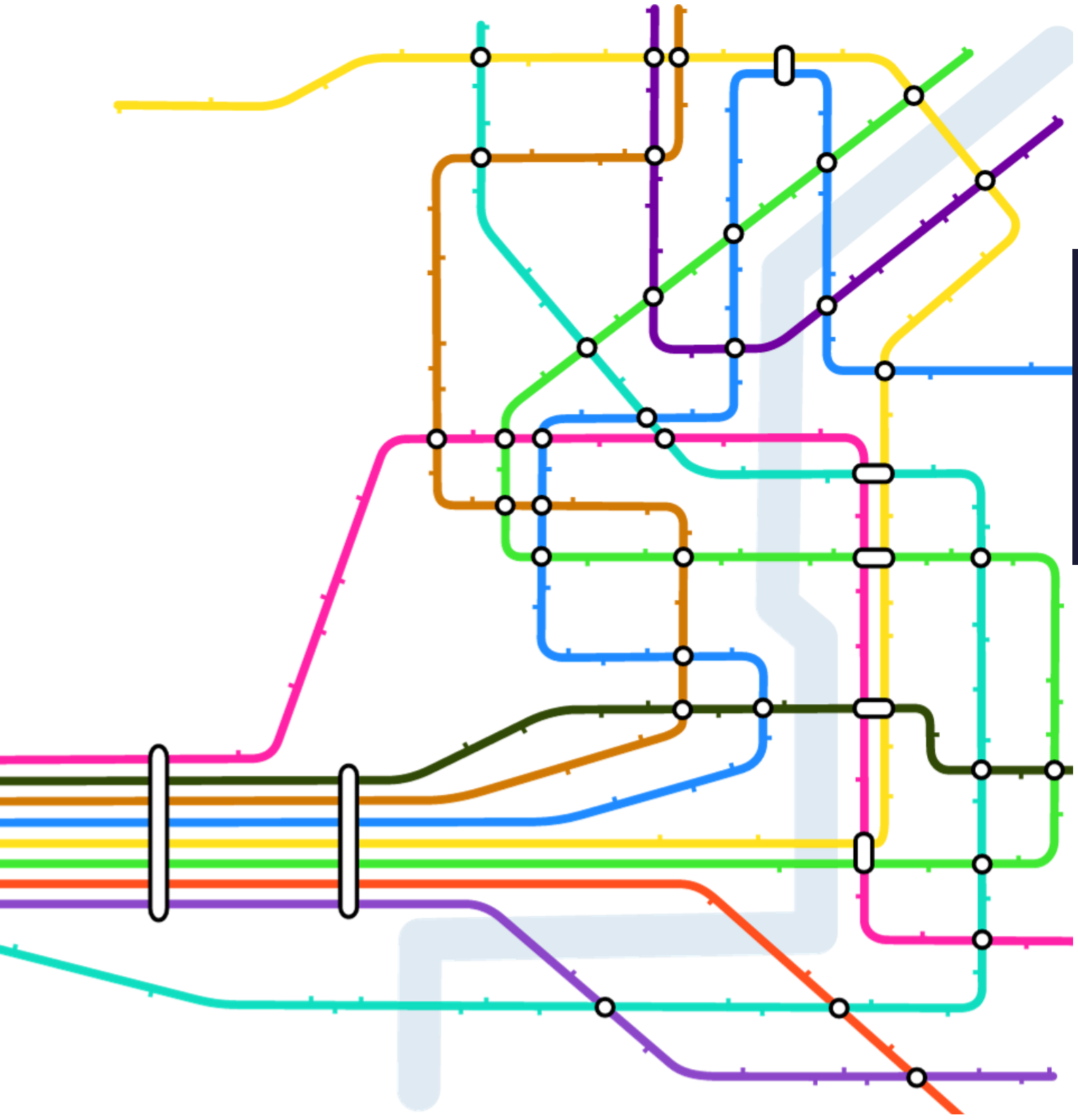
The emergence of the third and present generation of TOD is closely associated with the climate crisis. TOD has emerged beyond transit lines and high-density cores to encompass mitigation and adaptation strategies

While the term Transit Oriented Development was coined by Peter Calthorpe in his seminal work, The Next American Metropolis (1993), the impetus can be traced back to the mid 1800's. A shift from the Automobile city to a TOD city is imperative, not only due to vehicular dependency's overwhelming contribution to climate change, but also to enable just transitions. The advent and popularity of automobiles have had immense impact on urban life due to worsening AQI levels, traffic saturation points, catalysing the energy crisis, decreased road safety and loss of active realm. Hence, the transportation sector, though the most damaging to the socio-environmental segment, also acts as a key entry point to mitigate climate change by establishing sectoral synergies.

MOVING PEOPLE, NOT VEHICLES



Decarbonizing India's Road Transport: A Meta-Analysis of Road Transport Emissions Models, 2022 (Megha Kumar, Zhenying Shao, Caleb Braun, and Anup Bandivadekar)

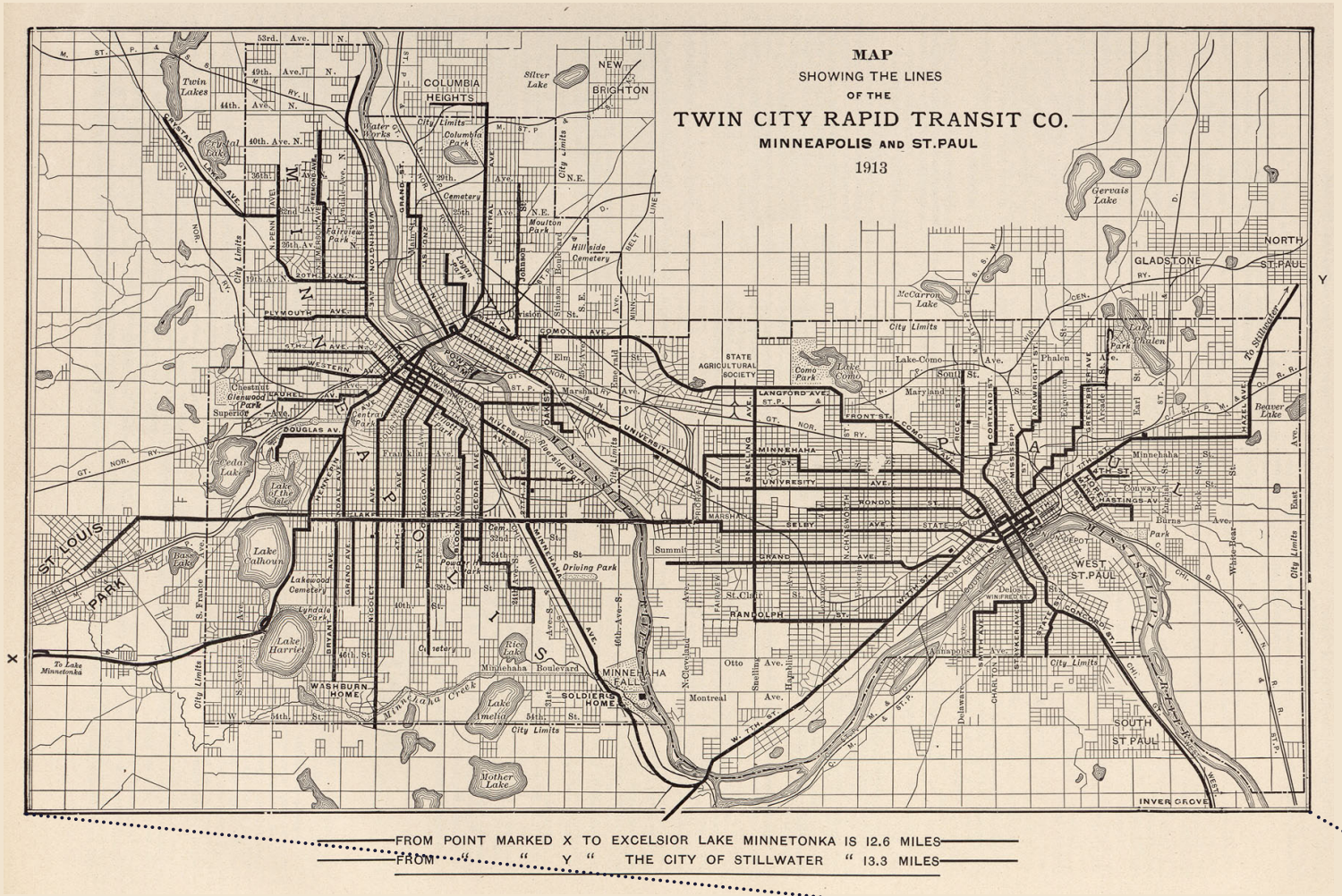


02

TRANSIT
ORIENTED
DEVELOMENT

EVOLUTION OF TOD

Transit-Oriented Development (TOD) is a concept that has evolved over nearly three decades, emphasising the integration of both transit and development aspects. The definition of TOD has become more diverse, particularly in terms of the "development" component. This section highlights the common principles and elements of TOD worldwide, while recognising variations in urbanisation trends between the Global North and Global South. Despite regional differences, both regions face similar urban challenges. TOD encompasses various components, with a significant emphasis on the "Ds" of land use, including density, diversity, design, distance to transit, and destination accessibility. This approach underscores the importance of creating urban environments that prioritise public transportation, making them more sustainable and accessible for residents.



2.1 TRANSIT ORIENTED DEVELOMENT

TOD AS A PLANNING CONCEPT

EMERGANCE OF TRANSIT ORIENTED DEVELOPMENT AS A PLANNING CONCEPT TO COMBAT URBAN CHALLENGES

 Information Source: Data collated from multiple sources

WHAT IS TOD AND WHEN DID IT EMERGE ?

Transit-oriented development (TOD) has rekindled its significance in recent years, driven by the advent of light rail trains and transit initiatives. Its inception in the early 1990s can be attributed to the visionary ideas of Peter Calthorpe. At its core, TOD champions the concept of vibrant and self-sustaining communities strategically positioned around transit hubs. It advocates for compact, transit-friendly growth that blends commercial and residential spaces within walking distance of transit stops, while also emphasising open spaces and a strong sense of community.

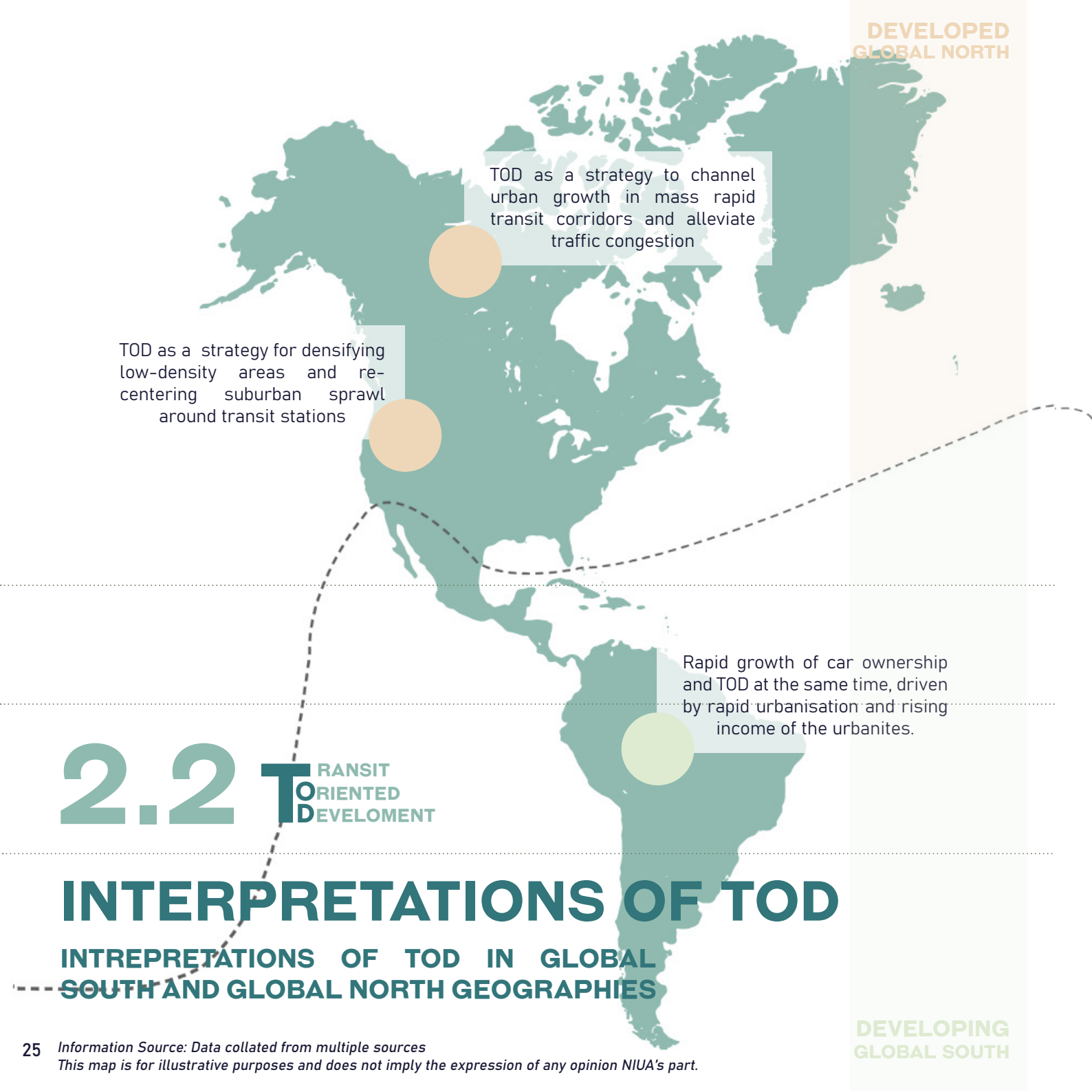
WHAT WAS THE TRIGGER FOR TOD AS A PLANNING TOOL ?

To grasp the significance of Transit-Oriented Development (TOD), let's journey back a century when public transportation was in its infancy. In 1891, Thomas Lowry introduced the Twin Cities Rapid Transit (TCRT) in Minneapolis and St. Paul.
During that era, transportation methods were rapidly evolving, transitioning from horse-drawn to cable cars, and eventually electric streetcars, which became the primary mode of transit in many cities, including the Twin Cities. Thomas Lowry saw an opportunity to leverage this.
At its peak, the TCRT streetcar network boasted an extensive 524-mile track system in and around the Twin Cities, serving over 200 million passengers annually in the 1920s. For Lowry, this transit system served as a catalyst for spurring real estate development in areas where he held substantial property, such as St. Louis Park and Columbia Heights.
In subsequent years, Peter Calthorpe and his colleagues coined the term "development-oriented transit" to describe this concept, signifying the utilisation of transit lines to stimulate real estate development in specific regions.

HOW WERE THE CHALLENGES COMBATTED ?

The introduction of streetcars in the Twin Cities and other metropolitan areas in the early 20th century had a profound impact on urban growth and accessibility. Streetcars allowed people to reside outside the city limits, offering more spacious living conditions while maintaining convenient access to urban job opportunities. This led to the rapid development of streetcar suburbs along Thomas Lowry's transit system, characterised by housing clusters near the streetcar tracks. These suburban areas witnessed the emergence of shops and multi-story buildings at key intersections, facilitating residents' commutes to the city for work and shopping.
Drawing inspirations from Edward Wakefield and Professor Alfred Marshal's ideas about organised population migration, Herbert Spencer's land tenure system, James Buckingham's model city concept-Howard aimed to find a solution for an open economy that didn't require self-sufficiency as a central requirement.
The solution to these challenges involved a shift in perspective. Unwin argued that streets should not be seen as inherently virtuous and, in fact, minimising street space allows for better town planning. He emphasised the importance of varying road widths and materials based on their intended use, distinguishing between throughways, streets, lanes, ways, and paths. This pro-pedestrian and anti-automobile approach aligns closely with the later Transit-Oriented Development (TOD) guidelines proposed by Calthorpe.

Graphic Source: McGraw Electric Railway Manual - Perry-Castañeda Map Collection -UT liberary online

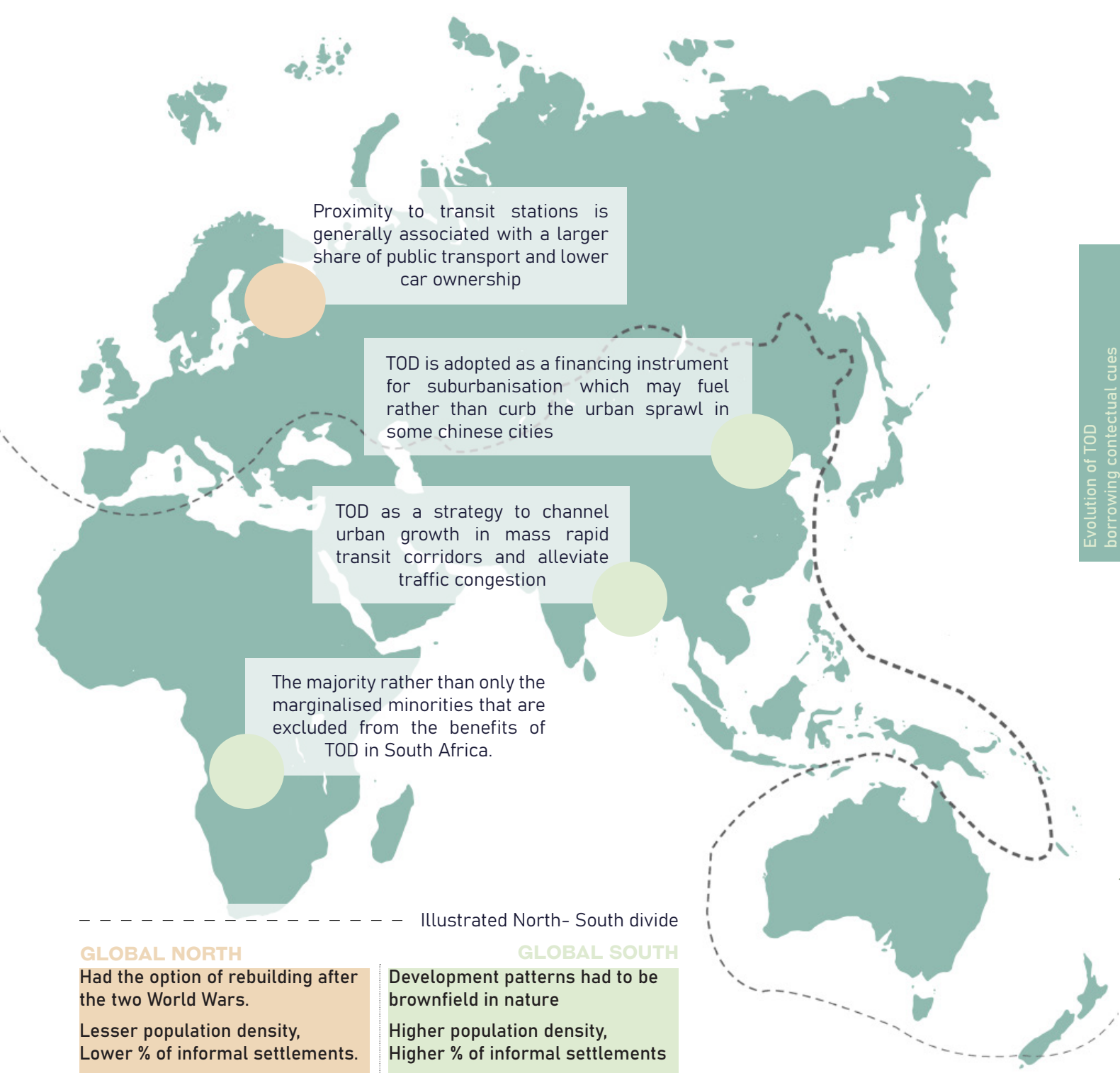


2.2 TRANSIT ORIENTED DEVELOMENT

INTERPRETATIONS OF TOD

INTREPRETATIONS OF TOD IN GLOBAL SOUTH AND GLOBAL NORTH GEOGRAPHIES

Information Source: Data collated from multiple sources
This map is for illustrative purposes and does not imply the expression of any opinion NIUA's part.



GLOBAL NORTH	GLOBAL SOUTH
Had the option of rebuilding after the two World Wars.	Development patterns had to be brownfield in nature
Lesser population density, Lower % of informal settlements.	Higher population density, Higher % of informal settlements
Lower Urbanisation rate	Higher Urbanisation rate

Graphic Source: Author(s)

 Information Source Data collated from multiple sources (ITDB & IBI)

2.3 COMPONENTS OF TOD

GLOBAL SOUTH'S PERSPECTIVE

- Density
- Diversity
- Design

Graphic Source: Author(s)

TRANSIT ORIENTED DEVELOMENT

2.3 COMPONENTS OF TOD

GLOBAL NORTH'S PERSPECTIVE

- Density
- Diversity
- Design

Information Source Data collated from multiple sources (EMBARQ & IBI)

Graphic Source: Author(s)

TRANSIT ORIENTED DEVELOMENT

GUIDING PRINCIPLES

Informal Sector Integration

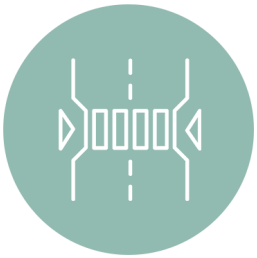
Multimodal Integration

Last and First Mile Connectivity

Interconnected Street Network

Complete Streets

Non-Motorised Transport Network



Traffic Calming

Mixed Land Uses

Optimised Densities

Street Oriented Buildings

Managed Parking

Housing Diversity

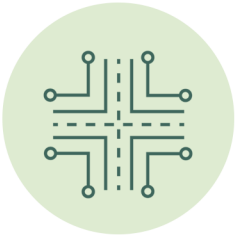
2.4 TRANSIT ORIENTED DEVELOMENT

PRINCIPLES OF TOD

SIMILARITIES IN THE CONCEPT ACROSS ALL GEOGRAPHIES

Information Source: Data collated from multiple sources

Transit Oriented Development
SUPPORTING PRINCIPLES



Right Size Infrastructure

Technology Integration

Safety and Security

Green Building & Infrastructure

Preserve & Create Open Spaces

Land Value Capture

High Quality Transit System

Barrier Free Environment

Engage Private Sector

Public Health

TOD enables active mobility, and fosters environments that improve mental and physical well-being

Road Safety

When people are centered in design of neighborhoods and streets, streets are safer

Quality of Life

TOD enables healthy development in young children and improves the quality of life for all family members

Transit Oriented Development
BENEFITS

Spatial/ Infrastructural Benefits

Socio-economic Benefits

Social Benefits

Environmental Benefits

TOD minimizes the impact of sprawling development on the environment

Principles of TOD borrowing contectual cues

Graphic Source: Author(s)

MEASURE OF TODNESS

URBAN DENSITIES

CRITERIA

urban densities suitable for developing TOD

POPULATION DENSITY

INDICATORS OF TODNESS

Number of people per sq. km
Number of commercial buildings per sq. km

LANDUSE DIVERSITY

creates a vibrant/ lively place out of a node

ALLOTMENT MIX-USE LAND

Diverse functions of land allocation - Mixed index

ECONOMIC DEVELOPMENT

higher economic development in an area leads to higher TOD

ECONOMIC DEVELOPMENT

Commercial density : Number of commercial enterprises/ sq. km
Employment density : Number of employees/ sq.km

URBAN SPACE

design of urban space that makes an area walkable and cyclable

ACCESS (FOOT AND CYCLE)

Destination accessibility (mix percentage of residential land use with other land uses)
Distance between the transit nodes

2.5 TRANSIT ORIENTED DEVELOMENT

TODNESS

IMPACT OF URBAN DEVELOPMENT AND TRANSIT CHARACTERISTICS ON THE TRANSIT-ORIENTED DEVELOPMENT (TOD) POTENTIAL OF AN AREA

Information Source: Data collated from multiple sources

RIDERSHIP SHARE

higher ridership indicates higher TOD-ness

TRANSIT CAPACITY UTILISATION

Passenger load and Service frequency of transit system in peak hours
Last mile connectivity (presence of feeder / paratransit system)

USER-FRIENDLY

user-friendly transit system to encourage people to use it

CITIZEN SURVEY (COMFORT)

Number of connections to different routes
Number of interchange to other mode
Access to the station/stop

ACCESSIBILITY AND ACCESS

better access | provides high accessibility and frequency of service

TRANSIT ROUTE COVERAGE & DESIGN

Impedance Pedestrian Catchment Areas (IPCA)
Intersection density (safety)
Presence of information display system
Quantity of accessible path

PARKING SUPPLY

parking supply for bicycles and cars aids in longer commutes

ACCESS ON FOOT AND CYCLE

Parking supply demand for cycles
Parking supply demand for cars (four wheelers)

TOD-ness borrowing contectual cues

"D"s OF TRANSIT ORIENTED DEVELOMENT

DENSITY

DIVERSITY OF LANDUSE

DESTINATION ACCESSIBILITY

DESIGN

The connotation "D" in Transit Oriented Development "TOD" originally emphasised sustainable and community development. Later with time, it has evolved to encompass four main aspects:

1 **Land Planning Model:** TOD highlights compact and mixed land use integrated with mass transit as a key development goal. Studies often focus on elements such as **density, diversity, design, distance to transit, and destination accessibility.**

2 **Transportation Policy:** TOD is seen as a strategy to promote Non-Motorised Transport (NMT) and increase public transit ridership while reducing traffic congestion and environmental impacts.

3 **Social Policy: TOD is considered an inclusive way to connect marginalised households with local and citywide opportunities, reducing transportation expenses for these households.**

4 **Financial Instrument: TOD is adopted as a development model to capture land value. It is used to finance public transportation investments and stimulate real estate development in suburban areas, particularly near transit stations.**

In essence, the first and fourth aspects of TOD prioritise environmental considerations, while the other two emphasise benefits for people and communities.

03

TRANSIT
ORIENTED
DEVELOMENT

CASE STUDIES

UNDERSTANDING CONTEXT AND OUTCOMES

This section presents a comprehensive exploration of Transit-Oriented Development (TOD) through a series of case studies. It presents the transformative potential of TOD in urban planning and development and provides insights into the scale, nature and impactful outcomes of TOD.

3.1

DELHI

POPULATION

1.60 CR (Census 2011)

2.12 CR (2021 projections as per census)

POPULATION DENSITY

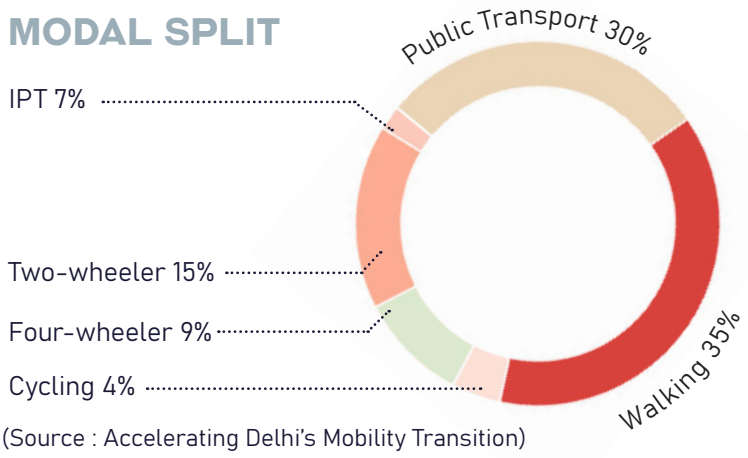
11,320 PP SQ. KM. (Census 2011)

AREA

1484 SQ. KM. (Census 2011)

In Delhi, streets of high-income areas are 1.7 TIMES more walkable, and the sense of safety is 1.7 TIMES higher

MODAL SPLIT

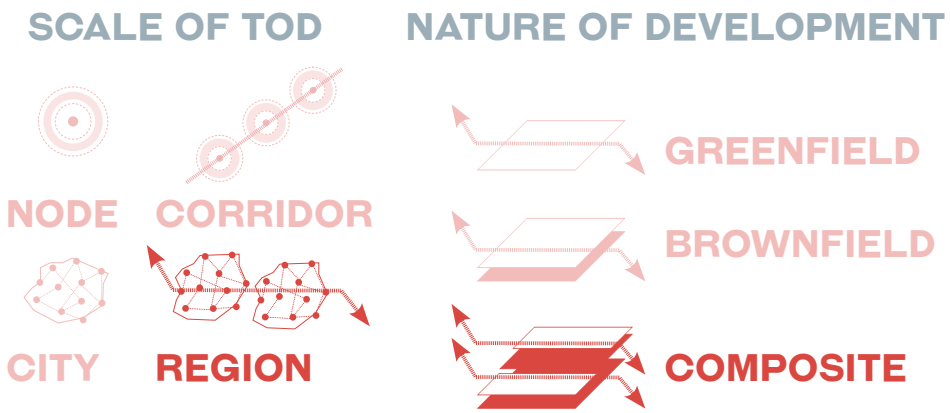


(Source : Accelerating Delhi's Mobility Transition)

Graphic Source: Author(s)

VISION

A TOD approach will help in bringing people and jobs closer to mass transit which will result in compact, walkable, mixed-use developments within influence zones of transit stations. This can potentially improve public transit ridership, reduce vehicular congestion, and reduce greenhouse emissions and pollution in the long term.



PROJECT STRUCTURE

The TOD Policy was notified on 31st July 2021 and framed within the Influence Zone along MRTS corridor, designated as the Transit-oriented Development (TOD) Zone in the Master Plan for Delhi 2021.

By 2018, DMRC has built over 8 lines of metro spanning 332 km. 12 TOD nodes have been identified for preparing Influence zone plans.

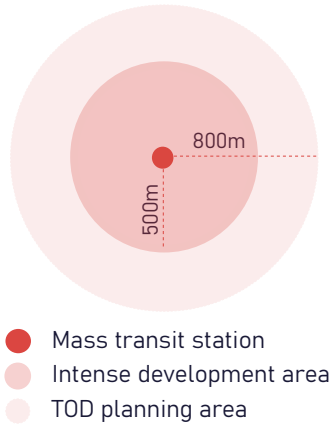
Expected sources of revenue are through the sale of FSI as per standard rates, irrespective of land use/ use premises which will either adversely affect the affordability of residential or there are chances for the government to lose the opportunity to earn from the commercial FSI.

SELECTION OF TOD AREA

12 TOD nodes have been identified around select mass transit stations, divided into:

a. "TOD Planning Area"-
Notional area of 800m radius around transit stations. Influence Zone Plans shall be prepared for the TOD Planning Area.

b. "Intense Development Area"-
Notional area of 500m radius around the transit station within the TOD Planning Area.



DEVELOPMENT AUTHORITIES

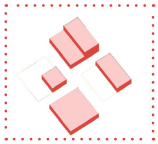
Delhi Development Authority (DDA)-Evaluate TOD schemes and give development permissions along with preparation of zonal development plans.

UTTIPEC- formulated to envision a unified and integrated mobility outlook for the entire region, identified a need for Transit-oriented Development (TOD) to accompany metro development in the city-region and began creating the TOD Draft guidelines in 2008.

Metro system network is developed by The Delhi Metro Rail Corporation (DMRC) which was jointly set up by the Government of India and Government of Delhi in 1995.

Graphic Source: Author(s)

DEVELOPMENTAL NORMS



FAR

The FAR shall be 1.5 times the existing permissible FAR on the plot or 300, whichever is more.

The maximum FAR limit for any plot included shall be 500.

Minimum FAR utilisation shall be equivalent to the permissible FAR.

MIX OF USES

Minimum FAR of 30% residential use, 10% commercial use, and 10% public amenities are compulsorily required on all land parcels.

ROAD NETWORK

Minimum 20% of the land is required to be reserved for roads. Principles of 250m c/c road density of vehicular roads and 100m c/c density of the pedestrian network.

OPEN SPACES

Minimum 20% of the land is required to be reserved for green open spaces for public use, adhering to principles of inclusion and another 10% green space for private use.

IMPACT

The impact of metro system has kept more than 3.9 lakh vehicles off the roads in 2014, resulting in a saving of Rs. 10,364 Crore in fuel consumption, reduction in pollution, work hours lost and fuel due to decongestion along with other benefits.

TAKEAWAYS

The TOD policy after being part of Master Plan for Delhi 2041 will contribute to improve public transit ridership, reduce vehicular congestion and reduce greenhouse emissions and pollution in the long run.

One of the key additions from sustainability point of view is the norm which states that the built form of the development is required to achieve a minimum of 3 stars or gold rating as per the Indian Green Building Standards.

3.2

AHMEDABAD

POPULATION

0.55 CR (Census 2011)

0.72 CR (2021 projections as per census)

POPULATION DENSITY

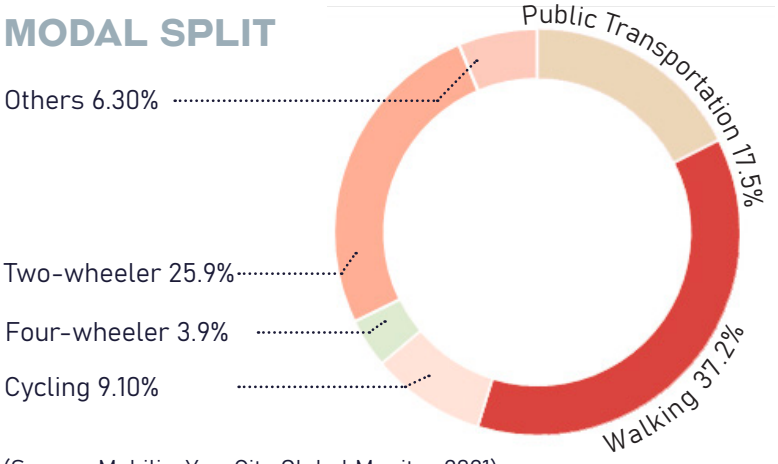
11,948 PP SQ. KM. (Census 2011)

AREA

466 SQ. KM. (Census 2011)

THE UN HAS CHOSEN AHMEDABAD'S BUS RAPID TRANSIT SYSTEM (BRTS) AS A SHOWCASE PROJECT TO HIGHLIGHT THAT ADDRESSING CLIMATE CHANGE IS NOT A BURDEN, BUT AN OPPORTUNITY TO IMPROVE THE LIVES OF PEOPLE.

MODAL SPLIT



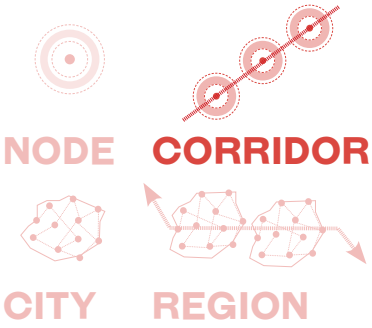
(Source :MobiliseYourCity Global Monitor 2021)

Graphic Source: Author(s)

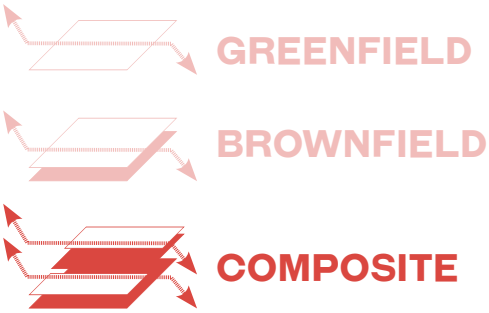
VISION

Integrate city structure and transport system towards greater accessibility, efficient mobility and lower carbon future.

SCALE OF TOD



NATURE OF DEVELOPMENT



PROJECT STRUCTURE

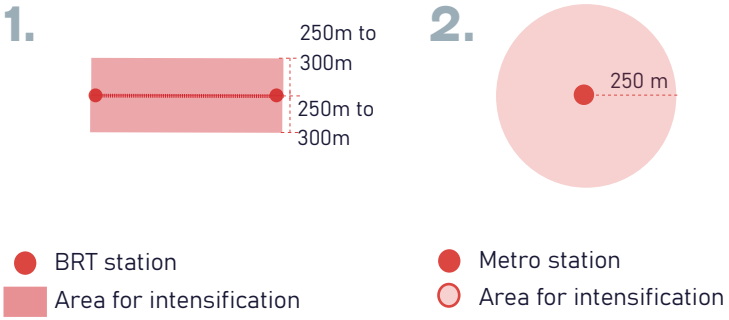
BRTS:
A corridor of 88 kms known as JanMarg was initiated in October 2009, in two phases with 160 buses and 143 stations under JNNURM of the Ministry of Urban Development, Government of India (GOI 35%, GOG 15% and AMC 50%). Ahmedabad Janmarg Ltd (AJL) operates a 160 km route with a fleet of 380 buses, serving approximately 220,000 passengers daily.
Metro:
Ahmedabad Metro Rail Project Phase-I launched with 40.03 km with two corridors and 32 stations.
38.6km and 28 stations are operationalised in October 2022.

Ahmedabad Janmarg Limited's revenue comes from the Urban Transport Fund, which includes fare-box payments, parking charges, advertising and proceeds from the sale of additional FAR along BRT corridors.

SELECTION OF TOD AREA

Two models:
BRT Corridor:
250 to 300 meters along the BRT corridor will be intensified depending on RoW.
Metro stations:
250 m around metro stations will be intensified.

Apart from this area with 500m buffer around interchange nodes of Level one and 250 m buffer around interchange node two is also proposed for intensification of densities.



DEVELOPMENT AUTHORITIES

Lead Planning & Implement Agency- Ahmedabad Janmarg Limited (AJL) – SPV under the purview of the Ahmedabad Municipal Corporation (AMC)

Planning and Design- CEPT University, Ahmedabad

Project Support- Ahmedabad Urban Development Authority (AUDA), Gujarat Infrastructure Development Board (GIDB), Urban Development & Urban Housing Department, Government Of Gujarat, Ahmedabad City Traffic Police

Gujarat Metro Rail Corporation (GMRC) Limited- SPV formed by Government of Gujarat for the faster execution of the metro rail project.

Graphic Source: Author(s)

DEVELOPMENTAL NORMS

TOD regulations integrated in development plan 2031 through Integrated Mobility Plan drafted in 2014. The plan also provides for the adoption of specific measures to promote TOD, such as complete streets and the development of Local Area Access Plans.

FAR

The FAR norms differ as per the location whether a BRT corridor, metro station or a transit node interchange which is where public transport services meet. This node is further categorised into two levels depending on the core station and the catchment area.

BRT CORRIDOR

BRT Corridor:
Plot on Road width between 45 to 60 m within 100 m from corridor- FSI 4
Beyond this upto 250 m from corridor- FSI 3
Rest of the city- FSI 2.75.
Road width between 24 to 45 m- Abutting plots- FSI 4
Beyond that upto 250 m from corridor- FSI- 3
Rest of the city- FSI 2.75
All roads below 24m – increase in FSI from 1.8 to 2.75

METRO STATIONS

TRANSIT NODE

Metro stations:
Around 250-300 m of metro stations - FSI 3.

Transit Node:
Level 1 interchange 500 m around the node- FSI 4
Level 2 interchange 250 m around the node- FSI 3

IMPACT

Social: The BRTS began operation in October 2009 from 13000 ridership to 1,35,000 per day in two years and now has 101 km route and growing. User satisfaction is high, with an 8.5 out of 10 rating in monthly user satisfaction surveys

Environmental: 20 to 22 per cent of the commuters have moved from using their motorcycles to the bus. 150 electric buses have resulted in fuel savings of 14972 litres per day and reduction of 15567.23 kg per day.

TAKEAWAYS

These TOD regulations drafted in 2014 are integrated in development plan 2031 which are significant for development of the city with transportation at its core. Sustainable Urban Mobility Plan will include the upgrade of the Integrated Mobility Plan of Ahmedabad (IMP) which will be drafted soon.

Information Source: Collated from multiple sources

3.3

PUNE

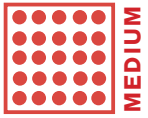
POPULATION

0.33 CR (Census 2011)

0.41 CR (2021 projections as per census)

POPULATION DENSITY

9903 PP SQ. KM. (Census 2011)



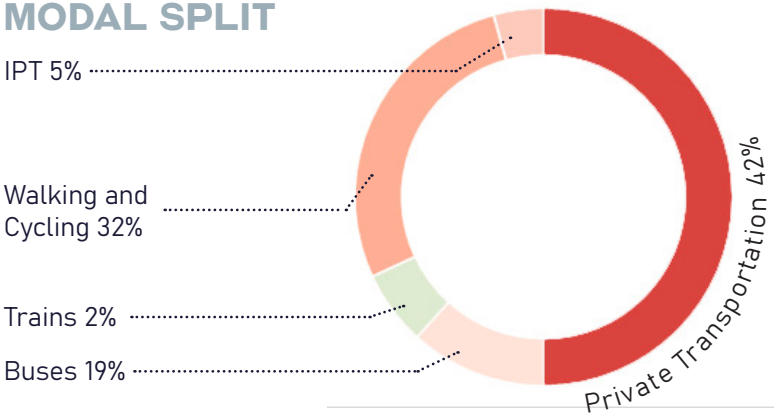
AREA

340 SQ. KM. (Census 2011)

PROJECTS PROPOSED IN CMP WILL HELP IN ACHIEVING SUSTAINABLE DEVELOPMENT BY INCREASING THE SHARE OF PUBLIC TRANSPORT AND NON-MOTORISED MODES, THUS REDUCING THE DEPENDENCE ON PRIVATE VEHICLES.

(Source: Comprehensive mobility plan for Pune Metropolitan Region)

MODAL SPLIT



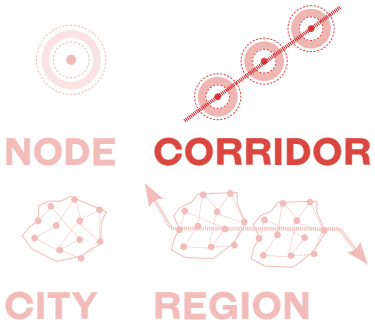
(Source :Pune Sustainable Transport Initiatives)

Graphic Source: Author(s)

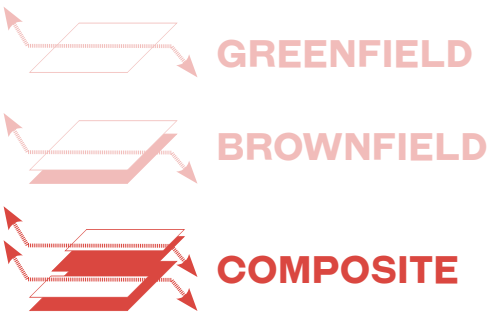
VISION

Complete street design, construction of street oriented buildings and optimum densities in residential, commercial and office buildings.

SCALE OF TOD



NATURE OF DEVELOPMENT



Information Source: Collated from multiple sources

PROJECT STRUCTURE

TOD regulations in the DCPR of Pune Municipal Corporation from January 05, 2017 and TOD policy for Pune Metropolitan Region (PMR) launched on October 10, 2022. Total length of TOD area in PMR is 55km and 36km within PMC limits.

The main mode being Metro for TOD, 10.34 km length of 2 lines combined is operational from all the 3 lines. PCMC-Phugewadi - 6km (Purple Line), Vanaz-Garware College- 4.35km (Aqua Line) is operational.

Scrutiny fee, hardship premium, premium for additional FSI etc. in TOD zone is kept in separate head at Municipal level for development of metro project.
Rate of Premium (in percentage of ready reckoner rates) is 30% for FSI to be used for tenaments less than or equal to 60 sq.m., 35% for FSI to be used for remaining residential/ commercial use. 50% of premium amount to be paid to the Planning authority in the area with the Urban Transport Project and 50% to the project implementing authority.

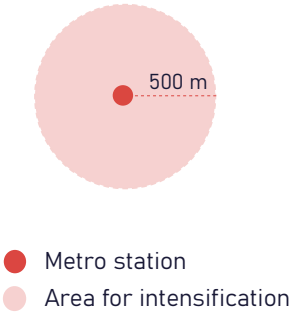
SELECTION OF TOD AREA

The area with 500 m around metro transit station is identified as TOD zone which may be relaxed up to 30 % where any reservation/ amenity space within such distance is utilised for the purpose of transportation.

Line 1- Purple Line (PCMC Bhavan to Swargate) – 14 Stations

Line 2- Aqua Line (Vanaz to Ramwadi) – 16 Stations

Line 3- Orange Line (Shivaji Nagar to Hinjewadi) – 23 Stations



DEVELOPMENT AUTHORITIES

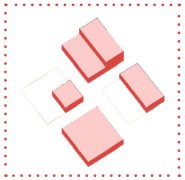
Development of corridors:
Two corridors of the metro, line 1 and line 2 are to be constructed by Maharashtra Metro Rail Corporation (Maha-Metro) which is in progress and partially operational.

One corridor line 3 to be completed by Pune Metropolitan Regional Development Authority (PMRDA)

Planning authority with the Pune corporation in PMC limits and PMRDA outside PMC limits will take care of delineation of zones and execution of complete streets design along the roads with metro.

 Graphic Source: Author(s)

DEVELOPMENTAL NORMS



FSI

Depending on the plot size and the approaching road width the maximum permissible FSI in TOD zone is:

9m to 12m- FSI 2.5
12m to 15m- FSI 3
15m to 24m- FSI 3.5
24m and above- FSI 4

AREA

For development or redevelopment:
Tenament size- min. 25 sq.m. and max. 120 sq.m. of carpet area
Proposed tenaments- at least 50% of total FSI < or = 60 sq.m. carpet area (for plots above 1000 sq.m.)

Stores above 500 sq.m. builtup area not allowed in TOD zone

PARKING

No on street parking unless specified in Integrated Mobility plan and 50% of the prescribed parking in TOD zone than that in DCR.

Enable construction of street oriented buildings while achieving optimum densities in residential, commercial and office buildings.

IMPACT

Additional FSI over and above the base permissible FSI, shall be granted from where the Metro Rail is passing through after taking into account the Impact Assessment of the implementation of these regulations and the impact is in terms of the impact on the city and sector level infrastructure and amenities as well as traffic and environment.

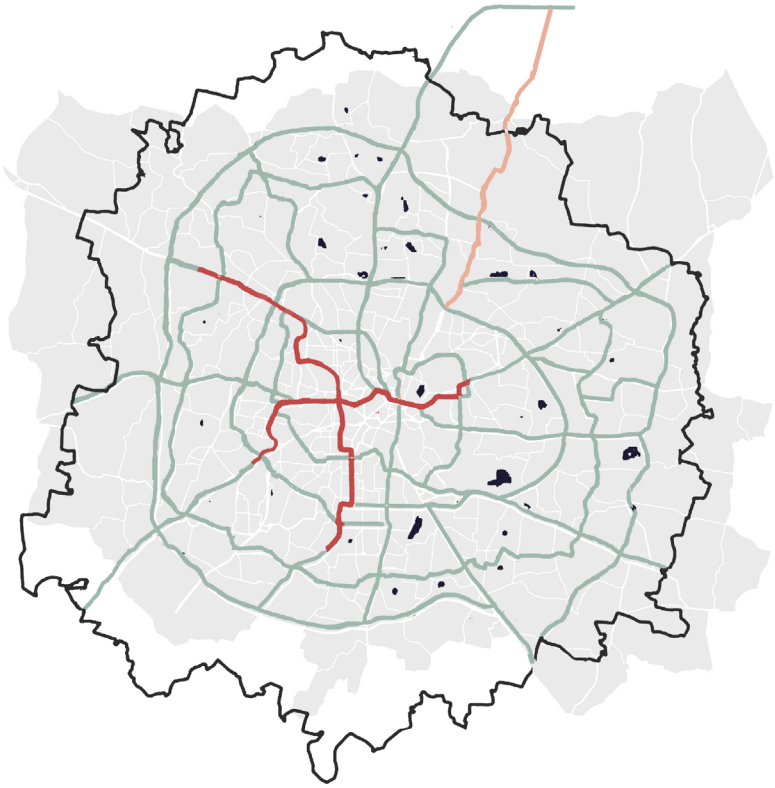
TAKEAWAYS

Pune's 2016-17 budget for PMC called for more than half of transportation spending to go to footpaths, cycle tracks, and BRT, thus prioritising sustainable transportation over car oriented infrastructure.

The Planning authority shall also ensure complete pedestrianisation in the TOD zones for easy movement of the pedestrians to & from station within a period from the publication of the TOD regulation which ensures effective implementation due to set targets within a specific timeframe.

3.4

BENGALURU



POPULATION

0.84 CR (Census 2011)

1.09 CR (2021 projections as per census)

POPULATION DENSITY

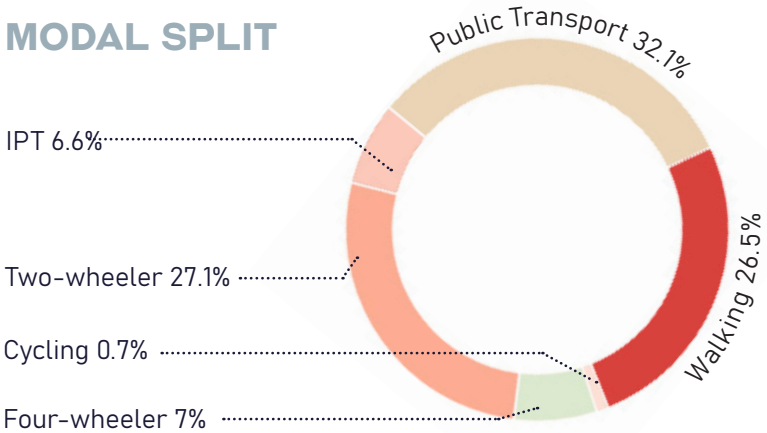
11,394 PP SQ. KM. (Census 2011)

AREA

741 SQ. KM. (Census 2011)

As part of Master Plan 2031, estimates from Bangalore Development Authority noted that 1.18 crore citizens waste 60 crore person-hours annually in Bengaluru due to congestion.

MODAL SPLIT



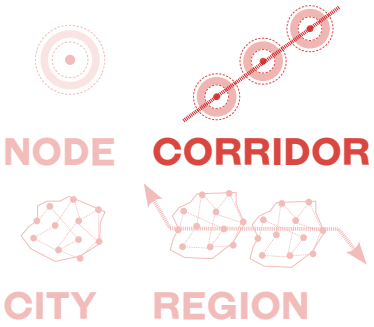
(Source :Comprehensive Mobility Plan for Bengaluru)

Graphic Source: Author(s)

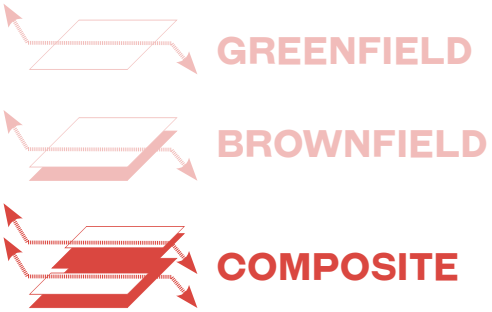
VISION

As per TOD Policy to create Public transport oriented city which will leads to the compact, people friendly, environment friendly city. Also, to build a multi-modal transport system for equitable mobility access and minimised negative externalities.

SCALE OF TOD



NATURE OF DEVELOPMENT



Information Source: Collated from multiple sources

PROJECT STRUCTURE

The Bengaluru TOD policy was approved in November 2022 which stated that the TOD principles are to be integrated in masterplans by Bengaluru Development Authority and other development authorities within the metropolitan area.

In terms of Metro transit, the total length of operational Metro is the entire Phase 1 of 42.3 km with 40 stations having 1 junction and consisting of purple lineof 18.1 km with 17 stations and green line of 24.2 km with 24 stations.

Ideal station features are summed up as 6-6-6 where 6-6-6 represents 6 minute walking to access from 0-500m from transit station, 6 min. cycling from 500m-1 km of station and 6-minute feeder bus from 2 km of station.

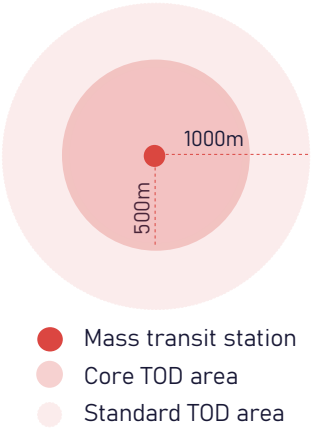
SELECTION OF TOD AREA

TOD zone comprising of 2 sub-zones:

i) Core TOD zone: 6 min. walk from transit station

ii) Standard TOD zone: 6 min. cycle from Transit Station

Core TOD is the area broadly 500m from transit station and
Standard TOD is the area broadly 500m-1000 m from transit station



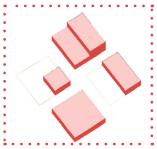
DEVELOPMENT AUTHORITIES

Transport planning mandated by Bengaluru Metropolitan Land and Transport Authority (BMLTA) through guidelines for transit service design, MMI and parking facilities and the plan to be prepared by Directorate of Urban Land Transport (DULT) and Bengaluru Metro Rail Corporation Limited (BMRCL).

The TOD policy is applicable to Bengaluru Metropolitan area comprising of Bengaluru Development Authority, part of Bengaluru Mysore Infrastructure Corridor Area Planning Authority (BMICAPA) and Bengaluru International Airport Area Planning Authority (BIAAPA).

Graphic Source: Author(s)

DEVELOPMENTAL NORMS



FAR

Higher FAR near transit stations for composite development (station - cum - commercial development), except in heritage zones.

25-50% addition over base FAR in TOD areas and linkage of FAR after provision for infrastructure augmentation.

DENSITY

The gross density of up to 2 times of the city population density shall be allowed in TOD Zone depending upon location, availability of infrastructure, landuse zoning and transit capacity.

The gross density of 250 pph to 400 pph shall be achieved in TOD corridor by 2031 and accordingly, FSI in Intense TOD Zone and Standard TOD Zone shall be atleast 50% and 25% more than that of base FSI.

PLAN

A comprehensive plan integrating physical infrastructure services to be prepared by Bengaluru Land Transport Authority.

ACCESS

Direct access from adjacent property to transit station

IMPACT

The anticipated impacts can be assessed through the major goals of TOD policy which include achievement of 70% share of public transport in motorised trips and 60% of the city population living within intense TOD zone.
This may require about 600 cu. km. of mass transit corridors.

TAKEAWAYS

There are several meaures taken from sustainability point of view like DCR and building plan approvals towards achieving green building certification, use of low carbon materials for constructing public infrastructure and impact assesment studies to be conducted to identify no development or low development areas within TOD zones.

Information Source: Collated from multiple sources

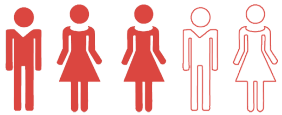
3.5

CURITIBA

BRAZIL

POPULATION

0.17 CR (Census 2022)



0.37 CR (2021 projections for Urban Area)

POPULATION DENSITY

4079 PP SQ. KM. (Census 2022)

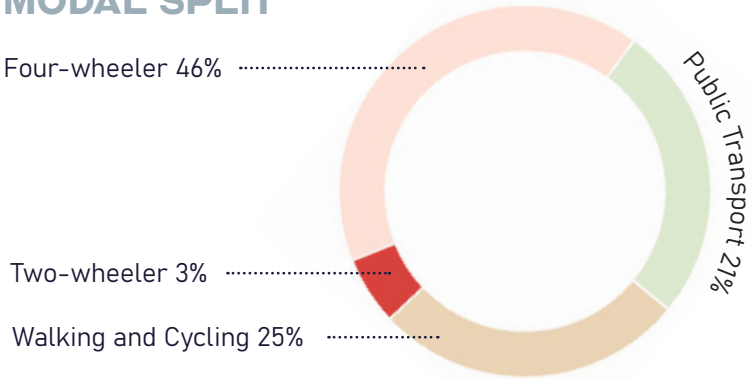
AREA

435 SQ. KM (Census 2022)

ZONING FOR MIXED-USE, WALKABLE NEIGHBOURHOODS: THE CITY MANDATED INCLUSIVE ZONING FOR SPECIAL SOCIAL INTEREST HOUSING SECTORS FOR LOW-INCOME RESIDENTS AND A JOBS ROUTE ZONE IN ORDER TO BOOST ECONOMIC ACTIVITY.

(Source : Curitiba, Brazil - A model for Transit Oriented Development - By ICLEI)

MODAL SPLIT



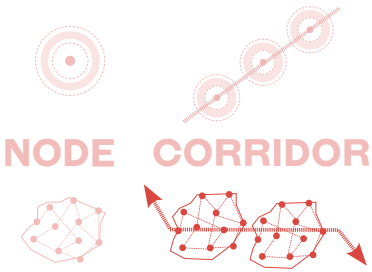
(Source :Tumi Curitiba Factsheet)

Graphic Source: Author(s)

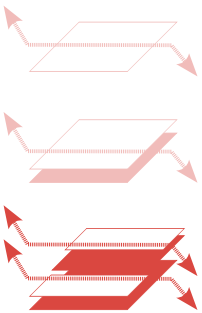
VISION

The relief of traffic and congestion in the downtown Curitiba by decentralising the location of employment providers. Increased social equity and well-being through the provision of more leisure areas and pedestrian zones in the center of the city. The promotion of public transport use and cycling in order to encourage a low-carbon and resilient city

SCALE OF TOD



NATURE OF DEVELOPMENT



Information Source: Collated from multiple sources

PROJECT STRUCTURE

In 1964, the city of Curitiba came up with the strategy for masterplan of combined investments in transportation with land use development.

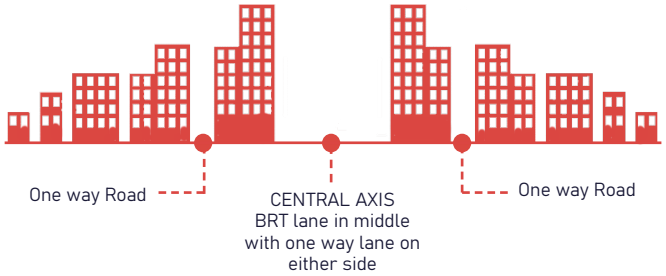
The Plan visualised the city in the form of a star, wherein five structural axes would be designed to steer high-density, mixed-use growth along mass public transportation corridors, otherwise known as the "Trinary Road System", from the city center thus the integration of transportation and land-use. The bus-way system along the five structural axes is only a part of the Curitiba city-wide bus mass transit system.

It is a system of median bus ways along the five "structural axes" complemented by "direct" express service on parallel arterial roads, and by an extensive feeder bus network.

SELECTION OF TOD AREA

In trinary road system, the central road of the three contains a two-way bus-way and also provides a limited number of traffic lanes.

Approximately at the distance of one block from each side of the central bus-way, a one-way traffic road with three or four lanes is developed for use by private vehicles.



DEVELOPMENT AUTHORITIES

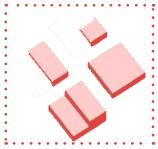
In 1965, Curitiba created a planning institute as a Municipal Independent Authority, (IPPUC) to develop, supervise, monitor, and to continually update the Master Plan.

The institute had 14 member representatives of multi-departmental executive board of departments like socio-economic planning, territorial planning, urban affairs, public works, legal implementation department etc.

Integration of local transport systems with regional transport systems and services- In 1974, the Curitiba Metropolitan Region came into force, therein linking transport within Curitiba's 13 municipalities.

Graphic Source: Author(s)

DEVELOPMENTAL NORMS



FAR

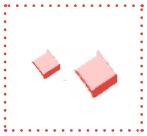
City mandated specific floor area ratios (FARs) for four out of its five corridors at 6:1 (later modified to 5:1), and 4:1 for medium-to-high density areas surrounding the axis in close proximity to transit routes.

Minimum 50% area on ground, first floors for shops, restaurants and commercial services along transit corridors promoting mixed residential and commercial development.

DENSITY

In 1975, limited density in the peripheral residential zone led the City to promote residency along structural corridors.

The highest density in Curitiba's TOD zone is 29400 persons/sq.km. or 9300 DUs/sq.km. indicating to a household size of 3.1 members.



TDR

A combination of control and incentives like restricting large scale shopping centres along transit corridors while providing incentives to transfer development rights from low density developments to high densities and incentives

EXTRAS

City mandated inclusive zoning for special social interest housing sectors for low income residents and a Jobs Route Zone in order to boost economic activity.

The city zoned specific car-free areas of the city, such as downtown Curitiba, for pedestrian use.

IMPACT AND TAKEAWAYS

The BRT is used by 85 percent of Curitiba's population. The RIT offers service via 6 corridors, 11 lines – covering a total of 81.5 km of the city per day. In one BRT lane, 10,000-20,000 passengers can be carried at one time, with a capacity of 40,000 passengers on busy roads

Between 1970 and 2000, the Human Development Index (HDI) for the city has risen from 0.7 to 0.8, placing it above the HDI levels of the state (both of which stood at 0.4 in 1970 and rose to 0.7 in 2000).

TOD improved Curitiba's low-emission, sustainable mobility. Curitiba's TOD has reduced travel times and private vehicle use.

3.6

COPENHAGEN

METROPOLITAN AREA

DENMARK

POPULATION

0.2 CR (Census 2021)

POPULATION DENSITY

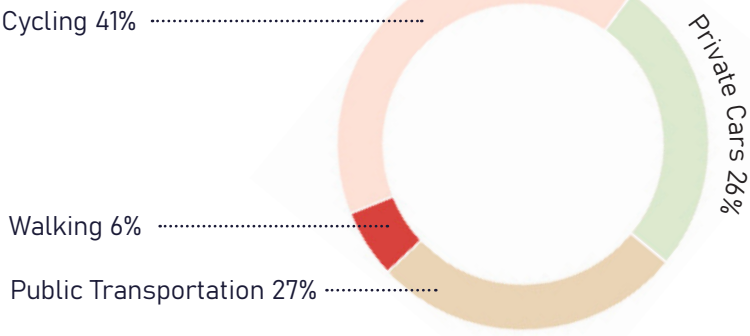
1131 PP SQ. KM. (Census 2021)

AREA

1768 SQ. KM. SQ. (Census 2021)

COPENHAGEN IS ONE OF THE WORLD'S MOST BICYCLE-FRIENDLY CITIES: WITH 454 KILOMETERS OF CYCLING LANES, MORE THAN 36,000 CYCLISTS COMMUTE 1,230,000 KILOMETERS EVERYDAY.

MODAL SPLIT



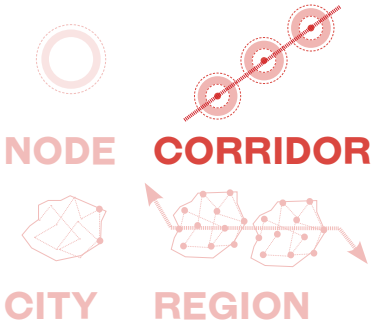
(Source :Deloitte City Mobility Index, Copenhagen)

Graphic Source: Author(s)

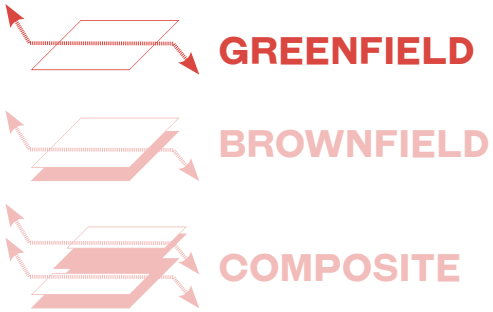
VISION

A sustainable development with metro at its core, good bicycle lanes and deliberately low and expensive car parks to minimise use of private transport.

SCALE OF TOD



NATURE OF DEVELOPMENT



PROJECT STRUCTURE

Orestad is known as Wrist or palm or also called as New finger of planned urban development of Copenhagen. Land Value Capture mechanism represented by land sales program. Orestad Development Corporaion (ODC) took out a loan against the value of its land assets to fund the construction of metro. Ensured provision of public transit but encumbered ODC with large debts from the start.

Government owned vacant lands before construction of metro are sold with higher development prices due to the economic impacts and high accessibility. Revenue were estimated to be 50% of the total metro construction costs.

Fences around the metro construction sites available for art, communication, urban furniture and other fun initiatives. The metro company finances the project by selling advertising space on selected sections of the fences.

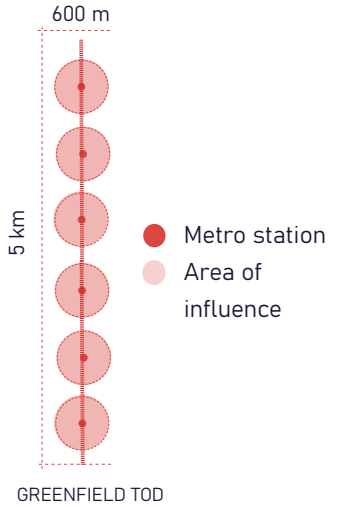
SELECTION OF TOD AREA

Greenfield TOD development of Orestad with geography 5km long and 600m wide having four districts in the city and six metro stations.

A large scale urban development project serving as an economic development zone and as a means to create investments for a new public transport system for the whole city.

The initial finger plan that laid the spatial framework for development in a way neglected this area as it formed the wrist.

The strategic location is close to the city centre, the airport and the new bridge to Sweden serving as a gateway to Denmark for international business coming from Swedish side by road or rail.



DEVELOPMENT AUTHORITIES

Orestad Development Corporation jointly owned by the Danish state and city through Municipality of Copenhagen 45-55 respectively. Both provided land while municipality was responsible for zoning.

ODC split in 2009 in two companies:
Metro Corporation tasked with developing the Metro network

City and Harbour Development Corporation tasked with land development in Orestad and redevelopment of various sites in Copenhagen harbour.

Graphic Source: Author(s)

DEVELOPMENTAL NORMS

PARKING

Low parking norm in Orestad:
Parking spaces being placed in parking garages to be shared by commercial and residential users.

Employees in Orestad will park during daytime and residents in Orestad during evening and night.

IMPACT AND TAKEAWAYS

The wrong estimation of the metro construction costs in the planning stage in 1992:
485 million euros increased to 1065 million euros.

The wrong estimation of the construction period:
7 years extended to 10 years leading to rise in construction costs to reach 1600 million euros.

Lack of connection to the private economic sector from the start:
Parliament decision to build link with neighboring Swedish city Malmo and establish Orestad as an economic development zone.

Before only 1 year from its completion in 2007, only 52% of land lots were sold. This can be attributed to the low market demand in this area, the low population, as well as the low metro ridership rates, together with the lack of mixed uses.

A sustainable feature in the form of a continuous body of water along the full North-South axis of the city connects the four districts. It constitutes the storm water management system in the form of SUDS(sustainable urban drainage system) adding recreational values to the area. The use of water as an integrated element for the creation of structure, identity and sustainable drainage solutions is a success.

Research is going on for the utilization of stormwater for heating and cooling of buildings with one of the homes utilizing groundwater for cooling purposes already.

3.7

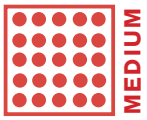
SINGAPORE

POPULATION

0.59 CR (Census 2023)

POPULATION DENSITY

8058 PP SQ. KM. (Census 2023)



AREA

728 SQ. KM. (Census 2023)

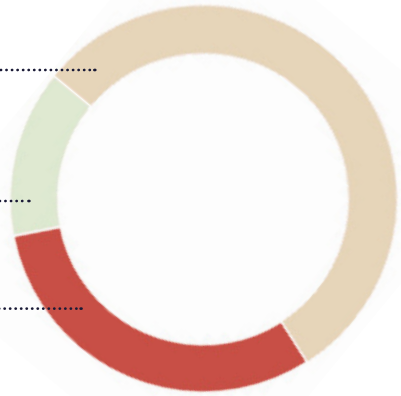
SINGAPORE IS TRYING TO CREATE 20 MINUTE TOWN AND 40 MINUTE CITY THROUGH TOD. WHICH LEADS TOWARDS HEALTHY LAND SAFE LIFE FOR CITIZENS.

MODAL SPLIT

Public Transportation 53%

Walking and Cycling 14%

Private Vehicles 33%



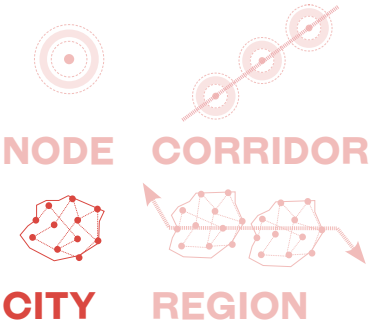
(Source :Deloitte City Mobility Index, Singapore)

Graphic Source: Author(s)

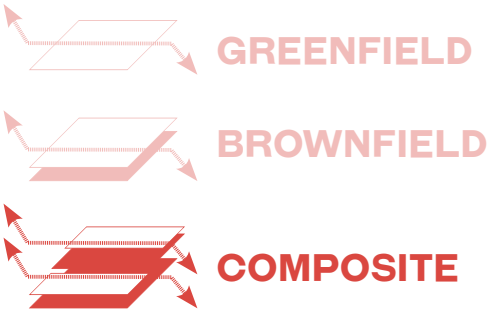
VISION

Singapore's TOD is primarily focused on urban renewal, through the expansion of the transit network. The result is a constellation of satellite towns that surround a central core, with rail networks that link these towns to industrial parks and the city centre.

SCALE OF TOD



NATURE OF DEVELOPMENT



PROJECT STRUCTURE

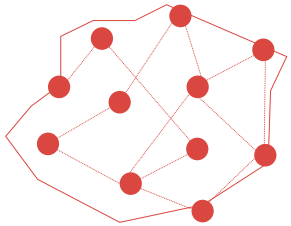
The Urban Redevelopment Authority assesses market demand and economic potential when selecting TOD areas. Factors like population density, employment centers, and projected growth play a role in identifying areas with high demand for transit connectivity and urban amenities.

TOD areas require the provision of supporting infrastructure and well-designed public spaces. The URA considers factors such as the availability of utilities, pedestrian and cycling infrastructure, green spaces, and overall urban design quality when selecting and planning TOD areas.

SELECTION OF TOD AREA

The entire development of the city is transit oriented. The multi-modal transport system work on different scales which connects entire city to the transport network.

The transit nodes are developed as 'Integrated Transit Hubs'.



Transit Nodes- Integrated transit hubs around the city

DEVELOPMENT AUTHORITIES

Ministry of Transport, Singapore

Urban Redevelopment Authority , Singapore

Land Transport Authority, Singapore

Graphic Source: Author(s)

DEVELOPMENTAL STRATEGY

DENSITY

The objective was two-fold:
Maximise development potential around the stations and improve the convenience of travel. Such sites around the stations were progressively released for high-density, mixed-use developments with high plot ratios and accessibility to public transport.

MIXED USES

The pace of release of the sites is usually carefully considered, to balance supply with actual demand for development quantum. TOD is a planning approach that aims to create compact, mixed-use communities centered around public transportation nodes.

INTEGRATED PLANNING

The goal is to promote sustainable and efficient urban development by integrating land use and transportation planning.

IMPACT AND TAKEAWAYS

By placing high-density, mixed-use developments near public transit stations, it has encouraged greater use of public transportation and reduced reliance on private vehicles. This has helped alleviate traffic congestion and reduced carbon emissions.

Higher Land Efficiency: TOD promotes land efficiency by maximising land use around transit nodes. By building vertically and creating compact, mixed-use developments, Singapore has made efficient use of limited land resources. reduces urban sprawl.

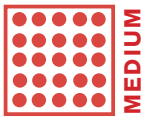
In comparison to non-TOD station site, a TOD station site has higher entropy index of mixed land use and value of Commercial Compactness. In the station area of TOD stations, the entropy index of land usemix averages at 0.76, and the proportion of residential and 44.27%. In the station area of the private estate, the average entropy index of land use mix is merely 0.36, but the proportion of residential land is over 70%. The compactness values of non-TOD sites are far less than that of TOD sites.

3.8

TOKYO
JAPAN

POPULATION
1.40 CR (Census 2022)

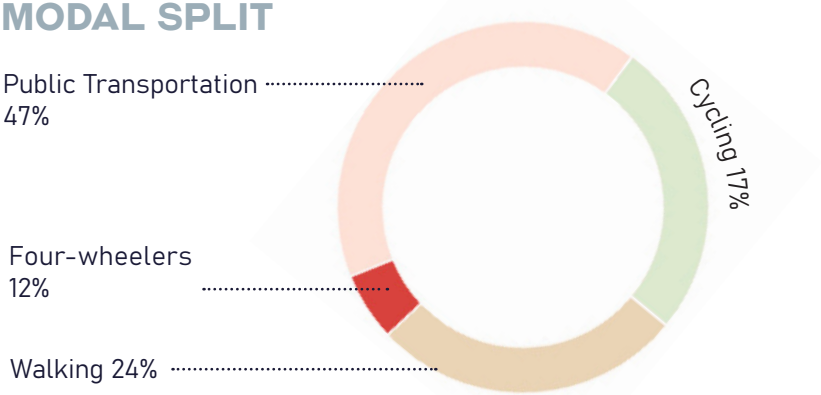
POPULATION DENSITY
6399 PP SQ. KM. (Census 2022)



AREA
2,194 SQ. KM. (Census 2022)

THE CITY IS ABLE TO KEEP PUBLIC TRANSPORT PROFITABLE BY DE-INCENTIVIZING AUTO TRAVEL, WITH COMPLICATED HIGHWAYS AND COSTLY TOLL ROADS

MODAL SPLIT

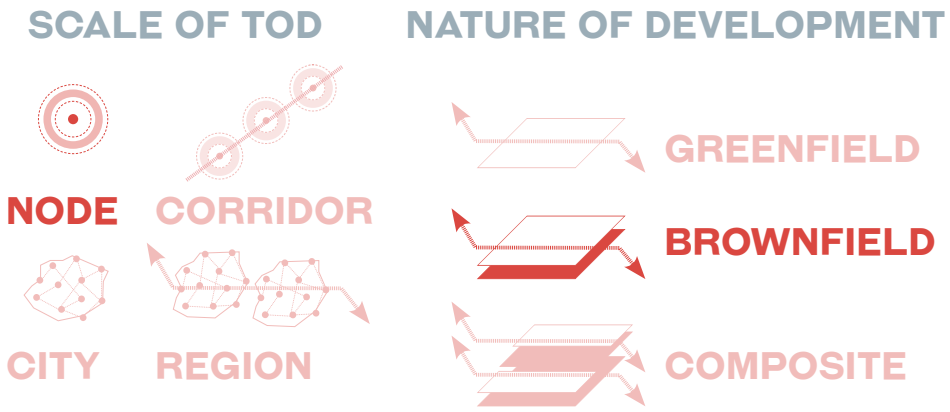


(Source :Deloitte City Mobility Index, Tokyo)

Graphic Source: Author(s)

VISION

Metropolitan level: Realise the multi-polar and decentralised land use by fixing the concentration of population and urban functions in Tokyo.
Corridor level: Strengthen access between Tokyo and suburban core cities and between suburban core cities by road, rail, and others.
Station area: Upgrade urban functions, improve living environment, and develop internationally competitive hubs to deal with a declining birth rate and ageing population.



Information Source: Collated from multiple sources

PROJECT STRUCTURE

The Urban Redevelopment Authority assesses market demand and economic potential when selecting TOD areas. Factors like population density, employment centers, and projected growth play a role in identifying areas with high demand for transit connectivity and urban amenities.

TOD areas require the provision of supporting infrastructure and well-designed public spaces. The URA considers factors such as the availability of utilities, pedestrian and cycling infrastructure, green spaces, and overall urban design quality when selecting and planning TOD areas.

SELECTION OF TOD AREA

Marunouchi was selected as a TOD zone in Tokyo due to its central location, excellent transit connectivity, underutilised land, economic potential, and the broader goal of urban regeneration.

These factors combined to make Marunouchi an ideal location for concentrated development that promotes sustainable transportation and urban growth.

DEVELOPMENT AUTHORITIES

Tokyo Metropolitan Bureau of Transportation

Ministry of Land, Infrastructure, Transport and Tourism

Japan International Cooperation Agency

 Graphic Source: Author(s)

DEVELOPMENTAL STRATEGY

DENSITY

Developers are encouraged to build compact and high-density developments within a short walking distance of transit stations, promotes the use of public transportation, cycling, and walking.

MIX OF USES

Guidelines encourage a blend of residential, commercial, and recreational spaces in close proximity to transit stations.

NMT

Regulations prioritise the provision of sidewalks, bike lanes, and public spaces.

Street designs prioritise safety, accessibility, and human-scale development, promoting walkability and reducing car dependency.

IMPACT AND TAKEAWAYS

Marunouchi's transformation into a TOD zone in Tokyo has been a success.

Through enhanced connectivity, mixed-use development, pedestrian-friendly infrastructure, and a focus on sustainability, the district has become a thriving urban center, setting a benchmark for TOD projects and inspiring cities globally.

The availability of extensive rail and subway networks encourages the use of public transportation, reducing the reliance on private vehicles and minimising greenhouse gas emissions.

The district features pedestrian-friendly streets, wide sidewalks, and well-designed walkways that encourage walking and cycling.

Optimises land use by creating a mix of residential, commercial, and office spaces in close proximity to each other.

This reduces the need for long commutes, supports a live-work-play environment, and minimises travel distances, leading to energy and time savings.

04

TRANSIT
ORIENTED
DEVELOMENT

ROAD MAP FOR ENABLING TOD- CONNECTING THE DOTS

Transit-Oriented Development (TOD) is a strategy for urban development that blends transportation and land use to promote sustainable practices such as maximising the use of public transit services. It prioritises vulnerable road users and creates an environment that improves the access to public transport by improving walking and cycling facilities. This roadmap for TOD, called “Connecting the dots,” outlines the strategies to achieve the concept’s full potential.

4.1 TRANSIT ORIENTED DEVELOMENT

ROADMAP FOR ENABLING TOD

CONNECTING THE DOTS

TOD implementation can be complex, it is essential that cities understand the dynamics at play related to all city systems in both public and private realm- real estate economics, transit routing, infrastructure design, land use planning and zoning, the development of the local economy through urban regeneration, and urban design- to achieve the concept's full potential. Bring together and connecting all dots - land use and transport planning, urban design, urban regeneration, real estate development, financing, land value capture, and infrastructure implementation to ultimately prioritise inclusion and resilience in an optimised environment an therby achieve more sustainable urban development.

01

SYNERGY BETWEEN LAND USE AND TRANSPORT

To achieve spatial balance , new developments may take place according to new corridors of mass transport.

Mass transport acts in combination with other factors generate a dynamic potential for growth and employment.

02

MULTI MODAL INTEGRATION

Improvement of the transit service in terms of frequency and reliability is essential to encourage ridership.

Intermodal Connectivity to establish robust connections between different modes of transit and ensure last-mile connectivity.

Develop transit-oriented amenities like bike-sharing, car-sharing, and park-and-ride facilities

03

ROBUST POLICY FRAMEWORK FOR TOD

Revision of zoning codes and land use regulations is required to align with TOD goals, allowing for higher density and mixed land uses near transit stations.

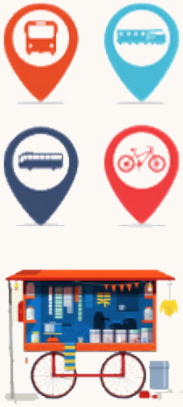
Adoption of Complete Streets policies and guidelines that prioritise safe and accessible streets for all transit users.

Establishment of TOD districts with specific development guidelines and standards to encourage mixed-use, pedestrian-friendly environments.

Information Source: Data collated from multiple sources

ENABLING COMPONENTS IN PUBLIC AND PRIVATE REALM FOR CATALYSING TOD

PUBLIC REALM



MMI (Multi Modal Integration)

Last Mile Connectivity

NMT (Non- Motorised Transport) Integration

Informal Sector Integration

PRIVATE REALM

Quality of urban space and providing convenient and efficient access to a diverse mix of land uses.

Design solution contributes to streets with higher degree of natural surveillance/ 'eyes on the street' from the buildings

Economic opportinities (Allied activities) Integration

04

EQUITABLE AND INCLUSIVE TOD

To prioritise equity and inclusion by addressing the needs of all with affordable housing options, job opportunities, and adopting Complete Streets policies and guidelines. Promote sustainable practices such as green building and renewable energy integration.

05

INCREASED RIDERSHIP OF PUBLIC TRANSPORT

TOD increases the accessibility of the transit stations by creating pedestrian and Non-Motorised Transport (NMT) friendly infrastructure that benefits large number of people, thereby increasing the ridership of the transit facility and improving the economic and financial viability of the system.

IMPACT ASSESSMENT OF TOD (MONITORING AND EVALUATION)

Establishment of key performance indicators (KPIs) to monitor and evaluate the impact of TOD on transportation, land use, and community development.

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