The Urban Unit
Urban Sector Planning & Management Services Unit (Pvt.) Ltd.

TRANSIT ORIENTED DEVELOPMENT

POLICY & IMPLEMENTATION TOOL-KIT *for* SUSTAINABLE URBAN DEVELOPMENT IN PUNJAB

Jain Mandar Casestudy

Punjab Transit Oriented Development Policy

Disclamer

This policy document is intended to serve as a guidance note for relevant authorities and entities in Pakistan regarding planning and implementation of Transit Oriented Development in cities of Punjab. It is imperative that all legally applicable procedures be followed, and that all necessary approvals and sanctions be obtained in accordance with the law prior to implementing any recommendations contained herein.

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Content

Foreword

As Pakistan grapples with the challenges posed by rapid urbanization, air pollution, and reliance on imported fossil fuels, the need for sustainable urban transportation, particularly mass transit systems, has become increasingly urgent. In this context, the government of Punjab is committed to developing master transit systems in its major urban centers—an approach that not only addresses local transportation needs but also contributes to global efforts to reduce carbon emissions and combat climate change. Adopting mass transit-based public transport systems is not just an environmental necessity for Pakistan, but also a strategic imperative to alleviate traffic congestion and reduce dependence on private vehicles.

Punjab is experiencing rapid urban growth which in parallel is exacerbating urban challenges, including congestion, pollution, and inadequate public transport. While mass transit systems exist, they operate sub-optimally with limited integration and accessibility. To address these issues, the Transit-Oriented Development (TOD) Policy is drafted proposing a comprehensive, sustainable urban development framework that integrates land use with transit planning, fostering compact, mixed-use, pedestrian-friendly communities centered around transit hubs.

The TOD policy envisions a future for Punjab that prioritizes sustainable, people-centric urban growth, balancing economic, social, and environmental goals. It seeks to create resilient urban environments that enhance the quality of life for all residents by aligning development with robust transit infrastructure.

Drawing inspiration from international success stories such as Singapore, Copenhagen, and Tokyo; this approach demonstrates how a TOD policy can reduce car dependency, increase public transit ridership, and improve urban livability. In Singapore, high-density development along transit corridors has not only boosted economic productivity but also fostered a sustainable urban environment. Similarly, Hong Kong's integration of transit investment with equitable housing strategies has created vibrant, socially inclusive neighborhoods. Cities like Tokyo and New York City have effectively used TOD to finance urban transit and promote sustainable growth.

With TOD, Punjab has the opportunity to transform its cities into engine of economic growths long visioned by the policy makers.

Executive Summary

Punjab is undergoing rapid urbanization, with its population projected to reach 184 million by 2047. This demographic growth has intensified urban challenges, such as congestion, pollution, and inefficient transportation networks. While the province has made notable investments in mass transit infrastructure such as the Bus Rapid Transit (BRT) systems in Lahore, Rawalpindi, and Multan, and the Orange Line Metro Train in Lahore; unfortunately, these initiatives have not yet achieved widespread accessibility or integration. Current development trends often focus on Transit Adjacent Development (TAD), which emphasizes transit infrastructure without adequately addressing the surrounding land use, limiting their overall impact.

To bridge these gaps, the Transit Oriented Development (TOD) Policy for Punjab offers a comprehensive framework for sustainable urban growth, drawing on global best practices to integrate land use and transportation planning. The underlying TOD policy envisions compact, mixed-use, pedestrian-friendly communities centered around high-quality transit stations. It advocates for simultaneous planning of both transit infrastructure and adjacent land use, optimizing accessibility and urban efficiency. By promoting development within an 800-1,000-meter radius of transit hubs, TOD encourages vibrant, walkable neighborhoods with a balanced mix of residential, commercial, and recreational spaces.

Implementing the TOD policy in Punjab will improve public transit access, integrate long-needed multimodal transport systems, and encourage vertical urban growth. Additionally, the policy addresses the inefficiencies of horizontal sprawl, which has significantly raised infrastructure costs and degraded environmental quality. It introduces inclusive housing models to ensure equitable access to transit and incorporates affordable housing provisions to mitigate the risk of gentrification.

A key component of this policy is the use of land value capture (LVC) mechanisms to fund transit and urban infrastructure. By directing the increased land and property values around transit hubs into public investments, LVC ensures financial sustainability and reduces reliance on public subsidies.

This policy offers a pathway for addressing Punjab's urban challenges by harmonizing development with transit infrastructure; thus the policy sets the foundation for a resilient urban future that aligns transportation investments with sustainable development objectives.

Preamble

Urbanization is one of the most transformative processes of the 21st century. The global urban population is projected to double by 2050. In Pakistan, the urban population is expected to grow from the current 75 million to approximately 168 million by 2047—more than doubling in size. Similarly, Punjab's population will rise to 184 million, and Lahore's to 24 million, if current growth rates persist. Currently, Punjab is 37% urbanized, according to the 2017 census, and this urbanization trend will drive increasing demand for both soft and hard infrastructure.

Pakistani cities face a multitude of challenges, including traffic congestion, deteriorating air quality, high rates of road accidents, and a rapidly increasing number of motorized vehicles—particularly motorcycles. Rising motorization has resulted in longer travel distances and times. In response, various provincial governments have initiated the planning and implementation of Mass Transit Systems in major urban centers. Punjab currently operates three Bus Rapid Transit (BRT) systems in Lahore, Rawalpindi, and Multan. Karachi has two operational BRT lines, with two additional lines under planning and construction. Similarly, Peshawar operates one BRT line, while Quetta is also planning a mass transit system. In addition to these BRT systems, Lahore has a rail-based transit line, the Orange Line Metro Train.

Despite these efforts, mass transit systems in Pakistan—apart from Peshawar—fail to serve the majority of the population effectively or provide comprehensive coverage due to poor system integration. For instance, Lahore's Speedo feeder buses and the Orange Line have not significantly improved public transit accessibility or availability for most residents. As a result, many commuters find public transit inaccessible or unavailable at the times and locations they require.

First-generation BRT systems in Pakistan, which primarily operate on point-to-point corridors, struggle to meet demand during peak hours, with buses often operating at full capacity. Despite this high ridership, provincial governments particularly in Punjab bear substantial financial burdens due to heavy subsidies, while revenues remain limited to farebox collections. To address these challenges, there is an urgent need to explore alternative revenue streams, particularly non-farebox revenue options. Among these, land value capture (LVC) through Transit-Oriented Development (TOD) is globally recognized as a sustainable solution.

Unfortunately, Pakistan's mass transit systems, especially in Lahore, exhibit characteristics of Transit-Adjacent Development (TAD) rather than true TOD. The critical difference is that TAD focuses solely on providing transit infrastructure, whereas TOD integrates land use planning with transit development to maximize accessibility and urban efficiency. TOD emphasizes simultaneous planning for public transportation and accessible land use, ensuring mixed-use development around transit hubs to optimize connectivity and commuter convenience.

In Lahore, for example, integrating TOD principles into planning is essential to improve public transit accessibility, quality, and capacity while leveraging land value for urban development. TOD can drive sustainable urban growth by enabling higher densities, enhancing connectivity, and providing better access to jobs and services. By aligning land use planning with transit networks, TOD facilitates mixed vertical land utilization, captures increased land value, and channels these resources into urban redevelopment and transformation.

Implementing Transit-Oriented Development is not only critical to addressing Pakistan's urban mobility challenges but also essential for achieving sustainable urban development. This requires a paradigm shift in planning, focusing on accessibility, integration, and the optimal utilization of transit systems to meet the demands of rapidly growing urban populations.

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Rational of Transist Orinted Development

A Sustainable Urban Growth Strategy

Transit-Oriented Development (TOD) is an urban planning and design strategy aimed at fostering compact, mixed-use, pedestrian- and bicycle-friendly urban development centered around high-quality transit stations. TOD integrates land use and transportation planning to create communities that encourage the use of mass transit and non-motorized travel (NMT), such as walking and cycling. By strategically locating jobs, housing, shops, public amenities, and green spaces near transit hubs, TOD aims to create inclusive, resilient, and sustainable urban environments. Modern definitions of TOD emphasize its role as a transformative approach to urbanization. The World Bank and other global institutions define TOD as a framework for creating high-density, mixed-use areas within walking distance of transit stations to promote economic development, reduce car dependency, and enhance livability. The International Transport Forum (ITF) highlights TOD as critical for building sustainable cities, integrating land use with mobility to optimize urban growth.

Environmental and Economic Benefits of TOD

TOD has proven to be an effective policy instrument for addressing environmental and economic challenges. In cities like Lahore, where excessive emissions from motorized transport have severely degraded air quality, TOD offers a viable solution to reduce the carbon footprint and improve environmental conditions. Concentrating development around transit nodes encourages a shift from private vehicles to public transport, significantly reducing greenhouse gas emissions. In addition to environmental benefits, TOD enhances firm productivity and worker livability, both of which are critical drivers of economic growth. By connecting households to jobs and services within a 1-kilometer radius of transit stations, TOD promotes sustainable urban growth and optimal utilization of transit capacity during peak hours.

Strategic Land Use Planning

Effective TOD requires mixed-use land development within a defined buffer area around transit stations—typically an 800- to 1,000-meter radius. This approach ensures accessibility to transit while creating vibrant, walkable neighborhoods that balance residential, commercial, and recreational uses. By concentrating higher densities near transit hubs, TOD maximizes the efficiency of public transport systems and supports the creation of self-contained communities.

A Response to Modern Challenges

TOD is a direct response to the pressing challenges of contemporary urbanization, including:

a. rising energy costs,

b. road congestion,

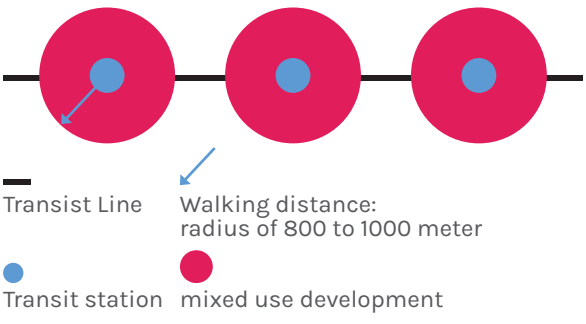
c. climate change,

d. limited housing options,

e. growing demand for urban living, and

f. the push for green building practices and walkable neighborhoods.

By emphasizing sustainable, high-density development around transit stations, TOD offers a path to resilient urban growth, environmental sustainability, and improved quality of life. In the context of Pakistan's rapidly urbanizing cities, adopting TOD principles is not just an opportunity but an urgent necessity for sustainable urban transformation.



Need For A Tod Policy

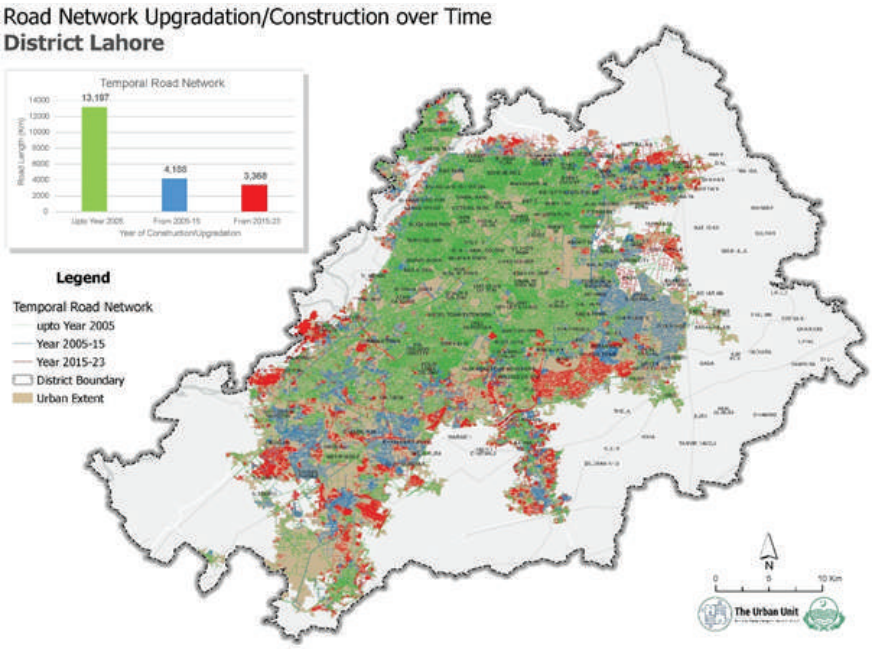
TOD is not a theoretical concept; it has been successfully implemented in major cities worldwide, including Singapore, New York City, Tokyo, Hong Kong, Copenhagen, Delhi, and Hyderabad. These cities have leveraged TOD to achieve sustainable urban growth, reduce traffic congestion, and improve overall quality of life. The underlying principle of TOD—integrating land use with transportation planning—is universally applicable and scalable to both large metropolitan areas and smaller cities.

In Pakistan particularly Punjab, however, TOD concept remains largely unexplored, despite its potential to address the urban mobility means sustainability challenges. In reality, lack of integrated planning between land use and transport has led to inefficient urban sprawl and increased reliance on private vehicles, exacerbating issues like road congestion and pollution. Notably, cities in Punjab are sprawling at an average rate of 5.6% annually since the last two decades in terms of area while the population is increasing at rate of 4.71% according to the Punjab Cities Growth Atlas 1995-2015.

Urban expansion in Punjab is outpacing population growth, with urban land consumption increasing disproportionately. The average land consumption index for Punjab cities stands at 1.37, meaning that for every unit increase in population, urban areas expand by 1.37 units. This indicates that each additional resident is consuming more land than before. Concurrently, this horizontal urban sprawl is directly impacting road network growth, leading to higher road densities and greater road availability in cities. The figure below illustrates the progression of road expansion in Lahore District across three periods: up to 2005, from 2005 to 2015, and from 2015 to 2023.

However, increased road density resulting from urban sprawl drives up the cost of delivering basic services by 30-50%. In contrast, global best practices demonstrate that Transit-Oriented Development (TOD) promotes vertical urban expansion, allowing cities to accommodate population growth without proportional increases in road density and urban sprawl. To address these challenges, cities in Pakistan especially those in Punjab must urgently adopt and implement TOD strategies.

Implementing TOD can bring the following transformative benefits:



Enhanced Economic Competitiveness:

Higher built densities and centralized job hubs drive agglomeration economies, significantly enhancing a city's competitiveness. Doubling job density can increase economic productivity by 5-10%, as seen in some of the world's most competitive cities, where 60% of office space is concentrated within just 9 square kilometers, maximizing efficiency and accessibility.

In contrast, cities in Punjab have adopted a horizontal development pattern, consuming excessive land for urban expansion. This sprawl not only wastes valuable land resources but also leads to longer travel distances, increased commute times, and reduced overall efficiency in urban mobility and economic activity. Transitioning to compact, vertically integrated development is critical for improving productivity and sustainability.

Vibrant and Inclusive Urban Areas:

Concentrating housing, jobs, public spaces, and transit infrastructure fosters vibrant, inclusive neighborhoods, reducing travel distances and promoting active, connected communities. However, the "place for people" concept is currently absent from Punjab's planning framework. This gap has led to the development of disjointed and standalone transport nodes, lacking integration with their surrounding urban environment, thereby diminishing their effectiveness and potential to create cohesive, people-oriented spaces.

Improved Transit Access and Reduced Vehicle Dependence:

Transit-Oriented Development (TOD) promotes pedestrianization and the establishment of Non-Motorized Transport (NMT) infrastructure, enhancing accessibility to transit stations. This approach reduces dependency on motorized vehicles and encourages greater public transit usage. However, motor vehicle registration statistics in Punjab reveal a significant reliance on private vehicles, underscoring the urgency of shifting this trend. Addressing this dependency is essential not only to alleviate traffic congestion but also to tackle the persistent SMOG issues that have plagued Punjab's cities in recent years, severely impacting public health and environmental quality.

Increased Real Estate Values and Economic Growth:

Proximity to mass transit hubs significantly boosts real estate values and drives GDP growth by fostering mixed-use neighborhoods that seamlessly integrate housing, jobs, and amenities. Unfortunately, this dynamic is notably absent in Punjab's cities. Despite their claim of being engines of economic growth, their actual contribution remains minimal due to a lack of congestion free mobility-oriented planning and integration, which hinders their potential to maximize economic and urban development opportunities.

Sustainable Urban Financing:

Cities can capture the increase in land and real estate values through mechanisms like land value capture (LVC). This additional revenue can be reinvested in local public amenities, including transit improvements, public spaces, affordable housing, and water and sanitation services.

Inclusive Development:

While transit investments may lead to gentrification, TOD can counteract this by creating inclusive neighborhoods that improve access to jobs, housing, and services for all income groups.

Reduced Carbon Footprint:

TOD minimizes environmental impact by clustering diverse land uses within transit hub catchment areas, reducing carbon emissions and fostering sustainable growth.

Optimal Land Utilization and Disaster Risk Reduction:

By promoting high-density housing in low-risk areas, TOD ensures more efficient land use while reducing exposure to natural hazards and enhancing disaster resilience. For Punjab's cities, transitioning from unchecked horizontal expansion to sustainable vertical growth through TOD is essential. By integrating land use and transport planning, TOD not only addresses urban sprawl but also enhances economic productivity, social inclusivity, and environmental sustainability, setting a strong foundation for future urban growth.

Purpose of TOD Policy

The purpose of a Transit-Oriented Development (TOD) Policy for Punjab is to offer clear guidance and policy direction to provincial and local governments and transport authorities for promoting TOD principles and integrating mass transit planning with land use strategies. The core premise of this policy is that land use and urban transport must be planned and managed together to ensure sustainable, efficient, and inclusive urban growth. This alignment fosters vibrant, connected communities, optimizes public transit investments, and promotes a balanced approach to urban development.

Vision of TOD Policy

The vision of a Transit-Oriented Development (TOD) Policy for Punjab is to create sustainable, people-centric communities by promoting compact, mixed-use, and appropriately dense urban development around transit stations. Unlike vehicle-oriented roadways, this vision prioritizes accessible, pedestrian- and bicycle-friendly infrastructure, ensuring that jobs, housing, shops, amenities, public spaces, and green areas are strategically integrated near transit hubs. TOD seeks to encourage Active mode of Transport i.e., non-motorized transport (NMT) provision and expand the use of mass transit systems while integrating land use with these means of transport. By incorporating thoughtful placemaking strategies, it aims to transform high-density developments into vibrant, livable, and inclusive spaces that cater to the needs of all community members.

The Principles of TOD Policy

a) Align human densities, economic densities, mass transit capacity, and transit network characteristics for greater accessibility.

b) Create compact regions with short commutes.

c) Ensure the resilience of areas connected by mass transit.

d) Plan and zone for mixed-use and mixed-income neighborhoods at a corridor level.

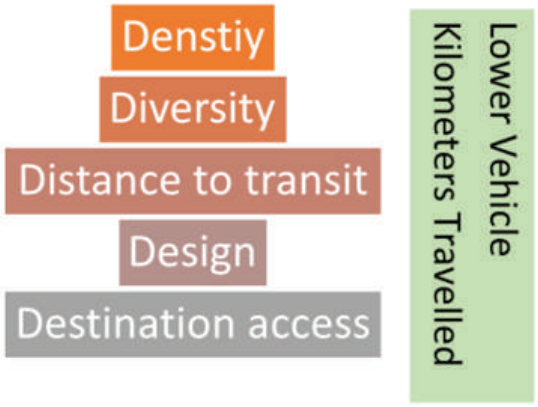
e) Create vibrant, people-centric public spaces around mass transit stations.

f) Develop neighborhoods that promote walking and cycling.

g) Develop good-quality, accessible, and integrated public transit.

h) Manage demand for private vehicles.

The key to lower Vehicle Kilometers Travelled (VKT) and higher trips on the transit system is ensured by five D's listed below in figure 2 ((Cervero & Kockelman, 1997) (Ewing & Cervero, 2010).



02

Transist Orinted Development Policy

People and Place Integration

Area of Influence for TOD

i. Designate the TOD area within an 800 to 1,000-meter radius from the transit station or stop, equivalent to a comfortable walking distance.

ii. Ensure this radius encompasses key urban functions and promotes pedestrian accessibility to transit services.

Integration in City Master Plans

i. Clearly identify the TOD influence areas in the master plans of applicable cities in Punjab.

ii. Align the designated TOD areas with urban development strategies, land use policies, and zoning regulations to optimize transit acces*sibility and land utilization.

Example: Copenhagen, Denmark implemented the "Finger Plan," emphasizing public spaces along transit corridors to integrate communities and promote pedestrian activity. Likewise, the city's water front public spaces can be used as a model for integration.

High density compact development

Promote High-Density Development

i. Concentrate jobs and population within the TOD influence area, featuring multiple street intersections to enhance accessibility.

Street Intersection Density

i. Maintain a minimum density of 100 street intersections per square kilometer within an 800-meter radius of each station to ensure walkability and ease of movement.

Suggested Floor Area Ratios (FARs)

i.High density suggested FARs are 8 for high rise zone 1, 12 for high rise zone 2 and 16 for skyscrapers as per the building regulations.

Balanced Activity Mix

i. Achieve a job-to-resident ratio between 0.50 to 0.70, ensuring a balanced mix of economic and residential activities within the TOD area.

Human Density Metrics

i. Evaluate the combined density of residents and jobs per square kilometer to gauge the vibrancy and economic potential of the TOD area.

Job Accessibility

i. Maximize job opportunities accessible via the transit station, focusing on jobs reachable within 30–45 minutes on foot or using public transit.

Optimized Real Estate Use

i. Prioritize premium real estate developments around the stations:

o High-premium use within a 400-meter radius of the station.

o Lower-premium use between 400 and 800 meters from the station.

Market Transactions and Economic Contribution

i.Encourage a high volume of market transactions in the TOD area to measure economic activity.

ii. Track the contribution of these transactions to the city's GDP and identify additional real estate demands at the city level.

Example: Singapore encourages high-density commercial and residential development along its MRT corridors to enhance economic efficiency.

Mixed Use Requirement

Land Use Diversity

i. Ensure a variety of land uses within an 800-meter radius of each transit station, including commercial spaces, grocery stores, restaurants, laundry shops, schools, healthcare facilities, and retail outlets, to support a comfortable and vibrant living environment.

Social Infrastructure Density

Evaluate and maintain a high frequency of educational, health, and cultural services within the TOD influence area to maintain diversity and to cater to community needs.

Minimum FAR Allocations

i. Mandate specific land use allocations for all developments:

o Residential Use: Minimum 30% of the overall FAR or covered area.

o Commercial Use: Minimum 5% of the overall FAR.

o Community Facilities: Minimum 10% of the overall FAR.

Flexible Land Use Based on Zoning

i. Allocate the remaining FAR according to the zoning classification:

o For predominantly commercial areas, prioritize commercial uses for the residual FAR.

o Similarly, for residential or industrial zones, adjust the remaining land use to align with the area's primary function.

Example: Paris, France promotes mixed-use neighborhoods around metro stations to reduce travel times and create vibrant communities.

Inclusive Housing

Promote High-Density Development

Role of Housing in TOD

i. Establish housing as a core component of TOD areas to create walkable, accessible, and inclusive neighborhoods.

Proximity to Transit

i. Ensure that housing developments are within walking distance of transit stations to promote ease of access and reduce reliance on private vehicles.

Mandatory Residential Allocation

i. Allocate a minimum of 30% of the total FAR in TOD areas for residential use to support vibrant, mixed-use communities.

Affordable Housing Provision

i. Dedicate an additional 15% of the built-up area within the TOD influence zone for lower-income groups, promoting social equity and ensuring access to affordable housing options as part of the TOD mandate.

Parking and Accessibility

Discouraging Private Vehicle Use

i. Reduce parking space supply in TOD areas to prioritize mass transit access and discourage private vehicle use.

ii. Implement higher parking fees to lower demand for parking in TOD zones.

On-Street Parking Restrictions

i. Prohibit on-street parking within 100 meters of transit stations, except for temporary uses such as disabled access, emergency vehicles, and freight delivery.

ii. Where permitted, use on-street parking as a buffer between motorized traffic and pedestrian/bicycle paths.

Shared Parking Strategies

i. Optimize parking space utilization by enabling shared use across different land uses with varying demand times (e.g., office parking during the day and residential parking at night).

Strict Parking Enforcement

i. Enforce a strict parking policy, including heavy penalties for illegal parking within the TOD area.

ii. Introduce dynamic pricing for parking based on time of day and duration to manage demand effectively.

Parking Restrictions by Proximity to Transit

i. Apply tight parking restrictions within the first 250 meters of transit stations, with slightly relaxed standards in the next 250 meters.

ii. Ensure restricted parking is supported by high-quality public transit systems.

Parking Space Allocation

i. Allow a maximum of 1.33 equivalent car spaces per 100 square meters of floor area within the TOD influence area.

ii. Permit additional shared parking spaces within a 500-meter radius of transit corridors for public use at all times.

Public Open Spaces and Circulation

Development and Maintenance Responsibility

i. Public open spaces must be designed, developed, and maintained by the developer or an authorized agency as part of the TOD scheme.

Land Use for Public Open Spaces

i. Allocate 20% of the land area in an integrated scheme of at least 4 hectares for public open spaces.

Accessibility and Usage

i. Public open spaces must remain open and ungated for public use at all times.

ii. Non-compliance will result in the space being occupied and managed by a government agency.

Green Space Allocation

i. Dedicate 10% of the amalgamated plot area for green spaces, promoting environmental sustainability.

Roads and Circulation

Reserve 20% of the land for roads and circulation, ensuring efficient movement and connectivity within the TOD area.

Pedestrian and Non-Motorized Transport Accessibility

Pedestrian and Bicycle Accessibility

i. Ensure walkability within an 800-meter radius (approximately a 10-minute walk) of each transit station.

ii. Design block sizes of 100 meters by 100 meters to encourage vibrant, walkable urban environments.

Bicycle and Pedestrian Connectivity

Provide infrastructure for footpaths and bike lanes, ensuring seamless connectivity for pedestrians and cyclists.

Footpath Standards

i. Maintain continuous, encroachment-free footpaths for pedestrian mobility.

ii. Footpath width standards:

o At least 1.8 meters in residential areas.
o At least 2.5 meters in commercial areas.

Traffic Calming Measures

i. Promote safe spaces for walking and cycling by reducing motorized vehicle speeds and volume within TOD areas.

ii. Enforce Speed limits:

o Streets with ROW ≤ 12 meters: Maximum speed of 20 km/h.

o All other streets: Maximum speed of 40 km/h.

Multimodal Integration

Seamless Transport Integration

i. Ensure seamless connectivity among various modes of transport within TOD influence areas, providing accessible and user-friendly information about available services.

End-to-End Multimodal Journeys

i. Facilitate integrated transport from origin to destination, enabling smooth transitions across different modes of transport.

Integrated Fare Systems

i. Implement a unified fare payment system to allow commuters to pay for multiple transport modes using a single platform, enhancing user convenience.

Supporting Multimodal Infrastructure

i. Provide infrastructure for feeder buses, non-motorized transport (NMT), and intermediate public transport to support multimodal integration.

ii. Include dedicated pick-up and drop-off spaces near transit stations.

iii. Ensure adequate bicycle parking and prioritize park-and-ride facilities as a last resort to minimize reliance on private vehicles.

Urban Design for Street Frontage

Building Orientation and Setbacks

i. No building setbacks are required to promote density and proximity to transit hubs.

ii. Buildings must front public streets to create a continuous and visually appealing building street wall.

Active Frontages for Vibrant Streetscapes

i. Active frontage is mandatory for streets with a right of way (ROW) greater than 12 meters.
ii. Active frontage design should encourage interaction through transparent windows, doorway entrances, and active street-level uses like shops, cafes, or restaurants.

Promoting Safety and Street-Level Vibrancy

i. Design principles must enhance the "eyes on the street" concept, fostering safety and vibrancy by ensuring pedestrian activity and natural surveillance from ground and upper building levels.

Commercial Transparency Requirements

i. Ground or street-level commercial spaces must ensure at least 50% transparency in their frontage to maximize visual interaction and connectivity with pedestrians.

Inclusive Spaces for Street Vendors

i. Designate specific spaces for street vendors to support inclusive economic growth and offer shopping variety.

ii. Ensure these spaces do not encroach on the ROW to maintain accessibility for non-motorized transport (NMT) and motorized vehicles.

Land Value Capture and Financing TOD

Land Value Capture (LVC) is defined as a public financing method by which government can:

o Trigger an increase in land values via investment decisions (building mass transit) and/ or regulatory decisions (e.g., change in land use or FAR));

o Institute a process to share this land value increment by capturing part or all of the change; and

o Use LVC proceeds to finance infrastructure investments (e.g., investments in transit and TOD), any other improvements required to offset impacts related to the changes (e.g., densification), and/or implement public policies to promote equity (e.g., provision of affordable housing to alleviate shortages and offset potential gentrification).

Principles of Land Value Capture (LVC)

i. Value Creation: Improve access through transit investments and develop frameworks for betterment levies and auctioning rights.

ii. Equitable Contribution: Those benefiting from increased property or service values due to TOD should contribute to the cost of its development and connectivity improvements.

Utilization of LVC Proceeds

i. Infrastructure Financing: Use captured value to fund transit infrastructure and TOD-related investments.

ii. Mitigating Urban Impacts: Allocate proceeds to offset densification-related challenges and infrastructure demands.

iii. Promoting Equity: Direct LVC revenues towards public policies like affordable housing initiatives to mitigate potential gentrification and ensure inclusivity.

Coordination and Implementation

Institutional Setup

Implementation of TOD will require various agencies to work together on housing, roads, water and sanitation and other infrastructure. Therefore, clear roles of responsibilities and coordination must be defined.

i. A new urban renewal authority has to be established with a province-wide jurisdiction and a very clear mandate. However, as mass transit network is presently most developed in Lahore, the other option is to have a dedicated directorate with a local authority such as Lahore Metropolitan Corporation or Lahore Development Authority (LDA). Such directorate can gradually transform into a center of excellence in TOD and provide services on province-wide basis.

ii. A dedicated government authority is usually the response to a situation requiring the delivery of hard infrastructure or other government services.

iii. The idea is to create a comprehensive urban renewal authority with mandate and powers for rezoning, capabilities in master planning, and the intent to produce new property value. The authority will have the mandate to deliver quality TOD and transit infrastructure, construct access points, built TOD style housing, and public amenities. The authority can also partner with the private sector to complete the aforementioned provisions.

iv. The proposed mandates of this new urban redevelopment authority will be to:

• Acknowledge and accept the broader and imperative role of integrated land use planning and development of transport master plans.

• Capture value of land through TOD and transit infrastructure development and also carry out the much-needed task of comprehensive urban renewal, the need of the hour in many parts of urban Pakistan.

• Demarcate jurisdiction areas as done by the Walled City Lahore Authority for example, of TOD zones where attention will be focused and where development will be transit oriented and of high density

• Focus on urban design and conservation efforts for urban renewal of old areas.

• Coordination with relevant agencies to avoid overlap and operations in silos, such as with Punjab Mass Transit Authority, The Urban Unit, Excise & Taxation, Waste Management Companies, WASAs, WAPDA, and LDA for example.

v. Define roles for municipal bodies, transit agencies, private developers, and community stakeholders.

vi. Encourage public-private partnerships (PPPs) for infrastructure and real estate development.

Regulatory Framework

i. Amend zoning regulations to allow for mixed-use, high-density developments.

ii. Mandate minimum residential and commercial uses within an 800-meter radius of transit stations.

iii. Implement parking restrictions and promote shared parking facilities.

Financing Mechanisms

i. Land Value Capture (LVC): Use tools such as betterment levies, rezoning fees, and auctioning development rights.

ii. Tax Increment Financing (TIF): Allocate increased tax revenues from TOD areas to finance transit infrastructure.

iii. Grants and Bonds: Leverage municipal bonds and grants for large-scale TOD projects.

Community Engagement

i. Conduct public consultations at all stages of planning and implementation.

ii. Use participatory planning tools like charrettes and stakeholder workshops.

03

TOD Roadmap Summary

TOD Roadmap

a) Understanding need for TOD
b) Determine a TOD vision
c) Identify stakeholders and roles for TOD planning
d) Structure a TOD organization if required
e) Assess existing policies and regulations regarding TOD
f) Create TOD supportive regulatory and zoning framework
g) Public outreach and citizen engagement
h) Finalize transit route and stations
i) Determine if TOD station area is ready for TOD implementation?
j) Align policies for different types of station areas based on clustering stations and development intensity
k) Policy levers to improve node, market and place values
l) Infrastructure Carrying Capacity Assessment
m) Create TOD plan, strategies and policies at selected scale: site, station, corridor or city level
n) Finalize transit infrastructure costs
o) Identify investment gaps and propose innovative funding mechanisms
p) Phasing of development and contribution to infrastructure/incentives needed
q) Monitor progress compared to plan

a) Understanding need for TOD

"Transit Oriented Development (TOD) is a planning and design strategy to ensure compact, mixed use, pedestrian- and bicycle-friendly, suitably dense urban development organized around the transit stations ." TOD promotes locating jobs, housing, shops and amenities near the transit stations encouraging NMT (non-motorized travel) and the use of mass transit. TOD is intended to be inclusive and resilient. It also supports careful place making to soften the perception of high densities.

b) Determine a TOD vision

A TOD vision for a city should be developed at a local government (or equivalent) level. It should be linked to the comprehensive urban development plan, or/and city land use plan. The vision can be helpful in planning for sustainable and inclusive growth.

c) Identify stakeholders and roles for TOD planning

It is fundamental to identify the main stakeholders involved in TOD for planning and coordination between key departments and stakeholders

d) Structure a TOD organization if required

A special body (task force, committee or agency) should be enacted by law or official notification to create, manage and implement the TOD plan.

e) Assess existing policies and regulations regarding TOD

The following existing (but not limited to) policies, rules and regulations should be assessed before formulating TOD specific regulations:

- Building regulations
- Land use rules
- Building code and standards
- Private housing scheme rules
- Master plans
- Outline development plans

f) Create TOD supportive regulatory and zoning framework

After reviewing and assessing different regulations, the city development regulation (building and zoning) must be updated and amended for TOD. The existing regulations must be replaced where possible or new transit supportive regulation must be created for the following metrics at least:

- Setbacks
- Block Width
- Complete Streets Standards
- Pedestrian & Bicycle Standards
- Suggested Land Use Mix
- Density Matrix
- Street Frontage
- Parking

g) Public outreach and citizen engagement

Successful TOD projects are 50% professional knowledge and best practices and 50% localized residents' knowledge. Participatory planning provides citizens the opportunity to govern their city and neighborhood and become a part in the decision making process.

h) Finalize transit route and stations

Assess people and job density, destinations and land use, potential and desired connections, and existing stakeholder recommendations and viable modes to finalize transit routes and stations.

i) Determine if TOD station area is ready for TOD implementation?

The urban policy literature suggests that three values (3V) of a neighborhood must be assessed to determine if the neighborhood and particular transit stations are feasible for TOD –

1) transit connectivity,

2) quality of urban environment and

3) market potential. This helps determine what kind of transit oriented development is viable in each neighborhood.

• Node value – measures how important a mass transit station is based on passenger traffic volume, connections between different modes of transport, and central locations within the network.

• Place value – determines how attractive a place is by assessing the quality of urban space including amenities; schools; health care facilities; type of urban development; local accessibility to daily needs by walking and cycling; quality of the urban fabric around the station, in particular its pedestrian accessibility; small size of urban blocks and fine mesh of connected streets, which create vibrant neighborhoods; and mixed pattern of land use.

• Market potential value - is the unrealized market value of a station area, sometimes measured through a composite index considering major drivers of demand, including current and future human densities, current and future number of jobs accessible within 30 minutes by transit, and major drivers of supply (including the amount of developable land, potential changes in zoning, and market vibrancy).

j) Policies for different types of station areas based on clustering stations and development intensity

• Infill: infill is recommended if the place value is suburban and node value is a single line station and it has low market value. Infill is “reuse of urban land for new, higher density construction ”. Affordable housing is an opportunity in such areas.

• Intensification: locations with built-up areas and existing public transit should have higher than existing densities. These are emerging stations in urban areas with intersections and potential markets. Affordable housing is an also opportunity in such areas.

• Transformation: strategy applies to mega hubs. High real estate value is expected when there is high place value created through job densification and high quality urban design.

k) Policy levers to improve node, market and place values

Type of value	Policy lever
Node	Increase the number of hubs and the number of lines/modes they connect to. Interlink neighboring stations into clusters. Increase accessibility for all within the network.
Place	Increase compactness (proximity to existing urban activity and short travel time to main destinations). Increase the diversity of uses. Increase the concentration of commercial, cultural, and educational amenities. Design neighborhoods that promote walking and cycling. Create a vibrant public realm.
Market potential	Increase residential density. Increase job density. Increase human density. Increase the diversity of land parcels to create a vibrant land market. Increase floor area ratios.

l) Infrastructure Carrying Capacity Assessment

Infrastructure is essential to lay the foundation while planning any city. Any TOD development and its viability depends on the carrying capacity of infrastructure. Hence, an assessment of infrastructure is necessary to ensure that the current infrastructure provision is sufficient and has the capacity to uphold future growth. If there is a mismatch between current and future needs and infrastructure capacities due to unanticipated growth, living conditions will further deteriorate. The following methods explain in detail below need to be followed:

• Infrastructure assessment goals

o Physical Infrastructure is high cost investment and essential for city development.

o Social Infrastructure guides the quality of life in any city depending on the access and affordability of it.

• Infrastructure assessment process

o Existing infrastructure inventory
o Existing demand analysis
o Future development plan
o Future demand analysis
o Assess carrying capacity
o Capital and operating cost estimates

m) Create TOD plan, strategies and policies at selected scale: site, station, corridor or city level

The following 14 objectives and 25 quantitative metrics must be captured in the TOD plan adapted from ITDP Scorecard (2017).

1. Walk – Develop neighborhoods that promote walking

i. OBJECTIVE A. The pedestrian realm is safe, complete, and accessible to all.

ii. OBJECTIVE B. The pedestrian realm is active and vibrant.

iii. OBJECTIVE C. The pedestrian realm is temperate and comfortable.

- o Metric 1.A.1 Walkways
- o Metric 1.A.2 Crosswalks
- o Metric 1.B.1 Visually Active Frontage
- o Metric 1.B.2 Physically Permeable Frontage
- o Metric 1.C.1 Shade and Shelter

2. Cycle – Prioritize non-motorized transport networks

iv. OBJECTIVE A. The cycling network is safe and complete.

v. OBJECTIVE B. Cycle parking and storage is ample and secure.

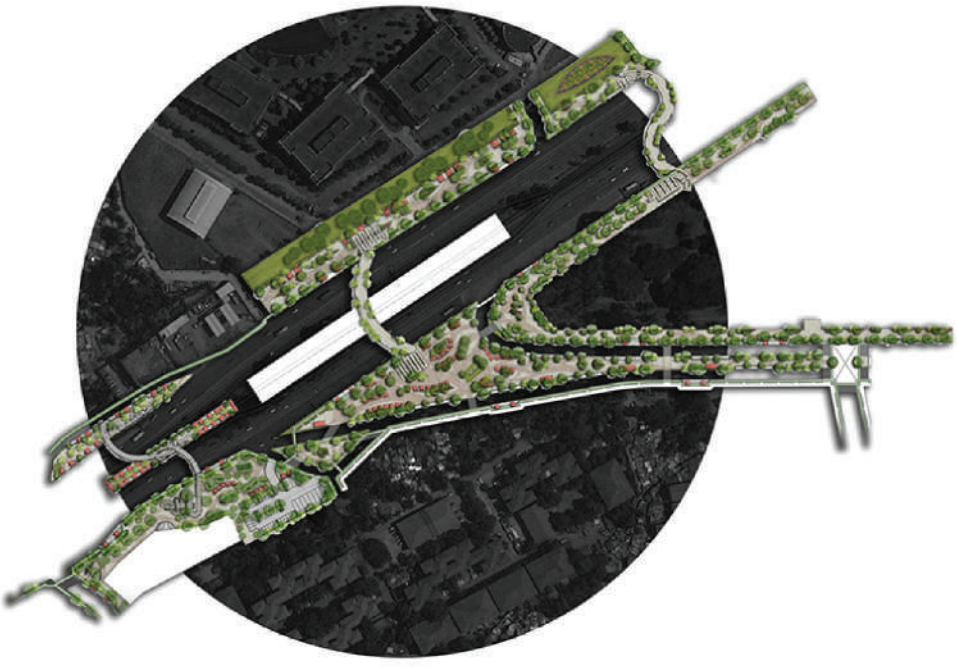
- o Metric 2.A.1 Cycle Networks
- o Metric 2.B.1 Cycle Parking at Transit Stations
- o Metric 2.B.2 Cycle Parking at Buildings
- o Metric 2.B.3 Cycle Access in Buildings

3. Connect – Create dense networks of streets and paths

vi. OBJECTIVE A. Walking and cycling routes are short, direct, and varied.

vii.OBJECTIVE B. Walking and cycling routes are shorter than motor vehicle routes.

- o Metric 3.A.1 Small Blocks
- o Metric 3.B.1 Prioritized Connectivity
- o Assess carrying capacity
- o Capital and operating cost estimates



4. Transit – LocateDevelopment Near High Quality Public Transport

viii. OBJECTIVE A. High-quality transit is accessible by foot. (TOD Requirement)

o Metric 4.A.1 Walking Distance to Transit

5. Mix – Plan for Mixed Uses, Income and Demographics

ix. OBJECTIVE A. Opportunities and services are within a short walking distance of where people live and work, and the public space is activated over extended hours.

x. OBJECTIVE B. Diverse demographics and income ranges are included among local residents.

- Metric 5.A.1 Complementary Uses
- Metric 5.A.2 Access to Local Services
- Metric 5.A.3 Access to Parks and Playgrounds
- Metric 5.B.1 Affordable Housing
- Metric 5.B.2 Housing Preservation
- Metric 5.B.3 Business and Services Preservation

6. Densify – Optimize Density and Match Transit Capacity

xi. OBJECTIVE A. High residential and job densities support high-quality transit, local services, and public space activity.

o Metric 6.A.1 Nonresidential Density
o Metric 6.A.2 Residential Density

7. Compact – Create Regions with Short Transit Commutes

xii. OBJECTIVE A. The development is in, or next to, an existing urban area.
xiii. OBJECTIVE B. Traveling through the city is convenient.

- Metric 7.A.1 Urban Site
- Metric 7.B.1 Transit Options

vii.OBJECTIVE B. Walking and cycling routes are shorter than motor vehicle routes.

- Metric 3.A.1 Small Blocks
- Metric 3.B.1 Prioritized Connectivity
- Assess carrying capacity
- Capital and operating cost estimates

8. Shift – Increase Mobility by Regulating Parking and Road Use

xiv. OBJECTIVE A. The land occupied by motor vehicle is minimized.

- Metric 8.A.1 Off-Street Parking
- Metric 8.A.2 Driveway Density
- Metric 8.A.3 Roadway Area

n) Finalize transit infrastructure costs

Costing for all the TOD interventions based on the project will be carried out. Municipal financing options include the following.

- Intergovernmental transfers
- Land value capture
- Tax increment financing (TIF)
- Land readjustment
- Developer fees and exactions
- Joint development
- Municipal bonds
- Bank loans and financing
- Direct fees through tools like congestion pricing and parking fees
- Grants
- Special funds such as urban transport fund (UTF)
- Crowdfunding

o) Identify investment gaps and propose innovative funding mechanisms

The infrastructure gap for developing counties in Asia excluding China, that is the difference between what is currently spent and the investment required, is greater than 5% of GDP. There is high cost of capital, operation and maintenance cost for mass rapid transit systems, and tight the fiscal capacity of countries like Pakistan and as such cities like Lahore cannot cover these high costs. Local and provincial governments already have high burden of spending on urban utilities and services such water, gas and sanitation, health and education besides subsidizing existing mass transit facilities. Therefore, fiscal constraints have provoked new ideas and innovations for financing infrastructure projects, such as Land Value Capture (LVC).

Land Value Capture hinges on two notions.

1.Improved access and land use planning create and add value to property and other business products or services

2. The notion of LVC affirms that those who benefit from the added value of TOD should chip in to the cost of the quality transit oriented development and connectivity.

p) Phasing of development and contribution to infrastructure/ incentives needed

Scheduling and phasing of activities should be based on the following:

• Priority: the immediate needs, and those activities with ease of implementation. 'Quick wins' are first activities to take place in TOD as they are quickest to bring positive change with low risk and resource constraints

• Resources: accessibility of equipment and staff. The critical path method of project management should be used to allocate resource efficiently.

• Risks: During each stage of activities, risks need to be minimized through phases and scheduling as appropriate.

q) Monitor progress compared to plan

The outcomes and outputs of a TOD plan, policy or program can't be fully and accurately anticipated. Therefore the process of monitoring and evaluation is imperative to keep track of the TOD project. Monitoring 'outputs' of a plan or policy is done with respect to defined targets. Project outputs are services or tangible goods offered by the TOD intervention such as the length of sidewalks provided. Evaluation of 'outcomes' is done with respect to goals. Projects outcomes are long term, wide scale objectives, such as the number of people walking as a mode of transport after TOD intervention.

04

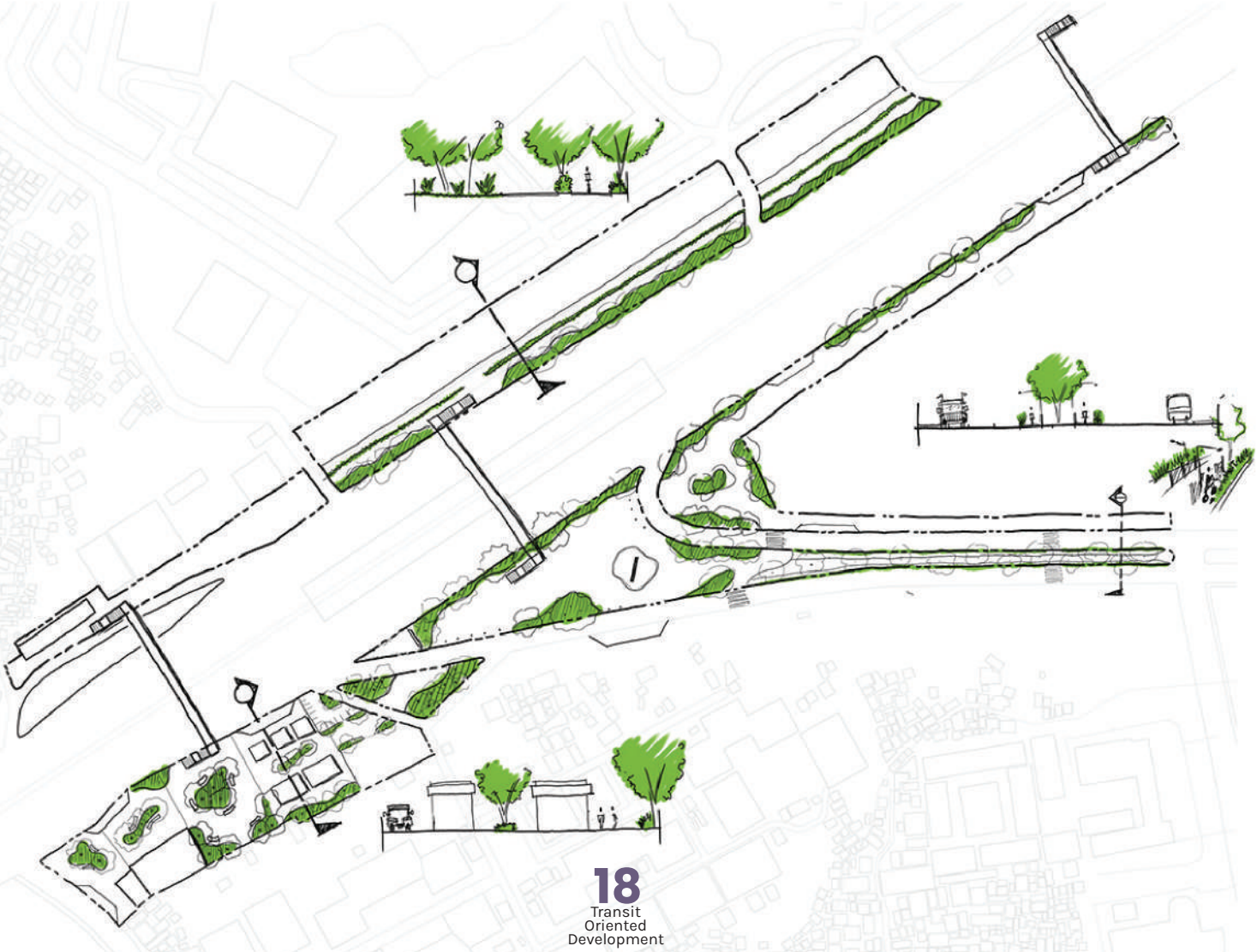
Transit Oriented Development Parameters

Determine TOD Vision

A TOD vision for a city should be developed at a local government (or equivalent) level. It should be linked to the comprehensive urban development plan, or/and city land use plan. Widespread participation in the development of the vision should be sought. Residents should be engaged through city level consultations to frame and design TOD to function locally.

It is imperative for cities to shift away from the use of motorized vehicles to pursue TOD. This requires a long-term vision and investment. Since TOD is a long term procedure, it is essential that the vision is accepted and owned not only by the political parties but also the entire residents of the city. This needs inter-party support and long-term investment in urban development.

Moreover, the planning and transportation departments must work together to develop a joint framework for delivering TOD. This is crucial as changes in land use for TOD are dependent on the transport infrastructure.



Identify Stakeholders and Roles for TOD Planning

It is fundamental to identify the main stakeholders involved in TOD for planning and coordination between key departments and stakeholders. It is imperative to overcome political and economic hurdles to build partnerships between various levels of government, several transport and planning agencies, private developers and citizens.

Stakeholders	Localized	Roles and Responsibilities
Local Government	Municipal Committees Metropolitan Corporations, Punjab Local Government and Community Development Department (LG&CD), Safe Cities Authority etc.	Transit and infrastructure planning, city and corridor master planning, local area planning (station area and neighborhood), development control regulations and building by-laws. Site plan reviews and approvals, infrastructure upgrades, land assemblage, active marketing of TOD opportunities, developer incentives, secure financing, enforcement (traffic police) and public outreach
Local Government	Traffic Engineering & Planning Agency (TEPA), Lahore Transport Company (LTC), Punjab Masstransit Authority (PMTA) etc.	Infrastructure investment, station design, systems planning, transit service, land assemblage, active marketing of TOD opportunities, secure financing and joint development of stations with the private sector
Regional Planning Agencies or Metropolitan Authorities	Punjab Urban Redevelopment Authority (Proposed), Punjab Housing and Town Planning Agency, The Urban Unit, LDA, FDA, RDA, FMDA, etc.	Long-range transportation planning, regional transit planning, regional growth management, technical assistance to local agencies and monitoring of urban transport funds
Private Sector Entities	Shop keepers, large businesses etc.	Provide financial support for TOD implementation, joint development of infrastructure in public private partnerships, construction, investment in real estate and funding transport system operations
Citizens, NGOS, and Advocacy Groups	Lahore Conservation Society etc.	Advocacy for NMT improvements, community participation in planning and design, attend planning meetings and advocate for high-quality design
Elected Officials	UC council representatives, housing minister, planning and development (P&D) ministers etc.	Developer and citizen awareness about the benefits of TOD, changing regulatory climate, advocate transportation demand management policies and local economic development incentives
Businesses and Real Estate Developers	ABAD, Association of Builders and Developers, etc.	Joint development with transit agencies, public-private partnerships, affordable housing construction, private sector investment in real estate and employee incentives

Stakeholders	Localized	Roles and Responsibilities
State Government	Provincial departments, PHATA, P&D, Excise and Taxation, Transport Planning Unit (TPU), Environment Protection Department	Policy changes, funding assistance, capacity building, technical assistance, Land and Market Reforms Environment safety, conservation and
Federal Government	Planning and Development Commission etc.	Policy changes, guidelines formulation, funding assistance, and capacity building

Moreover, the planning and transportation departments must work together to develop a joint framework for delivering TOD. This is crucial as changes in land use for TOD are dependent on the transport infrastructure.

This tool identifies roles and responsibilities of various stakeholders for a coordinated TOD implementation program.

Structure a TOD Organization if Required

A special body (task force, committee or agency) should be enacted by law or official notification to create, manage and implement the TOD plan. The organization will be held accountable to the public and function with transparency and a clear mission.

The organization will promote the development of planning research, design master plans and regulations, oversee implementation, coordinate with planning guidelines and professionals from different levels of governments such as development authorities, and the private sector.

It is important that the body is apolitical and may link its revenue stream to the revenue generated from TOD project itself. This will reduce the burden on government and encourage land value capture and revenue generation through TOD.

Here are the steps to establish clear roles and responsibilities for a TOD dedicated organization.

1. Identify mandate of TOD organization depending on scale

Mandate at different scales

a. City/regional scale

i. Mandate: policy and regulatory organization

• Engage with political leaders and decision makers for settings goals and building the vision for creating transit supportive development policies

• Collaborate with other agencies to address policy barriers for TOD

b. Corridor or station area scale

i. Mandate: technical project oriented organization

• Define project specific planning process and systems that allow TOD to happen within the existing planning and development framework

• Provide technical and financial assistance and oversee implementation

City/ Regional Scale TOD

PRIMARY PUBLICH SECTOR PARTITIPANTS

- [ ] Who owns and operates city/regional transit services? Include all agencies

AND

- [ ] Who creates regional growth/economic strategy?

AND

- [ ] Who creates and enforces development control regulations? Include ALL agencies form all local jurisdictions

AND

- [ ] Government organization(s) involved in affordable housing/ heritage preservation/ environmental protection.

SUPPORTING PARTICIPANTS/ COMMITTEES

- [ ] Non-profits involved in affordable housing/ social safeguards/ heritage preservation. Environmental protection

AND

- [ ] Private sector associations/ trusts involved in real-estate development/ business and commerce

Corridor/ Station area scale

PRIMARY PARTITIPANTS

- [ ] Who owns and operates transit services? Include primary corridor transit agency

AND

- [ ] Who ownd majority land around satations?

- [ ] Who creates and enforces development control regulations? Include specific agencies

AND

- [ ] Who provides infrastructure services? Include all agencies, including water, energy and drainage

SUPPORTING PARTICIPANTS/ COMMITTEES

- [ ] Real estate develpers (3-4 may be invited through tendering)

AND

- [ ] Transit feeder service operators (including ride-sharing services if applicable)

AND

- [ ] Experts in affordable housing/ heritage preservation/ environmental protection as needed.

Define Type of Institutional Structure

Type of structures

1. City/regional scale

i. Regional or Metropolitan Policy Committee – to review and formulate policy changes

ii. Provincial or city regulations formulation committee – to formulate transit supportive regulations

iii. Public and non-profit association - to lobby for TOD supporting policies in legal framework

2. Corridor or station area scale

i. Technical TOD task force – for the conceptualization of TOD plan, funding and implementation of proposals

ii. Public and non-profit association – to oversee TOD planning and implementation against goals and targets

iii. PPP – to finance and implement TOD

3. Define Coordination Mechanism

a. Define frequency of meetings with primary participants and with secondary participants and committees

b. Define mode and mandate of documenting minutes of meetings and communicating them to the public

c. Define coordination needs with other stakeholders and agencies not part of the special body from other jurisdictions or levels of government or other planning sectors

4. Notify the appointment of the organization

a. Notify the mandate of the organization or special body and TOD goals for the city or project

b. Notify the yearly budget needs and sources of funding

c. Notify the inter-agency coordination and support requirements from various government organizations to achieve the relevant goals

Assess existing policies and regulations regarding TOD

The following existing (but not limited to) policies, rules and regulations should be assessed before formulating TOD specific regulations:

- Building regulations
- Land use rules
- Building code and standards
- Private housing scheme rules
- Master plans
- Outline development plans

Create TOD Supportive Regulatory Framework

Based on the assessment in stage 5, master plans, building regulations, land use rules should be revised for TOD zones.

The main changes required in land use and planning regulations are :

1. Upzoning (or rezoning) for higher density development

2. Downzoning locations inaccessible by mass transit

3. A shift to mixed-use zoning in the areas near transit hubs

After reviewing and assessing different regulations, the city development regulation (building and zoning) must be updated and amended for TOD. Identify existing regulations that are obsolete, aren't friendly for developer or resident and are always superseded by site plan during approval.

Existing ground conditions to be studied are:

• TOD area character – site history, population, city-wide context

• Development – existing & proposed land use, surrounding buildings, land ownership

• Accessibility – pedestrian and bicycle network, transit access, feeder transport

• Existing infrastructure – roadways, utilities, public facilities

• Urban Design – street grid, setbacks, heights, building form, open spaces

• Parking – on-street, off-street, legal and illegal spaces, park and ride

The existing regulations must be replaced where possible or new transit supportive regulation must be created for the following metrics at least:

• Setbacks
• Block Width
• Complete Streets Standards
• Pedestrian & Bicycle Standards
• Suggested Land Use Mix
• Density Matrix
• Street Frontage
• Parking

Also assess whether the existing FAR provisions are being utilized to evaluate the market potential. The regulations should also include URBAN DESIGN AND PEDESTRIAN ACCESS which is currently lacking in Pakistan.

There are three options to legalize and implement the TOD supportive zoning framework:

1. To include the TOD regulation in the master plan/ development plan/ comprehensive plan and the plans should be bound by law

2. To crease a TOD policy as a special law that supersedes existing regulations
3. To establish a TOD special area in existing regulations

The framework should take into account short term goals without compromising long term values. Some of the obstacles to take into account are:

• Policy encouraging car ownership
a. Car widening, subsidized fuel prices and car loans encourage the use of motorized vehicles. Awareness needs to be raised about the negative impacts of car usage. Like many cities such as Singapore, congestion charges should be encouraged to restrict car mobility in the dense areas of the city.

• Parking is considered a free right
a. The general public considers parking a basic right and regulations also support providing parking space with development. This issue must be handled carefully and sensitively with the public to promote TOD goals

• Land ownership and development rights are absolute
a. It is difficult for public authorities to acquire land for TOD and transit development as land ownership is mostly private. The legal context must be reviewed to find ways to create TOD.

• Public transit in not considered a public service
a. With a dearth of public funds and subsidies, it is difficult for the authorities to maintain public transit, leaving the infrastructure in a dilapidated state. It is crucial for the government to subsidize public transport and the leaders must be told about its social and economic benefits.

• Urban planning regulations promote single-use sprawl planning

a. Minimum road widths and blocks sizes discourage compact development. The rules and standards must be revised to encourage high density, mixed use compact patterns of development.

• Rent control and land ceiling acts

a. While considering rent control and
land ceilings, it must be clear that they must be revised periodically or they create artificial real estate market, with major speculation and unaffordable prices.

• Planning acts are not flexible

a. The acts must allow for an integrated transport and land use planning approach. Whatever the law, it must allow for city planners and transport planners to work together to accomplish TOD.

Public Outreach and Citizen Engagement

Participatory planning provides citizens the opportunity to govern their city and neighborhood, and become a part in the decision making process. The core objective of TOD is to improve the quality of life for it's the current and future residents. The only way to inclusively implement TOD is by public participation and stakeholder engagement, to ensure the beneficiaries are aware of the benefits and changes TOD will bring and to address the residents' concerns as they best know their area.

Successful TOD projects are 50% professional knowledge and best practices and 50% localized residents' knowledge. Here is a tool for public outreach and citizen engagement.

1. Identify the stakeholders

a. Internal and external, directly and indirectly related stakeholders, anybody effected and impacted by the TOD plan, are to be identified and reached.

2. Have a plan to engage them

a. All stakeholders should not be engaged at once.

b. Stakeholders should be divided in target groups for clear collaboration

3. Use the best communication tools

a. Use the right tools at the right moment for the right target group

b. A tablet survey may not work for all users for example while an interview may be appropriate for certain stakeholders

c. A presentation may not be the answer for a resident while it may work for a government official

4. Ask the right questions

a. The questions depend on the stage of the project as different stages of the project beg for different feedback

b. Stages can be issues, ideas, concepts, solutions

5. Not everybody want to engage the same way

a. Time and medium of communication may vary from group to group and even person to person

b. Interest and relevance of issues also vary from person to person so the public outreach methodology must be prepared for this circumstance.

6. Most people only want to be informed

a. A broad information campaign should reach people through different channels

7. A few people want to engage directly

a. Allow few stakeholders to directly participate in a controlled environment if they want to engage.

8. Combine planning and outreach

a. Unique planning workshops such as Charrettes increase buy-in as stakeholders are part of the decision making process and help in planning process.

b. Charrettes are multiple day collaborative workshop lead by the core planning team bringing together residents, developers,

and policy makers to create a feasible TOD decision at the relevant stage, such a concept plan, land use plan or a local area plan. There are four feedback loops:

i. Visioning

ii. Ideas

iii. Concept

iv. Solutions

9. Include fun exercises

a. Customized activities and games may make it interactive and interesting for the stakeholders to be involved.

10. Some people are not able to attend workshops or physical consultation sessions

a. A long term social media or online strategy should be also in place to capture input of such individuals.

11. Use Visuals

a. In a world with an overflow of information, user friendly, intuitive and catchy content is necessary, otherwise, attention will be limited and time will be wasted.

12. Ensure two-way communication

a. Stakeholder outreach is about talking and listening to the stakeholders' and residents' concerns about the TOD ideas and plans

13. Make sense of the feedback

a. Stakeholder engagement is useless if the feedback isn't used and addressed in a systematic manner.

14. Don't overdo it – be strategic

a. Outreach needs to be effective, cost-efficient and relevant for all participants.

Finalize Transit Route and Stations

Use table below to map the initial routes and take feedback from the relevant stakeholders.

Stakeholders: transit planning, urban planning agencies, formal and informal transit operators, land use planners, environment planners, housing infrastructure and transportation departments, civic organizations.

Criteria	Measure	Importance
People and Job Density	Density of housing units and jobs identified through Census data and other surveys.	Areas with high population densities need Rapid Transit services to equitably fulfill mobility needs of all people.
Destinations and Land Use	Major trip generators within the city identified through destination mapping and land use maps.	Serving public destinations and high activity centers with Rapid Transit alleviates the potential for congestion and ensures optimum ridership.
Potential and Desired Connections	Identification of existing and potential desired connections measured from travel data and people's perception	Determine travel patterns using data from existing transit services or congestion mapping.
Existing Recommen-dations	Review recommendations from existing Plans and Policy Documents and ensure they are still relevant & valid	Ensure that existing (and relevant) studies are reviewed and recommendations are considered in transit planning e.g. Transportation Master Plan, Master Plan, etc.
Viable Modes	Shortlist Viable Modes based on density thresholds	Carry out a quick assessment of the most viable transit technologies and operating environment options for the city

1. Use the corridor screening criteria tables below to filter the corridors suggested in step above, based on the following themes :

a. City vision and goals

b. Transportation demand

c. Ease of implementation

d. Community building

a) City Vision and Goals

Criteria	Round 1 Screening	Round 2 Screening
Growth Potential	Projected growth in 10 years within 500 meter of corridor in • Population density (person/ha) • Employment density jobs/ha) Higher is better	Supports high intensity mixed use development in strategic locations
Economic Development	Linkages to major growth centers, existing or proposed, within 500 meter of the corridor Higher is better	Feasible for businesses and attracts human resources influencing long term employment goals
Mixed Use Development Potential	Areas with mix of land uses (2 or more) within a 500 meter buffer of corridor Higher is better	Opportunities for new mixed use development and redevelopment through land availability and market acceptance
Land Value Capture Potential		Willingness to live along the corridor, flexibility to change parking and access and property value increase

a) Transportation Demand

Criteria	Round 1 Screening	Round 2 Screening
Transit Ridership Potential	Existing and project population and job densities, existing transit ridership on existing services Higher is better	Compare transit capacity to forecasted transit ridership (persons/hour) for all mode options
Travel time improvement potential	Route length, average auto delay, maximum V/C ratio, travel time (auto VS existing transit) Lower performing roadway is preferred	Compare travels times of transit options and road travel by motorized vehicles
Existing transit network integration	Transfer points with existing transit network Higher is better	Highest potential of network reach and future expansion, options to integrate with local and regional, existing and planning transit systems.
Transit service reliability		Right of way features impacting quality, frequency and flexibility of rapid transit, availability of width for dedicated tracks, intersections, restricted turning movement and signalization
Supportactive transportation		Urban form that supports walking, cycling and transit, block sizes, street connectivity, availability of walking and cycling facilities
Safely for all corridor users		Possibilities to improve intersections and road crossings, specify their location, emergency vehicle access

c) Ease of Implementation

Criteria	Round 1 Screening	Round 2 Screening
Ability to implement	Coordination of jurisdiction under a single or few coordinated agencies. Fewer coordination challenged are better	
Ease of construction	Availability of Right of Way (ROW) and minimal immovable barriers. More space is better	Amount and sensitivity of construction challenges including sensitive or historical areas, rail crossings, waterway crossings, sharp turns, right of way issues, utilities etc.
Financial viability	Estimate annual cost per person-kilometer based on the type of operating environment and mode	Cost benefit analysis and economic analysis of corridor options
Property impacts		Minimize the need for land acquisition or major land readjustment; undue negative impact on property ownership or property values.
Environmental impact	Minimize impacts to designated environmentally significant areas, wetlands and provincially significant wetlands, fish habitat, woodlands and significant woodlands, significant valley lands, or environmentally sensitive areas, the habitat of endangered and threatened species and designated areas of natural and scientific interest	

d) Community Building

Criteria	Round 1 Screening	Round 2 Screening
Supports inclusive growth objectives	Low income and middle income neighborhoods' access to affordable transit	Development potential for high affordability
Connectivity to neighbor-hoods and business areas	Higher neighborhood penetration and accessibility choices through a denser street network.	Enhanced access to community facilities such as schools, hospitals, parks
Intensifica-tion potential	High number of underutilized plots are better. Corridors designated for growth and intensification are preferable, as they have the potential to intensify over time (TOD) and support ridership potential.	Availability of land for intensification within a 500m buffer of the corridor, including: • Parking lots, • Underutilized spaced • Dilapidated/end of life-cycle buildings • Transitional land uses, e.g. former industrial uses, etc.
Public spaces and amenities		Allow greater use of the public realm and improved aesthetics, enhance community connections, support safety and security through design and minimize impacts on existing public and private trees.
Cultural heritage impacts		Minimize impacts to built cultural heritage features and archaeological resources.
Climate Resilience		TOD to result in urban densification leading to climate change resilience, lower impact of air pollution and greenhouse gas emissions

When, where and how to implement TOD: The Three Values (3V) Framework

The urban policy literature suggests that three values (3V) of a neighborhood must be assessed to determine if the neighborhood and particular transit stations are feasible for TOD – 1) transit connectivity, 2) quality of urban environment and 3) market potential. This helps determine what kind of transit oriented development is viable in each neighborhood.

Informed decision making is imperative to determine what kind of TOD will be suitable. Here is a methodology to determine the right level of density a station can afford and the mix of development for each area, balancing job, housing and other utilities . The framework for identifying suitable TOD plans is the three values (3V) approach to determine the recipe for and around transit stations.

TOD cannot be uniformly applied across a whole city or even a transport corridor as the densities vary from high to low within a city. No one solution fits all. A TOD typology distinguishes between different transit stations based on their suitability for accommodation of growth. Only 15% of transit stations and their relevant TOD zones in walking distance can support very high density development .

1. Node value – measures how important a mass transit station is based on passenger traffic volume, inter-modality, and centrality within the network .

2. Place value – determines how attractive a place is by assessing the quality of urban space including amenities; schools; health care facilities; type of urban development; local accessibility to daily needs by walking and cycling; quality of the urban fabric around the station, in particular its pedestrian accessibility; small size of urban blocks and fine mesh of connected streets, which create vibrant neighborhoods; and mixed pattern of land use. It is measured through a composite index .

3. Market potential value - is the unrealized market value of a station area, sometimes measured through a composite index considering major drivers of demand, including current and future human densities, current and future number of jobs accessible within 30 minutes by transit, and major drivers of supply (including the amount of developable land, potential changes in zoning, and market vibrancy) .

The two main reasons policy makers find the 3V framework realistic and useful is:

a) The approach allows policymakers to classify transit stations into groups by characteristics, to which different strategies of development can be applied.

b) The framework identifies imbalances between connectivity, accessibility, place quality and market potential value at each station .

Drivers and Calculating Node Value

Node value is driven by the significance of a node in a transit network. A hierarchy of nodes exists based on the number of lines, modes of transport, complexity of the hub, accessibility and centrality as they serve more passengers.

An index is created by weighing these metrics

Degree centrality calculates the number of connections or links in a node. King's Cross London for example has 6 tube lines and 12 links

2. Closeness centrality is the average distance by number of links, from one station to every other station in the network (Salat and Olliver 2017, p.39).

3. Betweenness centrality for one station is the "number of shortest paths from all stations to all others that pass through this station (Salat and Olliver 2017, p.39).

4. Intensity of node activity is the daily ridership at the station or traffic flow in one node. The frequency of trips from each station. Three and a half million passengers use Shinjuku Station in Tokyo daily.

5. Intermodal diversity is the number and types of modes of transportation a station links, such as metro trains, buses, high speed rail.

Drivers and Calculating Place Value s

Place value is driven by the quality of urban fabric. High quality is obtained by smaller blocks, land subdivisions of various sizes and a high density of street intersections.

An index is created by weighing these metrics (Salat and Olliver 2017, p.45-46)

1. Density of street intersections calculates the density of street intersections in an 800 meter radius of each station. Global practice is to develop 100 intersections per square kilometers for enhanced walkability and accessibility.

2. Pedestrian accessibility measures the area walkable within 800 meter radius from a station within a 10 minute walk in every direction. Recommended block sizes are 100 meters by 100 meters to promote walkability and vibrant development. Urban blocks of New York City are very walkable and their size is 60 meters by 190-280 meters.

3. Diversity of land uses measures the various types of land uses around 800 meters of each station. Areas with commercial uses, grocery, restaurants, laundry, schools, healthcare and other retail shops allows residents for a comfortable living experience.

4. Density of social infrastructure measure the frequency of educational, health and cultural services around 800 meter radius of a transit station. This increases place value too.

5. Pedestrian/bicycle connectivity measures access to footpath and bike lanes infrastructure.

Drivers and Calculating Market Value

Market potential of a station depends on the untapped market value in the surrounding areas. Market potential of a station is dependent on the real estate development demand by developers for businesses and residents. The number of housing required in the 800 meter radius is impacted by the number of job accessible within a 30 minute ride from the station. Market potential supply is dependent on the ease with which developers can navigate and develop, available land and the amount of construction allowed in terms of mixed use, FARs, etc. (Salat and Olliver 2017, p.49)

Drivers of demand

1. Human density calculates the count ofpeople and jobs per square kilometer within an 800 kilometer radius from the transit station. This correlates with the presence of a strong real estate market.

2. Activity mix is the job to resident ratio of 0.50 to 0.70 mentioned earlier, the ratio
of jobs in the 800 meter radius to the number of residents.

3. Forecasted rate of growth in human density measure the expected increase in traffic at the station.

4. Number of accessible jobs measures the number of jobs that can be accessed through the transit station within 30-45 minutes on foot and using public transit.

Drivers of supply

1. Real estate opportunities measures the level of land that can be developed by the developer within 400 meter radius to the transit station for high premium use and lower premium use with 400-800 meter radius from the transit station.

2. Volume of market transactions is an indicator for measuring the number and amount of market transaction within the nodal area to calculate the percentage contribution to city GDP. Additional demand for real estate at city level can be
considered.

to city GDP. Additional demand for real estate at city level can be considered.

Node, place and market values are usually unbalanced and unequal across cities and transit stations. The next step is to identify which group or cluster a transit station falls in, is based on their relevant values. Different policies, development strategies and level of investments will be applied to different station clusters or groups. There are three types of clusters based on each, node, place and market value have been formed. (Salat & Ollivier, 2017, pp. 50-51)

Clustering Stations Areas Based on Node Value

1. Single-line stations: extend towards the periurban or suburban areas and are part of the branches of the core-and-branch transit system.

2. Core transfer stations: transfer stations with two or more connections or lines centered in the city core.

3. Highly connective hubs: hubs with the highest node value. They have high scores in inter-modality, centrality and intensity of passenger ridership.

Clustering Stations Based on Place Value

1. Suburban areas: usually have single use of land such as residential, industrial or business without mixed on large tracts of plots. The population in suburban areas is low to moderate without many transit options. Street connectivity and pedestrian activity is also lacking. The area cannot support TOD and lacks urban characteristics.

2. Urban areas: area with high to moderate population with good street connectivity and pedestrian activity. Land uses in such neighborhood are mixed with options for jobs in retail and services sectors.

3. Intense urban areas: are most well-suited for TOD. There is a high diversity of land uses with a strong economic presence.

Clustering Stations Based on Market Value

1. Limited areas: have weak market potential and are not suitable for mixed use or compact development. TOD investment is not a good idea in such areas, and will not lead to further private development.

2. Emerging areas: currently have low to medium real estate prospective. Emerging areas may not be ready yet for TOD investment; however, smaller investments could catalyze additional private market investment. The area could strengthen market potential in the longer run.

3. Strong areas: have high market potential for compact mixed use TOD development. Investments for TOD should be a priority focusing on urban amenities and pilot projects.

Policies for different types of stations: Infill, Intensification and Transformation

Investments in transit oriented development are aimed to create a ripple effect of market investments. However, several other investments are requisite for this to set in for example, human capital, business development, neighborhood amenities.

Three types of strategies can be recommended based on the mix of station values, and 9 area types as shown in the matrix in figure 3 . These strategies are not static but dynamic as a place and transit station can transform its node, place and market value over time.

1. Infill: infill is recommended if the place value is suburban and node value is a single line station and it has low market value. Infill is “reuse of urban land for new, higher density construction ”. Affordable housing is an opportunity in such areas. The suggested strategy objectives are:

a. Promote long term planning

b. Increase activity levels and transit services through increased densities

c. Fund multimodal transportation system

d. Plan for maintain equity in marginalized communities

2. Intensification: locations with built-up areas and existing public transit should have higher than existing densities. These are emerging stations in urban areas with intersections and potential markets. Affordable housing is an also opportunity in such areas. The suggested strategy objectives are:

a. Invest in catalytic TOD projects to increase the market value

b. Promote development oriented planning

c. Evaluate and add missing multimodal transport links

3. Transformation: strategy applies to mega hubs. High real estate value is expected when there is high place value created through job densification and high quality urban design. The suggested strategy objectives are:

a. Invest in aggressive TOD projects to increase the market value by increasing densities and lowering parking

b. Diverse building types and mixed land uses

c. Advance urban design

d. Create employment opportunities

e. Provide affordable housing

f. Increase transit services

g. Increase capacity and utilities to support the volume of uses

Figure 3: matrix of recommended strategies for value clusters

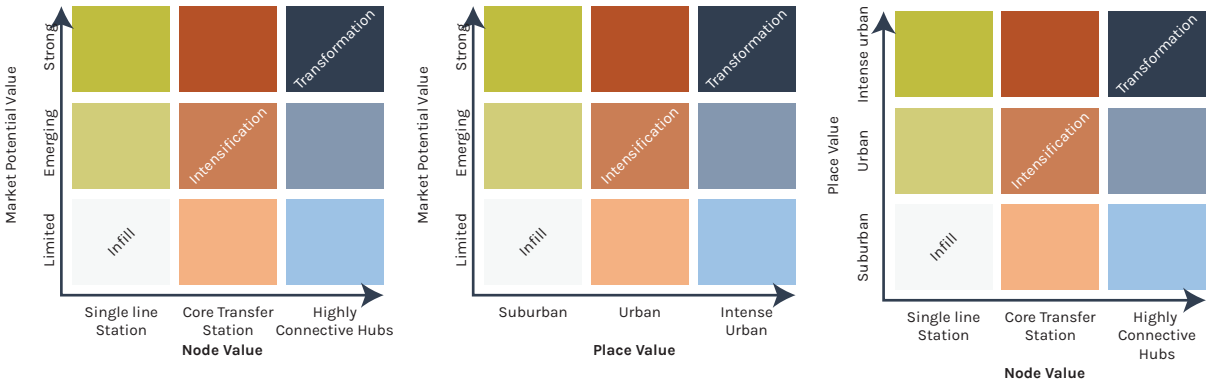


Figure 4: Levels to increase node, place and market potential values

Type of value	Policy lever
Node	Increase the number of hubs and the number of lines/modes they connect to. Interlink neighboring stations into clusters. Increase accessibility for all within the network.
Place	Increase compactness (proximity to existing urban activity and short travel time to main destinations). Increase the diversity of uses. Increase the concentration of commercial, cultural, and educational amenities. Design neighborhoods that promote walking and cycling. Create a vibrant public realm.
Market potential	Increase residential density. Increase job density. Increase human density. Increase the diversity of land parcels to create a vibrant land market. Increase floor area ratios.

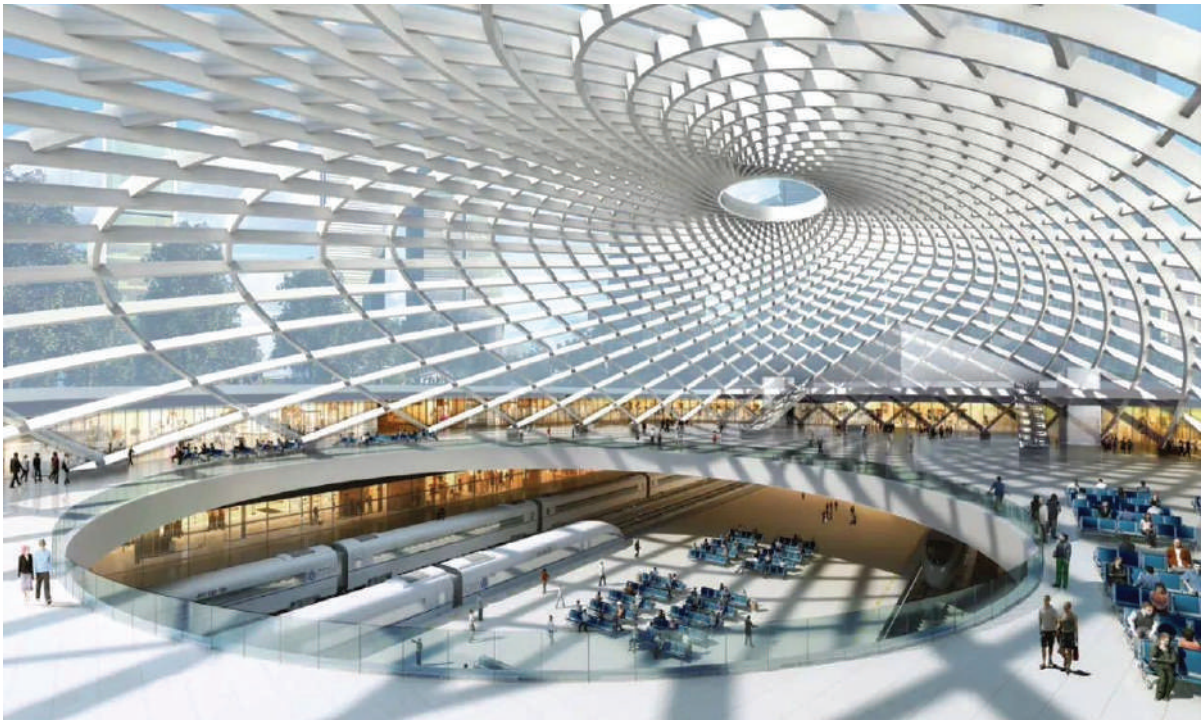
Infrastructure Carrying Capacity Assessment

Infrastructure is essential to lay the foundation while planning any city. Any TOD development and its viability depends on the carrying capacity of infrastructure. Hence, an assessment of infrastructure is necessary to ensure that the current infrastructure provision is sufficient and has the capacity to uphold future growth. If there is a mismatch between current and future needs and infrastructure capacities due to unanticipated growth, living conditions will further deteriorate.

An assessment is important before changes in densities are proposed. This tool assesses the capability of areas to support infrastructure needs, as TOD requires serious built form changes and transportation development. There is a variation in assessment based on the type of development and classification of the area.

a) Greenfield development
Greenfield development is unused land where there isn't any need to remodel or demolish existing structures for construction.

b) Urban/ suburban
Urban or suburban projects are parcels or tracts of land in built up areas that are already served with public utilities. It could also involve changing current built up property from one use of land to another.



Infrastructure Assessment Goals

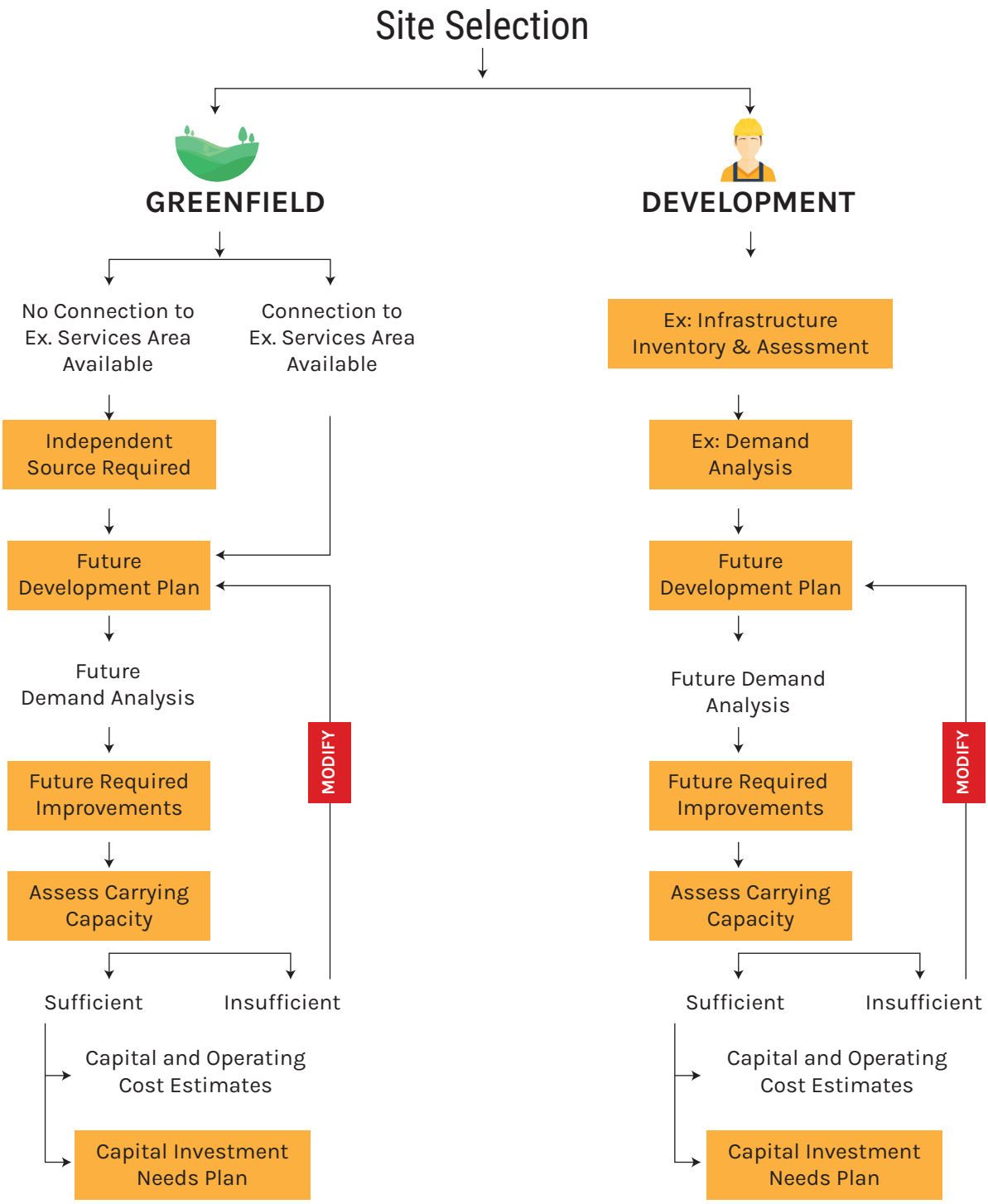
a) Physical Infrastructure is high cost investment and essential for city development.

b) Social Infrastructure guides the quality of life in any city depending on the access and affordability of it.

Infrastructure Type	Greenfield	Urban/suburban	Elements
PHYSICAL INFRASTUCTURE			
Water supply	To determine capital investment needs	To identify existing designed capacity and capability of serving additional densities	Water Consumption Water Supply Water Treatment Water Networks
Sewerage	To determine capital investment needs	To determine the network capacity required to serve additional densities	WW Generation WW Treatment WW Disposal
Energy	To determine capital investment and secure energy supply	To assess and manage existing grid capacity	Energy Consumption Energy supply Energy generation Distribution & transmission
Solid Waste	To determine capital investment to treat, collect and transfer waste	To determine excess solid waste generation for additional densities	SW Generation SW Diversion Treatment & Disposal Collection & Transfer
Information	To determine capital investment and secure information needs	To determine information need increases for additional densities	Information Demand Collection and Communication Modes Information Modes Information Networks
PHYSICAL INFRASTUCTURE			
Landscape	To understand vulnerabilities and planning opportunities	To identify the ability of the landscape to provide functional requirements	Landscape Demand Landscape Program Landscape Pattern Landscape Maintenance
SOCIAL INFRASTRUCTURE			
Healthcare	To determine zoning reservations and capital investment needs	To ensure the adequacy of medical facilities to serve the additional population	Adequacy Accessibility Affordability Quality
Education	To determine zoning reservations and capital investment needs	To ensure the adequacy of educational facilities to serve the additional population	
Recreation	To determine zoning reservations and capital investment needs	To ensure sufficient recreational zones to serve the additional needs	
Police/Fire/ Others	To determine zoning reservations and capital investment needs	To ensure adequacy of emergency response services to serve the additional densities	

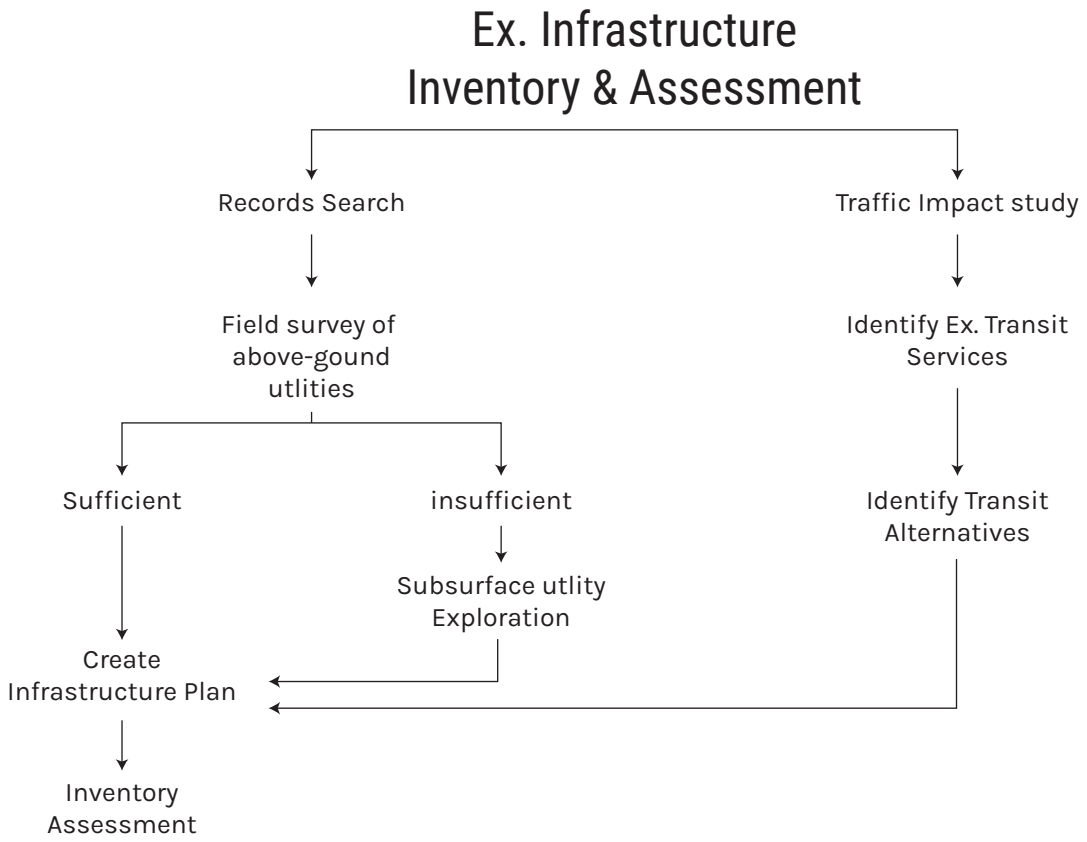
Infrastructure Assessment Process

The infrastructure assessment process determines if current provision is adequate and has the capacity to support additional growth. Infrastructure capacities are often mismatched with current needs due to unforeseen fast urban growth. This flowchart determines the studies required to assess the infrastructure capacity.



Existing Infrastructure Inventory

Planned densities and population guide in planning for infrastructure. Therefore, when estimating infrastructure needs, projections of population and densities to serve by a utility is necessary.

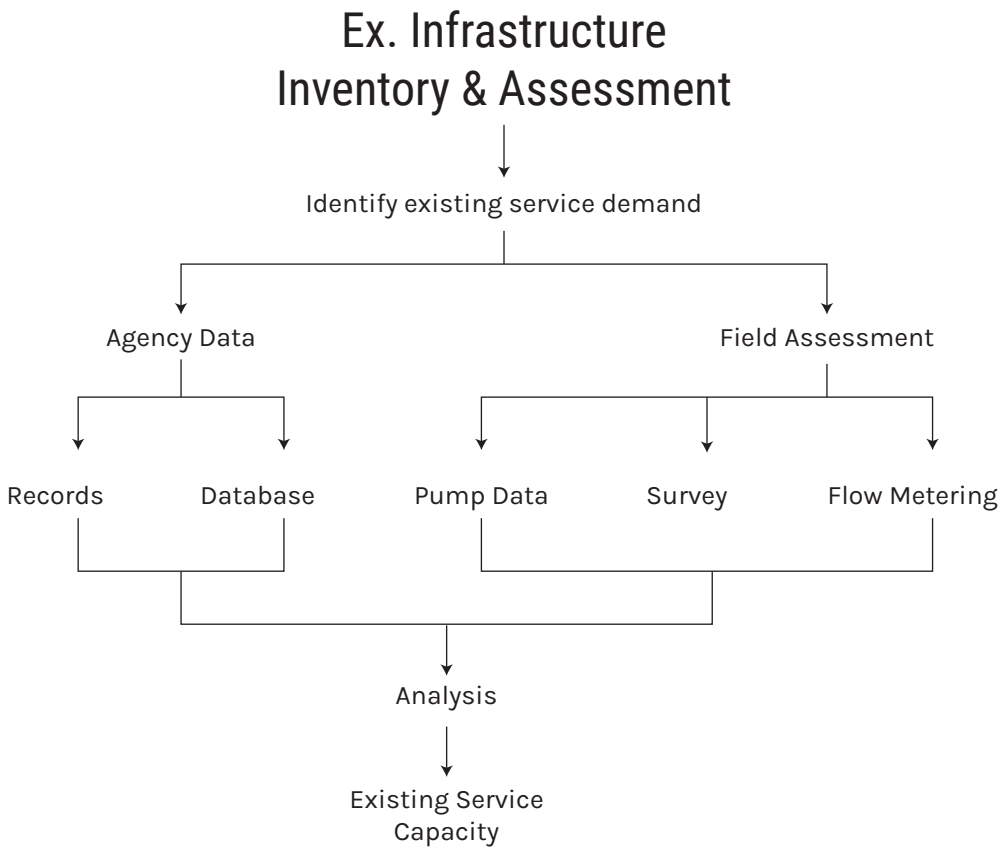


INFRASTRUCTURE CAPACITY MEASURES

Water availability	Installed capacity (MLD)
Source of water supply	Within city limits or no
Water coverage	Area served by supply network Per capita supply (LPCD) Supply duration
Wastewater disposal	Wastewater generated daily Disposal capacity (MLD) Present Operating capacity (MLD)
Solid waste	Waste generated daily (tonnes/day) Collection daily (tonnes/day)

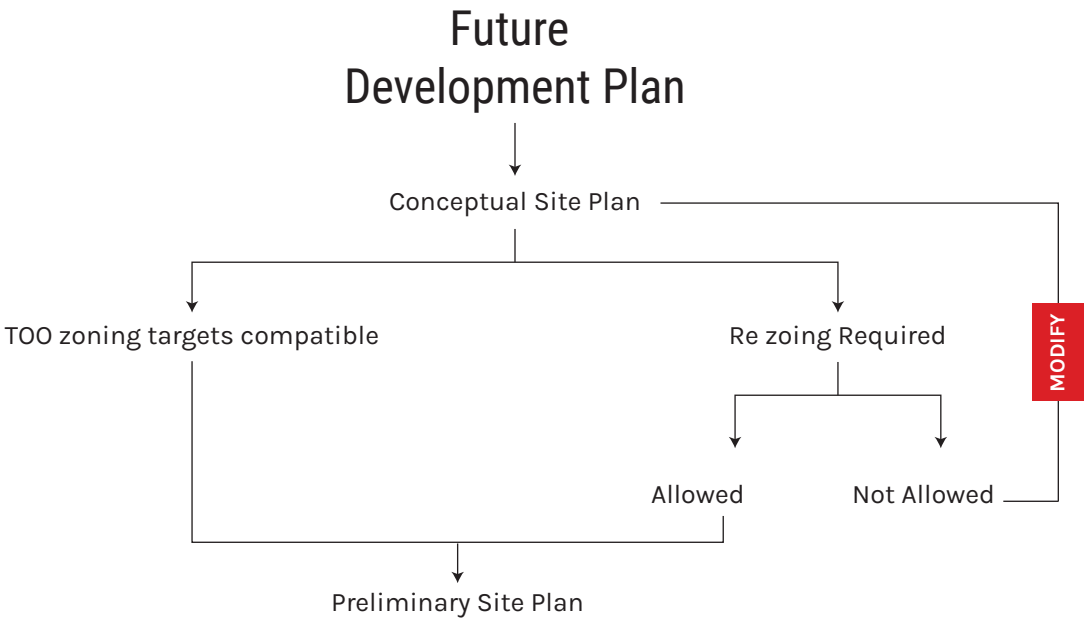
Existing Demand Analysis

Infrastructure demand is expected to increase with TOD and this tool is expected to assist in calculating existing demand.



Future Development Plan

Compare future infrastructure development plan with conceptual site plan to see if zoning needs and TOD targets are in line with each other. If the TOD needs are not met by the infrastructure plan, trade-offs will need to be made to allow for transit supportive development while completing infrastructure needs.



Scorecard for TOD Planning & Implementation

The TOD Standard is a policy brief as it describes the core principles of inclusive growth. It identifies the key objectives that are essential for implementation of sustainable urban development for transportation. All material for the scorecard below is adapted from ITDP (2017).

The TOD Standard can be used by developers and designers to plan and design phases to identify gaps and opportunities for TOD improvement. Planners can use it to find priority areas for investment and densification or improvement action. Citizens and civil society can use it to rate existing conditions or redevelopment proposals and advocate for higher-standard transit-oriented societies in the places where people work and live.

The TOD Standard was established to measure development projects as the basic building blocks of urban expansion and the main objectives of investment decisions, comprehensive plans, land use and design codes, and other processes and frameworks of urban development. Another method this scorecard allows is to use it to evaluate the catchment areas of existing transit stations and enable planners and stakeholders to understand the existing land use characteristics and identify where opportunities and challenges exist.

The purpose of the TOD Standard scorecard is to provide references and metrics with clear definitions, simple standard and a rapid assessment tool as a basis for the implementation of inclusive TOD. This is a unique assessment tool with a simple scoring system that distributes 100 points across 25 quantitative metrics that are designed to measure the implementation of 8 principles and 14 objectives.

The 8 principles are

1. Walk	2.Cycle	3. Connect
4. Transit	5. Mix	6. Densify
7. Compact	8. Shift	

1. Walk

OBJECTIVE A.
The pedestrian realm is safe, complete, and accessible to all.

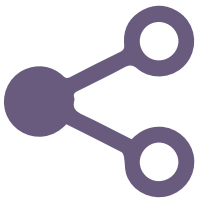
OBJECTIVE B.
The pedestrian realm is active and vibrant.

OBJECTIVE C.
The pedestrian realm is temperate and comfortable.

2. Cycle

OBJECTIVE A.
The cycling network is safe and complete.

OBJECTIVE B.
Cycle parking and storage is ample and secure.



3. Connect

BJECTIVE A.
Walking and cycling routes are short, direct, and varied.

OBJECTIVE B.
Walking and cycling routes are shorter than motor vehicle routes.

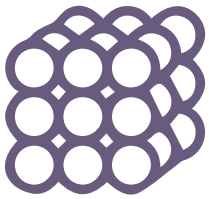
4. Transit

OBJECTIVE A.
High-quality transit is accessible by foot. (TOD Requirement)

5. Mix

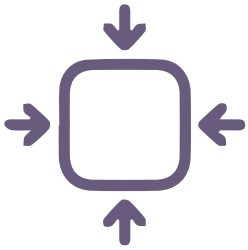
OBJECTIVE A.
Opportunities and services are within a short walking distance of where people live and work, and the public space is activated over extended hours.

OBJECTIVE B.
Diverse demographics and income ranges are included among local residents.



6. Densify

BJECTIVE A.
High residential and job densities support high-quality transit, local services, and public space activity.



7. Compact

OBJECTIVE A.
The development is in, or next to, an existing urban area.

OBJECTIVE B.
Traveling through the city is convenient.

8. Shift

OBJECTIVE A.
The land occupied by motor vehicle is minimized.

1

Walk – Develop neighborhoods that promote walking		Metric Points	Total Metric Points
Metric 1.A.1 Walkways	Percentage of intersections with safe, all-accessible crosswalks in all directions.		3
Metric 1.A.2 Crosswalks	Percentage of intersections with safe, all-accessible crosswalks in all directions.		3
Metric 1.B.1 Visually Active Frontage	Percentage of walkway segments with visual connection to interior building activity.		6
Metric 1.B.2 Physically Permeable Frontage	Average number of shops, building entrances, and other pedestrian access per 100 meters of block frontage.		2
Metric 1.C.1 Shade and Shelter	Percentage of walkway segments that incorporate adequate shade or shelter elements.		1
		0	**15**

2

Cycle – Prioritize non-motorized transport networks		Metric Points	Total Metric Points
Metric 2.A.1 Cycle Networks	Access to a safe cycling street and path network.		2
Metric 2.B.1 Cycle Parking at Transit Stations	Ample, secure, multi-space cycle parking facilities are provided at all transit stations.		1
Metric 2.B.2 Cycle Parking at Buildings	Percentage of buildings that provide ample, secure cycle parking.		1
Metric 2.B.3 Cycle Access in Buildings	Buildings allow interior access and storage within tenant-controlled spaces for cycles.		1
		0	**5**

3

Connect – Create dense networks of streets and paths		Metric Points	Total Metric Points
Metric 3.A.1 Small Blocks	Length of longest pedestrian block.		2
Metric 3.B.1 Prioritized Connectivity	Ratio of pedestrian intersections to motor vehicle intersections.		1
		0	**5**

4

Transit – Locate development near high quality public transport		Metric Points	Total Metric Points
Metric 4.A.1 Walking Distance to Transit	Walking distance to the nearest transit station.		
		TOD Requirement	**TOD Requirement**

5

Mix – Plan for mixed uses, income and demographics		Metric Points	Total Metric Points
Metric 5.A.1 Complementary Uses	Residential and nonresidential uses within same or adjacent blocks.		8
Metric 5.A.2 Access to Local Services	Percentage of buildings that are within walking distance of an elementary or primary school, a healthcare service or pharmacy, and a source of fresh food.		3
Metric 5.A.3 Access to Parks and Playgrounds	Percentage of buildings located within a 500-meter walking distance of a park or playground.		1
Metric 5.B.1 Affordable Housing	Percentage of total residential units provided as affordable housing.		8
Metric 5.B.2 Housing Preservation	Percentage of households living on site before the project that are maintained or relocated within walking distance.		3
Metric 5.B.3 Business and Services Preservation	Percentage of pre-existing local resident-serving businesses and services on the project site that are maintained on site or relocated within walking distance.		2
		0	**25**

6

Densify – Optimize density and match transit capacity		Metric Points	Total Metric Points
Metric 6.A.1 Nonresidential	Nonresidential density in comparison with best practice in similar projects and station catchment areas.		2
Metric 6.A.2 Residential DensityPrioritized	Residential density in comparison with best practice in similar projects and station catchment areas.		1
		0	**5**

7

Compact – Create regions with short transit commutes		Metric Points	Total Metric Points
Metric 7.A.1 Urban Site	Number of sides of the development that adjoin existing built-up sites.		8
Metric 7.B.1 Transit Options	Number of different transit options that are accessible within walking distance.		2
		0	**10**

8

Shift – Increase mobility by regulating parking and road use		Metric Points	Total Metric Points
Metric 8.A.1 Off-Street Parking	Total off-street area dedicated to parking as a percentage of the development area.		8
Metric 8.A.2 Driveway Density	Average number of driveways per 100 meters of block frontage.		1
Metric 8.A.3 Roadway Area	Total road bed area used for motor vehicle travel and on-street parking as percentage of total development area.		6
		0	**15**

Total Score : 100

Identify investment gaps and propose innovative funding mechanisms

The infrastructure gap for developing counties in Asia excluding China, that is the difference between what is currently spent and the investment required, is greater than 5% of GDP. There is high cost of capital, operation and maintenance cost for mass rapid transit systems, and tight the fiscal capacity of countries like Pakistan and as such cities like Lahore cannot cover these high costs. Local and provincial governments already have high burden of spending on urban utilities and services such water, gas and sanitation, health and education besides subsidizing existing mass transit facilities. Therefore, fiscal constraints have provoked new ideas and innovations for financing infrastructure projects, such as Land Value Capture (LVC).

Land Value Capture hinges on two notions.

3. Improved access and land use planning create and add value to property and other business products or services

4. The notion of LVC affirms that those who benefit from the added value of TOD should chip in to the cost of the quality transit oriented development and connectivity.

The first hurdle to accomplish LVC is how to quantify the land value appreciation that may occur as a result of government intervention. According to a study of 61 cases of mass rapid transit in developed and developing economies , the price premium for properties within the catchment area of the mass transit station is 5% for residential properties and 30% for commercial properties. Land prices continue to decline as one moves away the transit station catchment area by 8% for residential and 15% for commercial properties, per kilometer of distance. However, the limitation of the study is that it ignores the differences in design quality, accessibility through the network, and economic conditions across cities, leading to further variations in property values. Various components of land value are explained in Figure 5.

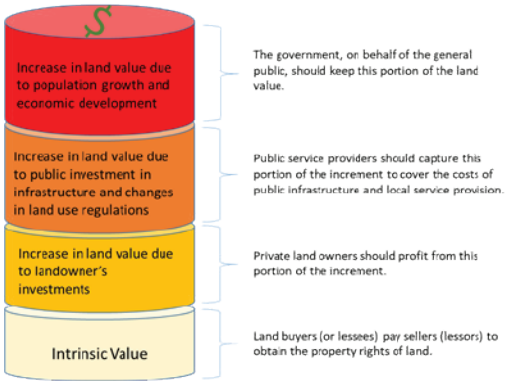


Figure 5: Land value and their attributions adapted

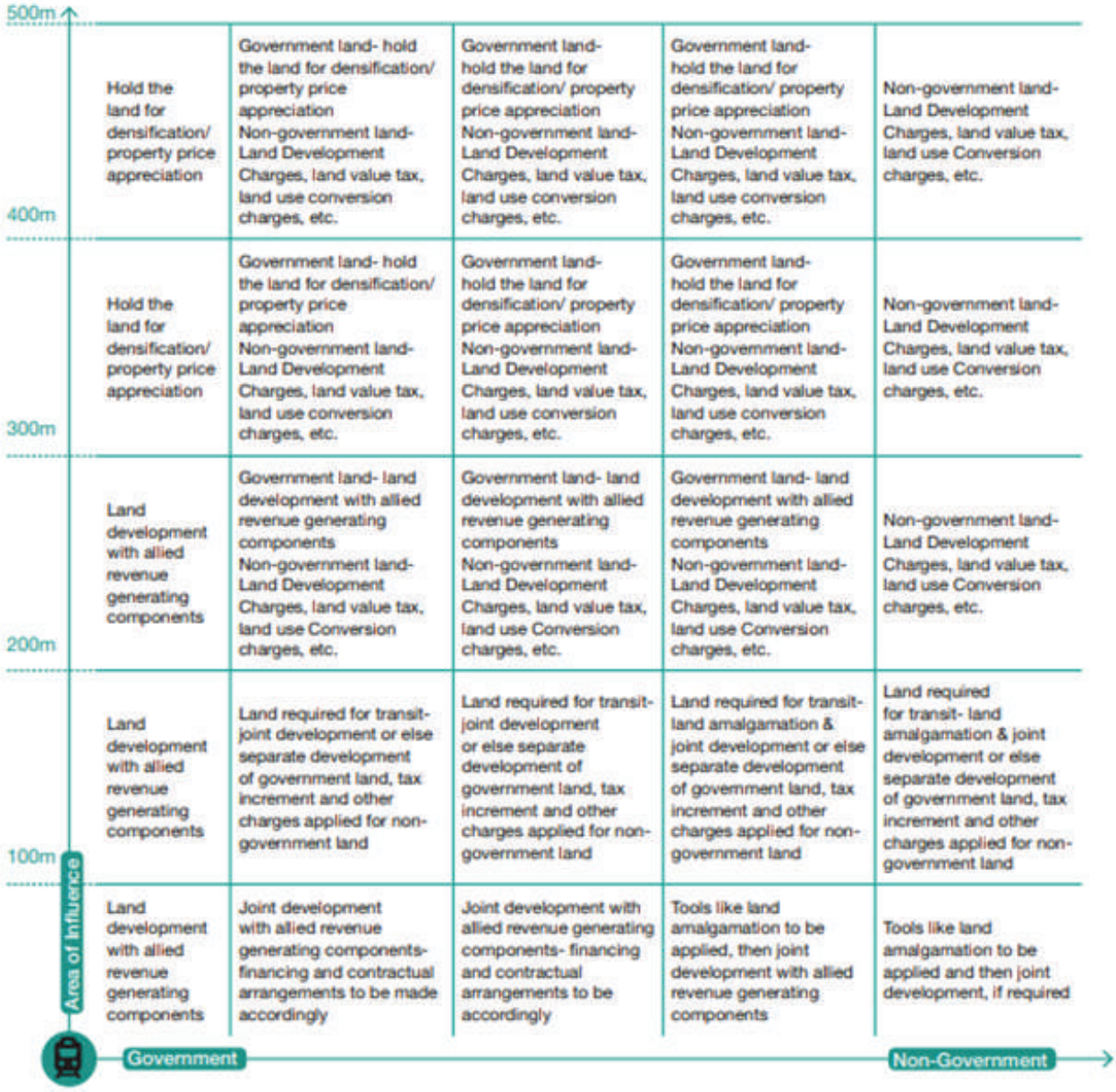
LVC is defined as a "public financing method by which governments

(a) Trigger an increase in land values via investment decisions (building mass transit) or regulatory decisions (e.g., change in land use or FAR) and/or infrastructure investments (e.g., transit);

(b) Institute a process to share this land value increment by capturing part or all of the change; and

(c) Use LVC proceeds to finance infrastructure investments (e.g., investments in transit and TOD), any other improvements required to offset impacts related to the changes (e.g., densification), and/or implement public policies to promote equity (e.g., provision of affordable housing to alleviate shortages and offset potential gentrification)."

There are two main categories for LVC: development based LVC and tax or fee based LVC. Through development based LVC, direct transaction of properties whose values increased due to infrastructure projects or government regulations, provide value capture. Through tax or fee based LVC, indirect methods are used to capture value, for example surplus is extracted from property owners through tax or fees instruments, such as property tax or betterment charges.



Hold the land for densification/ property price appreciation	Government land- hold the land for densification/ property price appreciation Non-government land- Land Development Charges, land value tax, land use conversion charges, etc.	Government land- hold the land for densification/ property price appreciation Non-government land- Land Development Charges, land value tax, land use conversion charges, etc.	Government land- hold the land for densification/ property price appreciation Non-government land- Land Development Charges, land value tax, land use conversion charges, etc.	Non-government land- Land Development Charges, land value tax, land use Conversion charges, etc.
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Land development with allied revenue generating components	Government land- land development with allied revenue generating components Non-government land- Land Development Charges, land value tax, land use Conversion charges, etc.	Government land- land development with allied revenue generating components Non-government land- Land Development Charges, land value tax, land use Conversion charges, etc.	Government land- land development with allied revenue generating components Non-government land- Land Development Charges, land value tax, land use Conversion charges, etc.	Non-government land- Land Development Charges, land value tax, land use Conversion charges, etc.
Land development with allied revenue generating components	Land required for transit-joint development or else separate development of government land, tax increment and other charges applied for non-government land	Land required for transit-joint development or else separate development of government land, tax increment and other charges applied for non-government land	Land required for transit-land amalgamation & joint development or else separate development of government land, tax increment and other charges applied for non-government land	Land required for transit- land amalgamation & joint development or else separate development of government land, tax increment and other charges applied for non-government land
Land development with allied revenue generating components	Joint development with allied revenue generating components- financing and contractual arrangements to be made accordingly	Joint development with allied revenue generating components- financing and contractual arrangements to be accordingly	Tools like land amalgamation to be applied, then joint development with allied revenue generating components	Tools like land amalgamation to be applied and then joint development, if required

Proven Mechanism for Land Value Capture

Practical means of funding for major transit projects lie in five main LVC mechanisms .

A. A value capture through the mainstream taxation system

B. Special fees and levies;

C. Auction of development rights;

D. A comprehensive TOD and urban renewal agency with value capture capabilities

E. Direct property-rail agency as developer in the “East Asian” style.

A Value Capture Through the Mainstream Taxation System

This is a tax based LVC mechanism. The cost of expansionary effort of major transit systems is financed through, or funds are borrowed against, expanding existing taxation regime’s base or value, also called tax increment financing strategy. Taxes levied may be of different kinds from property to commercial or income tax or a combination thereof. Property tax conforms with the subsidiarity principle as the tax can be easily matched to the catchment area of transit stations. However, business and income taxes may also be justifiably increased in response to a rise in economic activity. The core concept is a structured process for the estimation and reuse of higher tax revenue for transit infrastructure financing.

Land and property tax is the most common form of LVC instrument. Taxes are usually levied on estimated land value or combined land and property value as the tax base. The difference between the two options is widely debated and has important efficiency principles. Theoretically, land tax promotes high density development and enhances land use efficiency.

Special Fees and Levies

This is a fee based LVC mechanism. To improve transit service delivery, it involves fees or charges targeting a defined beneficiary base, as fee-for-service or fee-for-amenity. These special fees are new and specific levies on benefits and recipients of profit margin in response to the estimated amount of benefit received. Examples of special fees and levies are:

• Betterment levies are for a specific demarcated area or jurisdiction which has received benefits from accessibility and enhanced connectivity through a public transit system.

• Connection fees are for physically connecting a property or building to a new or existing transit station, and a fee is charged to the property owners. The connection fee should cover the cost of constructing the access point or physical connection to the transit station, and also cover the benefit received from added accessibility and connectivity in terms of economic value.

• Rezoning fees is paid for increasing FAR regulation and allowing the development of higher floor space.

Special fees and levies upholds the expectation that the government earmarks the fees to the exact benefit or infrastructure element to be provided in return, and also expects clear evaluation of the increase in property value or benefit received by the relevant stakeholders.

Auction of Development Rights

This is a development based LVC mechanism. This mechanism involves selling land (through open auction) associated with the development of a transit station and system. The development opportunity is conditional to the delivery of a transit station construction or even an entire rail track infrastructure, as part of the auction process. This approach is similar to a PPP model as the private sector provides the development of the transit facility while the government provides the land for a cost. The winning bidder pays for the development rights. This approach clearly links the value addition to the delivery of transit infrastructure.

However, the number of bidders interested in providing a transit system infrastructure may be limited. The auction price like any bidding process depends on the number of active bidders competitively involved in the auction. Therefore, this option must be carefully articulated ensuring healthy competition

through sufficient number of active bidders to achieve a fair value in return for the land for sale at auction. If the packaging of real estate development with transit infrastructure delivery is too complicated for Pakistan, then the government can carefully sell the land via auction separately and use the proceeds to develop a transit facility through state management.

A Comprehensive TOD and Urban Renewal Authority with Value Capture Capabilities

A dedicated government authority is usually the response to a situation requiring the delivery of hard infrastructure or other government services. An authority can be set up to perform relevant LVC functions and deliver transit infrastructure. Therefore, in this mechanism, LVC can be achieved by:

• Creating a comprehensive urban renewal authority with mandate and powers for rezoning, capabilities in master planning, and the intent to produce new property value. The authority will have the mandate to deliver quality TOD and transit infrastructure, construct access points, built TOD style housing, and public amenities. The authority can also partner with the private sector to complete the aforementioned provisions. A good example of such an authority in in Singapore, the Urban Redevelopment Authority (URA).

• The urban renewal authority can also take up the broader and imperative role of integrated land use planning and development of transport master plans.

• The urban renewal authority can capture value of land through TOD and transit infrastructure development and also carry out the much needed task of comprehensive urban renewal, the need of the hour in many parts of Pakistan and Lahore.

Direct Property Rail Agency as Developer in the “East Asian” style.

This is a development based LVC model referred to as the “East Asian Rail and Property” model. ‘Direct property’ LVC examples have been very successful in East Asian rail agencies in Hong Kong, Singapore and Japan. Direct property rail agency is a transit operator or agency responsible for development and trading, at a commercial scale, property holdings related to stations or transit corridor level projects. The main aim is to use the profit from trading and development for TOD and transit infrastructure funding.

• This mechanism has a transit authority or organization directly involved in property dealing and can involve all the other 4 mechanisms mentioned above. This may be a key support or enabler for the other LVC models to be successful and viable as TOD projects require a lot of funding and are recognized as a catalytic endeavor for further economic and real estate added value.

• This is an important mechanism as transit organizations involved in maintaining the TOD transit stations should be in close proximity to the station amenities. The transit agency or authority should preferably have control of property holdings for operations and access to the transit corridors and for better maintenance and service delivery, rather than a private party to have control and access to the properties related to transit services.

TOD Strategies

Metropolitan/City Level

Global best practices suggest TOD and the vigor of various land use shouldn't be evenly distributed across a city; however, the intensity of land use should peak where access to jobs is the highest. Manufacturing firms locate where land is cheap, and there is easy access to logistics. Retailers and other firms with high value added services (finance and research for example) locate where production and sales can be increased through agglomeration and localization economies with many similar organizations or urbanization economies with sufficient supply chain options. A 30-minute benchmark of access to jobs and firms generates positive agglomeration effects. Therefore, a high density concentration of jobs and people in an area which can be accessed in 30 minutes is ideal.

Network Level

The formation of transit stations, lines and links has a key role in shaping the urban space in terms of agglomeration and urban densities. The transit network is usually in the layout of a core-and-branch system, which is when the core is concentrated with stations and transfer lines, and the branches disperse by the number of lines and stations. The mesh and density of station is higher in the network core and lower in the branches. This creates economic densities at the core. The network layout shapes the urban form and densities. "Cities are networks from which dense activity locations emerge (Salat & Ollivier, 2017, p. 24)".

Polycentric systems and multimodality

In London, New York City and Zhengzhou, two thirds of jobs are located outside the core area along the branches which allows for the opportunities to create mixed use development along the branches radiating from the core, and connected through multimodality. This also gives rise to polycentric systems with multiple economic centers around the city along the branches and sub cores. The job-resident ratio is recommended to be 50 to 70% in a commuting district within an area of 15 square kilometers. Efficient transit systems have integrated hierarchies of service, fares, and information – a seamless combination of transport modes connecting urban, regional and national regions - referred to as multimodality.

Zoning around stations

To obtain high returns on investment in transit networks, maximum development is encouraged at major interchanges with most accessibility. While moderate development is suggested for areas that are less accessible and development is discouraged in areas beyond 1 kilometer from the transit stations (Salat and Olliver 2017, p.25). Similarly suitable FARs are set grounded on development potential based on uses and access. Singapore and Seoul have set their FAR based on proximity to transit stations. In Singapore the CBD has an FAR of 8-25, next to CBD the FAR is 6 and FAR is in the range of 1.5-4 in the residential areas. There should also be flexibility allowed in development for the developer based on market needs. In Kings Cross Long, the developer has a margin to changes uses up to 20% between residential, office and retail.

Station Level

In TOD, the interaction between communities and stations is essential. Transit adjacent development (TAD) and TOD both suggest an 800 meter radius or 10 minute walk of development focus (Salat & Ollivier, 2017, p. 26). However, TAD does not incorporate all the principles of TOD important for local community development, such as connectivity to transit station, land use composition, site design and station access. Most development countries tend to create TAD rather than TOD, by retrofitting existing infrastructure. To ensure TOD at station level, the following principles must be followed:

. Station design quality should be enhanced and stations should be easily accessible by all households in an 800 meter radius, to increase place value

. Public investments will thereby have to be prioritized

. Provide access to health, education, recreation and commercial facilities

. Monitor and pull private sector activity

05

International Practices

International Practices for TOD and LVC

Presented henceforth are three examples from India; Hyderabad, Delhi and Mumbai. The example from Hyderabad focuses on a successful practice of PPP and funding the metro-rail project through LVC. The Delhi example presents lessons learned in terms of policy and governance structures. The example from Mumbai provides useful tips for parking management.

PPP Best Practices in Hyderabad

Hyderabad is one of the largest exporter of software in India and a leading IT sector of the world. Hyderabad Metropolitan Development Area (HMDA) which includes the Greater Hyderabad Metropolitan Corporation (GHMC) has more than 7.5 million people within 7,257 square kilometers, projected to become 11.6 million in 2025. The Hyderabad Metro Rail is proposed to reach 72 kilometers (66 km so far except the old city), currently the second longest system in India with 48 stations after Delhi (250 stations). The project's estimated cost is INR 141.32 billion (USD 1.98 billion) (HMRL, n.d.). In October 2019, there were 417,000 passengers daily (TNMStaff, 2019). It has a frequency of 3 – 5 minutes, and each station is roughly 1 kilometer apart. The entire system is elevated and covers most of GHMC.

Corridor 1:
Miyapur – L.B.Nagar (29 Km)

Corridor 2:
Jubliee Bus Stand - Falaknuma (15 Km)

Corridor 3:
Nagole – Raidurg (28 Km)

Master Plan

The Metropolitan Plan 2031 of HMDA aims for compact development along the transport corridors outside the outer ring road, and promotes agglomeration of social and economic activities. A metro rail system was developed as a standalone project and later incorporated to the master plan of GHMC by the state government. The amendment included TOD zones of 300 meter radius mixed land use zone along the metro corridor to encourage commercial and business use. The rules are relaxed andlocalized as opposed to strict development strategies and land use regulations. (Suzuki, et al., 2015)

Government Structure

Like Lahore, Hyderabad had several administrative organizations and municipalities which were consolidated leading to one of the success factors of the city. Five organizations were merged and an umbrella spatial authority, the HMDA was set up in 2008. The authority is responsible for planning, coordination, supervision, promotion and acquisition of the developments in HMDA by securing funding for amenities and infrastructure (Suzuki et al. 2015, p.197).

Public Private Partnership Metro Rail Project

Hyderabad's PPP model is entrepreneurial of design-build-finance-operate-transfer and takes after reviewing many global best practices in Bangkok, London, Singapore and Tokyo. Larsen and Toubro Limited (L&T) won the largest metro PPP project with the lowest viability gap funding (VGF) of less than 10%. VGF is financing from the national government to complete the cost of PPP financing.

Hyderabad Metro Rail Limited (HMRL) was established as special purpose vehicle (SPV). HMR works as an arbitrator and ensures L&T receives right of way for metro construction, coordinating with GHMC, traffic and police, public works agencies for several clearances. A clear concession agreement was signed with the state government, for 35 years including construction for 5 years, which also outlines the PPP commitments and lists land parcels available for real estate development with

allocation of public uses. Under the PPP responsibilities, the government bought land along the main metro corridors before development, and L&T built deports, railway segments and pillars for the elevated metro rail system. HMR bought 269 acres of land for property development. L&T Metro Rail Pvt. Limited was entitled to the development, operation and maintenance of real estate along the metro corridor, with the right to subcontract. The list of real estate has small land parcels available to L&T for commercial gains. Another important two responsibilities of the concessionaire L&T were to provide connectivity of metro rail to other transport modes, and integrate the metro system with surrounding environments, however, the cost of the same have not been included.

Land Value Capture (LVC) – Funding Arrangements

According to the agreement, the government meets 40% of the project cost and 60% is contributed by L&T. A consortium of 10 banks led by the State Bank of India accumulated funding. The debt to equity ratio was 2:1. L&T forecasts 50% of revenue from fares, 45% from property development and 5% from marketing and parking. (Suzuki et al. 2015, p.200)

Lessons Learned from Dehli

Many cities in India, including Delhi also have the required density and diversity for TOD to be applicable. However, implementation hasn't always been swift. The urban area of Delhi has a population of about 16 million in an area of 1,483 square kilometers. The 2021 master plan of Delhi developed by the Delhi Development Authority (DDA) has been enforced. Delhi's master plan has an entire section dedicated to TOD. TOD has been defined as:

"Key for low-carbon, compact development with mixed land use that allows for optimized development along transit corridor. TOD increases densities and places high-rises along the transit corridors to accommodate a wide variety of uses. It is an ideal tool for governments to address inclusivity by setting minimum caps for housing for various segments. With the policy capturing the essential elements of mixed-use development, non-motorized transport and pedestrian priority, and encouraging a walk-to-work culture, Delhi in particular is looking at TOD as a solution to its mobility and air quality challenges by developing the areas around metro stations." (WRI 2014 in Joshi et al. 2017)

Governance

The example of Delhi has a mix of useful policies as well as important failures to learn from. The policies for density, diversity, mixed use, design, housing, funding and accessibility have been discussed below.

As the national capital, Delhi has had strong support from the national government and success of the metro system in terms of operations. However, as opposed to Hyderabad's PPP model discussed above, Delhi has a conventional government led approach for funding which has unfortunately led to issues that Lahore can learn from. Like Lahore, Delhi faces complex policy making and interest sharing across a plethora of government departments and levels. The DDA and Delhi Metro Rail Company (DMRC) have been unable to capture Land Value for infrastructure financing and public transit development. Land around the metro stations has been underutilized largely because of inconsistence in policy and regulations, and lack of proper coordination amongst DDA, DMRC and other stakeholders.

According to Suzuki et al (2015), there has been intense conflict between DDA and DMRC in property development and taxation, and relaxation of FAR. DDA initially kept FARs as low as 1.0 for DMRC's first property development around a metro station, with the thought process to avoid congestion in the transit metro station. DDA did not allow higher FAR for DMRC properties so DMRC properties do not attract more people than DDA properties. For this reason, approvals for building design, land uses and other clearances took longer than expected. It seems the fundamental wedge between the two was confusion on how to share the benefit from property development around metro stations.

Further conflict has risen as DMRC used land transferred from the national government for real estate speculation for DMRC's own interest without paying property taxes or sharing the benefits with DDA and other land contributors. The two organization could have resolved such issues through negotiation and regulation, and work as a team or create a special organization to handle the Delhi metro system. benefits with DDA and other land contributors. The two organization could have resolved such issues through negotiation and regulation, and work as a team or create a special organization to handle the Delhi metro system.

Density

Delhi master plan and Zonal Development Plans (ZDP) have demarcated 500 meter buffer around the Mass Rapid Transport System (MRTS) lines and stations as Influence Zones (IZ). These IZs are planned for higher densities and in turn planned to influence demand for mode of transportation. Higher densities are expected to lower the average distance travelled using all modes of transportation, preferably NMT and train. (Joshi, et al., 2017) property to create a Developer Entity (DE), and form a single patch of contiguous land of a minimum of 1 hectare, referred to as an integrated scheme. For any scheme, a minimum of FAR 2 and a maximum of FAR 400 with a maximum density of 2,000 persons per hectare (ppHa) is allowed. The housing density permissible is 450 dwelling units per hectare. The densities will be considered for the entire amalgamation of the plot.

A completed plan approved for a TOD scheme will be considered a part of the IZ if more than 50% of the planned scheme area is within the Influence Zone. Within the IZ, TOD integrated schemes and it's allowed FAR, setbacks and densities for a DE supersede any other regulatory authorities' height, FAR and ground coverage restrictions, through the development and approval of a comprehensive TOD integrated scheme proposed by a DE. However, green open and public space of 20% can not be reduced.

Amalgamation and readjustment of plots for city planning is allowed for all redevelopment schemes in Delhi including TOD integrated scheme. The TOD policy promotes and encourages densification of low dense areas in other areas in addition to the IZ along the MRTS corridor.

Mixed Land Use and Diversity

According to the TOD policy in integrated schemes, a minimum of 30% of overall FAR or covered area shall be mandatory for residential use, and a minimum 5% of FAR for commercial use and minimum 10% of FAR for community facilities are also mandatory within prescribed land uses. At least 50% of the total FAR shall be as per ZDP use. Figure 6 shows the mix of uses proposed in the relevant predominant land uses (Joshi et al 2017 p.16).

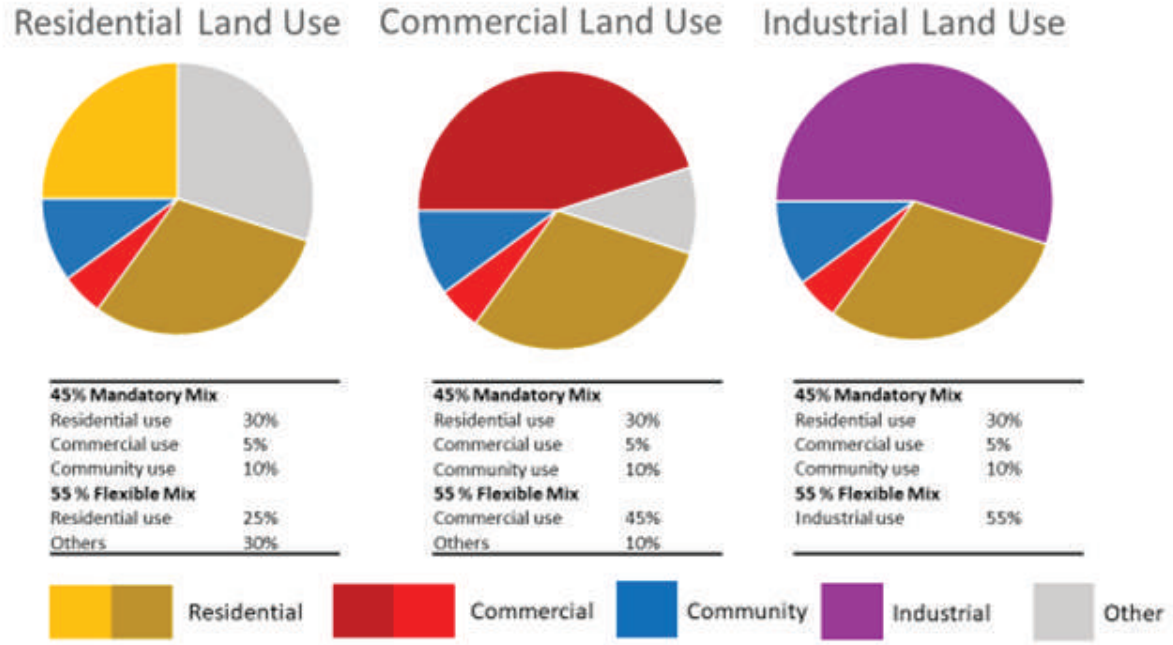


Figure 6: Mix of uses proposed in TOD zone by Delhi Development Authority, adapted from Joshi et al 2017

Design

1. No setbacks are required.

2. The building front shall outlook the public street to create a continuous building street wall.

3. Active frontage is required when the right of way is greater than 12 meters. Active frontage is the street front where there is visual interaction with people on the street and those in the buildings on ground and upper levels. Active frontage elements include access points, transparent windows, entrance doorways, and shops, cafes or restaurants at street level.

4. All of the above will facilitate 'eyes on the street' concept and create vibrancy at street level by rush and people surveying others on the street for safety.

5. Commercial uses or shops should have at least 50% transparency of frontage at ground or street level.

Housing

Housing is essential for TOD zones as they complete the objective of walkable and accessible neighborhoods. Housing must be provided within walking distance to a transit station. In Delhi, a requirement of 30% residential use of total FAR is applicable with an additional 15% for the economically weaker section of the society. This is an initiative to support affordable housing as part of the TOD mandate.

Funding

One of the mechanism's to fund the TOD public transit system in Delhi is to charge and sell development rights to build over and above the permissible FAR. Similarly, development rights of underused FAR can be transferred to other parts of the city.

Parking and Accessibility

Parking space allowed (permissible equivalent car spaces) is 1.33 units per 100 square meter of floor area. Within the integrated scheme in influence zone of the 500 meter radius along the transit corridor, additional parking maybe created on sharing basis with the public during all times. Public open spaces will be designed as well as developed and maintained by the DE or agency. The land use allocated for public open spaces is 20% of the integrated scheme or area combined by the DE of at least 4 hectares. The public open space will remain open and ungated for the general public for all hours according to the TOD policy, the failure of which will result in occupation by a government agency. Moreover, 10% of the amalgamated plot area will be green space. Moreover, 20% of land shall be used for roads and circulation.

Reduced Parking Norms to Improve Quality of Life in Mumbai

Prioritizing access to mass transit, the parking norm and private vehicles are discouraged in TOD zones. The supply of parking spaces is reduced and the demand for parking is also decreased by making it expensive to park in TOD zones. On-street parking within 100 meter of transit stations has to be prohibited, except for temporary parking for pickup for disabled, emergencies and freight delivery. In cases where on-street parking is allowed, it should act a buffer for bicyclists and pedestrians from motor vehicles.

Parking spaces are maximized in the influence zone by sharing spaces between uses, the demand for which is different during various times of the day. Parking required for offices during the day can used as parking for housing during the night for example. It is important to enforce a strict parking policy with heavy penalty for illegal parking in the TOD zone. Parking should also have price variations during different times of the day and according to the duration of parking.

Mumbai's proposed parking prioritizes access to mass transit, allowing tight parking restrictions in the first 250 meters from transit stations and slightly less stringent standards in the next 250 meters. It is imperative to note that the restricted parking must be supplemented with better public transport systems.

New parking standards for TOD zones in Mumbai to regulate off street parking supply and design have been proposed in a report by World Resources Institute (Rangwala, et al., 2014). First two zones are created, TOD parking zone 1 and 2. TOD parking zone 1 encapsulates plots with greater than 50% of plot area within 200 meter radius from the entrance of a transit station. Zone 2 includes plots with more than 50% of plot area within 200 to 500 meter radius from the entrance of the transit station. Zone 1 has more stringent parking requirement than zone 2.

In parking regulation option 1, the entire zone 1 will not be parking free but parking will be provided in public parking lots at a fee, in buildings outside TOD zones and in buildings in TOD zone 2. Minimum parking spaces are abolished and maximum "measure of on-plot parking to be allowed in TOD areas" (Rangwala et al, p.51). The following figure 7, depicts the maximum number of ECS (Equivalent Car Space) allowed per 100 square meter of floor area of each building.

Parking Regulation in TOD areas: OPTION 1				
	TOD Parking Zone 1: Maximum number of ECS per 100sq.m floor space of buildings		TOD Parking Zone 2: Maximum number of ECS per 100sq.m floor space of buildings	
	Residential	Commercial	Residential	Commercial
Option 1: Parking Management – stringent approach	0	0	0.5	0.65
Parking space and FSI calculation	Parking space provision is included in calculation of FSI for the plot.			
Overall parking at plot level control	The maximum overall number of parking allowed per 100 sq m of plot area for zone -2 as 1.0 car space			
Parking for physically handicapped to be provided additional to the mentioned above				

FLOOR SPACE INDEX (FSI) = TOTAL COVERED AREA ON ALL FLOORS / PLOT AREA
Figure 7: Proposed parking regulation option 1 adapted from Rangwala et al, 2014.

In option 2, the following maximum number of ECS allowed per 100 square meter of floor area of each building in figure 8.

Parking Regulation in TOD areas: OPTION 2				
	TOD Parking Zone 1: Maximum number of ECS per 100 sq m floor space of buildings		TOD Parking Zone 2: Maximum number of ECS per 100 sq m floor space of buildings	
	Residential	Commercial	Residential	Commercial
Option 2: Parking Management – restrained approach	0.35	0.45	0.70	0.90
Parking space and FSI calculation	Floor spaces provided for parking spaces are included as part of FSI calculations for the plot.			
Parking for physically handicapped to be provided additional to the mentioned above				

Figure 8: Proposed parking regulation option 2 adapted from Rangwala et al, 2014.

06

Toolkit for Transit Oriented Development

Toolkit for TOD

Develop Neighborhoods That Promote Walking
Walk Principle
1 – 15 Points

Objective A:
The pedestrian realm is safe, complete, and accessible to all

Metric 1.A.1 Walkways
Percentage of walkway segments with safe, all-accessible walkways. 3 points

Metric 1.A.2 Crosswalks
Percentage of intersections with safe, all-accessible crosswalks in all directions. 3 points

Objective B:
The pedestrian realm is active and vibrant

Metric 1.B.1 Visually Active Frontage
Percentage of walkway segments with visual connection to interior building activity. 6 points

Metric 1.B.2 Physically Permeable Frontage
Average number of shops, building entrances, and other pedestrian access per 100 meters of block frontage. 2 points

Objective C:
The pedestrian realm is temperate and comfortable

Metric 1.C.1 Shade and Shelter
Percentage of walkway segments that incorporate adequate shade or shelter elements. 1 point

Metric 1.A.1 Walkways
Percentage of walkway segments with safe, all-accessible walkways. 3 points

Definition:
Walkways are complete and all-accessible when all blocks, properties and entrances have safe and continuous walkways, connected to all adjacent pedestrian network in all directions.

This is an essential feature of TOD. A block's walkways are measured as segments in the pedestrian network. Segments are stretches of walkways between two adjacent intersections in the network and can be of any of the following types :

a) Dedicated sidewalks protected from vehicular traffic by a curb or other adequate device.

b) Shared streets designed for safe sharing between pedestrians, cyclists, and vehicles (i.e., with speeds capped at 15 km/hour

c) Pedestrian paths or pedestrian-cyclist shared paths.

Acceptable complete walkway segments must meet all the following criteria:
a) be designed for easy pedestrian access to all adjoining buildings and properties on the block frontage segment,

b) be unobstructed and barrier-free for people with disabilities, including wheelchair users and people with low vision, according to local regulations or international standards ,and

c) receive street lighting at night that is adequate for pedestrian safety and security.

Measurement method:
1. Quantify the total walkway segments abutting the block. (Blocks are areas impermeable to public pedestrian traffic and limited by public-accessible pedestrian walkways, including passages through building

2. Quantify the qualifying walkway segments (see details above).

3. Divide the second measure by the first to calculate the percentage of walkway network completeness.

Percentage of the walkway network that is complete
100% - 3 points
90% or more – 2 points
80 % or more – 1 point
Less than 80% - 0 points

Metric 1.A.2 Crosswalks

Percentage of intersections with safe, all-accessible crosswalks in all directions . 3 points

Definition:

• A core feature of TOD is to provide a complete and all-accessible pedestrian network

• Safe crosswalks are mandatory at intersections of roads where motor vehicle speed is greater than 15 km/hour

• In a very dense network of streets, a crosswalk is required only at 200 meter or less intervals

To qualify as safe and all-accessible crosswalks, the following must be accomplished:

a) Crosswalks must be barrier free for special persons with disabilities, according to international standards or local regulations

b) Crosswalks should be 2 meters or more in width and demarcated

c) Crosswalks must be sufficiently lit at night for security

d) Crosswalks must offer refuge islands if there are more than two traffic lanes

Measurement method:

1. Quantify the number of intersections that require pedestrian crossing facilities.

2. Quantify the number of these intersections with qualifying crossing facilities

3. Divide the second measure by the first to calculate the percentage of complete intersections.

Scoring Criteria:

Percentage of intersections that have complete crosswalks
100% - 3 points
90% or more – 2 points
80 % or more – 1 point
Less than 80% - 0 points

Metric 1.B.1 Visually Active Frontage

Percentage of walkway segments with visual connection to interior building activity. 6 points

Definitions:

• A walkway segment (the length of frontage between two intersections in the pedestrian network) is considered visually active if more than 20% of the length along the building frontage is visually active.

• Visually active frontage is visually penetrable building fronts on the ground floor along the public sidewalk.

• Visually penetrable frontage is completely or partially transparent windows or entrances along the walkway segment between ground level and 2.5 meters above ground.
• Residential building windows with niches or sills at eye level are allowed.

• Landscaping not designed for routine use of people is not included in the visually active frontage, however, accessible open spaces such as parks are included.

• Garage entrances and other vehicle-only access points are not included as visually active frontage and count as blank walls.

• Undeveloped plots (plots farmed, fallow, vacant, or used as park and gardens) are not included in the measurement.

Measurement method:

1. Quantify the total number of public walkway segments.

(a) For narrow streets with a right of way from building line to building line of less than 20 m, both sidewalks can be counted as one public walkway segment.

(b) For streets with a right of way from building line to building line of 20 m or more, each sidewalk must be counted as one walkway segment.

2. Quantify the number of public walkway segments that qualify as visually active (see details above).

3. Divide the second measure by the first to calculate an active frontage percentage.

(b) For streets with a right of way from building line to building line of 20 m or more, each sidewalk must be counted as one walkway segment.

2. Quantify the number of public walkway segments that qualify as visually active (see details above).

3. Divide the second measure by the first to calculate an active frontage percentage.

Scoring Criteria:

Percentage of walkway segments with visually active frontage
90% or more - 6 points
80% or more - 5 points
70 % or more - 4 point
60% or more - 3 points
50% or more – 2 points
Less than 50% - 0 points

Metric 1.B.2 Physically Permeable Frontage

Average number of shops, building entrances, and other pedestrian access per 100 meters of block frontage. 2 points

Definitions:

• Qualifying entrances include openings to shops/stores, restaurants and cafés, building lobbies, active service entrances, pedestrian passageways, park gates, and corner plaza access.

• Non qualifying entrances include emergency-only exits, storage, motor vehicle garages, and driveway entrances.

• Undeveloped plots (plots still vacant, or used as parks and gardens) are not included in the measurement.

• Alleyways that dead-ends and do not lead to a main pedestrian entrance do not quality.

Measurement method:

1. Quantify the total length of block frontage that abuts public walkways and divide by 100 meters.

2. Quantify the number of entrances along public walkways.

3. Divide the second measure by the first to calculate the average number of entrances per 100 m of block frontage.

Scoring Criteria:

Average number of entrances per 100 m of block frontage
5 or more - 2 points
3 or more – 1 points
Fewer than 3 – 0 point

Metric 1.C.1 Shade and Shelter

Percentage of walkway segments that incorporate adequate shade or shelter elements. 1 point

Definitions:

• Walkway segments are the parts of walkways that lie between two adjacent intersections in the pedestrian network, including nonmotorized network intersections.

• Shade and shelter can be offered through different facilities that a locally available such as trees, buildings and freestanding structures.

• Shaded walkways are walkways that provide appropriate shading over the clear pedestrian path in the hottest season.

• Streets with more than two traffic lanes must be adequately shaded on both sides to qualify as shaded walkway segments.

Measurement method:

1. Quantify the number of walkway segments.

2. Quantify the number of segments that incorporate climate-adequate shade or shelter elements.

3. Divide the second measure by the first to calculate the percentage of adequately shaded and sheltered walkways.

Scoring Criteria:

Percentage of all walkway segments that have adequate shade and shelter amenities
75% or more - 1 points
Less than 75%– 0 points

Prioritize Nonmotorized Transport Networks Cycle Principle 2 – 5 Points

Objective A:
The cycling network is safe and complete.

Metric 2.A.1 Cycle Networks
Access to a safe cycling street and path network 2 points

Objective B:
Cycle parking and storage are ample and secure

Metric 2.B.1 Cycle Parking at Transit Stations
Ample, secure, multi-space cycle parking facilities are provided at all transit stations. 1 point

Metric 2.B.2 Cycle Parking at Buildings
Percentage of buildings that provide ample secure cycle parking. 1 point

Metric 2.B.3 Cycle Access in Buildings
Buildings allow interior access and storage within tenant-controlled spaces for cycles. 1 point

Metric 2.A.1 Cycle Networks
Access to a safe cycling street and path network 2 points

Definitions:
Complete cycling network subdivisions with secure conditions are defined as:

• Street segments with speeds above 30 km/hour with exclusive or protected cycle lanes, spatially segregated from vehicles in both directions (e.g., painted or physically separated cycle lanes),

• Slow street segments with a vehicular speed of 30 km/hour or slower (exclusive or protected cycle lanes are not required

• Pedestrian-priority street segments, or shared streets, with 15 km/hour (vehicular speed limit (no segregation of either pedestrians or cyclists is required), or paths restricted to pedestrians and cyclists.

Measurement method:
1. Identify all street and path network segment in the area that qualify for safe cycling (see details above) and connect to a qualifying transit station.

2. Identify the building the farthest (walking distance) from the safe cycling network. Exclude any extreme outliers. Measure the walking distance from the building to the safe cycling network.

Scoring Criteria:

Percentage of all walkway segments that have adequate shade and shelter amenities
75% or more - 1 points
Less than 75%– 0 points

Metric 2.B.1 Cycle Parking at Transit Stations
Ample, secure, multi-space cycle parking facilities are provided at all transit stations. 1 point

Definitions:
• Secure cycle parking needs fixed, mass facilities to lock bicycle and NMT vehicles, such as outdoor racks and storage.

• Cycle parking facilities should be located outside pedestrian or vehicle circulation paths and within 100 meters (m) of a transit station entrance.

Measurement method:
1. Identify all transit stations within the scope defined below.

2. Identify any station that does not provide mass, secure cycle parking facilities (see details above).

Scoring Criteria:

Cycle parking at transit stations
Multispace cycle racks are provided within 100 m of all transit stations - 1 points
Multispace cycle racks are not provided or are only provided at some transit stations - 0 points

Metric 2.B.2 Cycle Parking at Buildings

Percentage of buildings that provide ample secure cycle parking. 1 point

Definitions:

• Applies to buildings with a floor area larger than 500 square meters or six residential units.

• Cycle parking at buildings is acceptable if:
a) is located clear of pedestrian or vehicle circulation areas within 100 m of the entrance, and

b) provides ample racks or other fixed facilities to securely lock bicycles and other nonmotorized vehicles.

Measurement method:

1. Quantify all applicable buildings.

2. Quantify all applicable buildings with qualifying cycle parking (see details above).

3. Divide the second measure by the first to calculate a percentage for cycle parking provision.

Scoring Criteria:

Percentage of buildings that qualifying cycle parking
25% or more - 1 points
Less than 25% - 0 points

Metric 2.B.3 Cycle Access in Buildings

Buildings allow interior access and storage within rented spaces for cycles. 1 point

Definitions:

• Cycle access via common hallways and elevators into residential and nonresidential tenant-controlled or rented spaces must be allowed by building code or bylaws or by long-term lease agreement.

Measurement method:

• Review applicable codes and bylaws or a tenant handbook

Scoring Criteria:

Cycle access in buildings
Cycle access is required by building codes or bylaws or long-term lease agreement - 1 points
Cycle access is not required by building codes or bylaws or long-term lease agreement - 0 points

Create Dense Networks of Streets and Paths Connect Principle 3 – 15 Points

Objective A:

Walking and cycling routes are short, direct, and varied.

Metric 3.A.1 Small Blocks

Length of longest pedestrian block.10 points

Objective B:

Walking and cycling routes are shorter than motor vehicle routes

Metric 3.B.1 Prioritized Connectivity

Ratio of pedestrian intersections to motor vehicle intersections. 5 points

Metric 3.A.1 Small Blocks

Length of longest pedestrian block.10 points

Definitions:

• Pedestrian block is a set of contiguous adjoining properties impermeable to public pedestrian traffic. A block line separates the adjoining properties from public pedestrian passages demarcating a block. For example, a building with a through passage open to the public counts as two pedestrian blocks.

• Public accessibility is defined as unrestricted passage for all for at least 15 hours a day.

• Blocks are measured by the length of the longest block face or block frontage. The block line is measured corner to corner between two adjacent intersections in the pedestrian network.

• Blocks that are permanently impermeable to pedestrians, such motorways, are not counted.

Measurement method:

1. Quantify the number of blocks that lie fully within the development.

2. Measure or estimate the length of each block.

Scoring Criteria:

Percentage of all walkway segments that have adequate shade and shelter amenities
75% or more - 1 points
Less than 75%– 0 points

Metric 2.B.1 Cycle Parking at Transit Stations

Ample, secure, multi-space cycle parking facilities are provided at all transit stations. 1 point

Definitions:

• Secure cycle parking needs fixed, mass facilities to lock bicycle and NMT vehicles, such as outdoor racks and storage.

• Cycle parking facilities should be located outside pedestrian or vehicle circulation paths and within 100 meters (m) of a transit station entrance.

Measurement method:

1. Identify all transit stations within the scope defined below.

2. Identify any station that does not provide mass, secure cycle parking facilities (see details above).

Scoring Criteria:

Cycle parking at transit stations
Multispace cycle racks are provided within 100 m of all transit stations - 1 points
Multispace cycle racks are not provided or are only provided at some transit stations - 0 points

Metric 2.B.2 Cycle Parking at Buildings

Percentage of buildings that provide ample secure cycle parking. 1 point

Definitions:

• Applies to buildings with a floor area larger than 500 square meters or six residential units.

• Cycle parking at buildings is acceptable if:
a) is located clear of pedestrian or vehicle circulation areas within 100 m of the entrance, and

b) provides ample racks or other fixed facilities to securely lock bicycles and other nonmotorized vehicles.

Measurement method:

1. Quantify all applicable buildings.

2. Quantify all applicable buildings with qualifying cycle parking (see details above).

3. Divide the second measure by the first to calculate a percentage for cycle parking provision.

Scoring Criteria:

Percentage of buildings that qualifying cycle parking
25% or more - 1 points
Less than 25% - 0 points

Metric 2.B.3 Cycle Access in Buildings

Buildings allow interior access and storage within rented spaces for cycles. 1 point

Definitions:

• Cycle access via common hallways and elevators into residential and nonresidential tenant-controlled or rented spaces must be allowed by building code or bylaws or by long-term lease agreement.

Measurement Method:

• Review applicable codes and bylaws or a tenant handbook

Scoring Criteria:

Cycle access in buildings
Cycle access is required by building codes or bylaws or long-term lease agreement - 1 points
Cycle access is not required by building codes or bylaws or long-term lease agreement - 0 points

Create Dense Networks of Streets And Paths Connect Principle 3 – 15 Points

Objective A:
Walking and cycling routes are short, direct, and varied.

Metric 3.A.1 Small Blocks
Length of longest pedestrian block.10 points

Objective B:
Walking and cycling routes are shorter than motor vehicle routes

Metric 3.B.1 Prioritized Connectivity
Ratio of pedestrian intersections to motor vehicle intersections. 5 points

Metric 3.A.1 Small Blocks
Length of longest pedestrian block.10 points

Definitions:
• Pedestrian block is a set of contiguous adjoining properties impermeable to public pedestrian traffic. A block line separates the adjoining properties from public pedestrian passages demarcating a block. For example, a building with a through passage open to the public counts as two pedestrian blocks.

• Public accessibility is defined as unrestricted passage for all for at least 15 hours a day.

• Blocks are measured by the length of the longest block face or block frontage. The block line is measured corner to corner between two adjacent intersections in the pedestrian network.
• Blocks that are permanently impermeable to pedestrians, such motorways, are not counted.

Measurement method:

1. Quantify the number of blocks that lie fully within the development.

2. Measure or estimate the length of each block.

Scoring Criteria:

90% of blocks within the catchment area are:
Shorter than 110 m – 10 Points
Shorter than 130 m – 8 Points
Shorter than 150 m – 6 Points
Shorter than 170 m – 4 Points
Shorter than 190 m – 2 Points
More than 10% of blocks within the catchment area are longer than 190 m – 0 Points

Metric 3.B.1 Prioritized Connectivity
Ratio of pedestrian intersections to motor vehicle intersections. 5 points

Definitions:
• Pedestrian intersections are intersections in publicly accessible pedestrian network. The network has streets with sidewalks and crosswalks, shared streets with priority given to pedestrians, pedestrian paths and passages.

• Motor vehicle intersections are intersections or junctions in the vehicular road network excluding pedestrian priority streets.

• Intersections at plazas and open spaces permeable to pedestrians and cyclists, but without defined paths, are counted as four-way intersections.

Measurement method:
1. Map all motor vehicle intersections within the development and to the centerline of peripheral streets.

2. Map all pedestrian intersections within the development and to the centerline of peripheral streets. Count all motor vehicle intersections with appropriate walkways and crosswalks as pedestrian intersections in this step.

3. Quantify all intersections as follows:

a) A four-way intersection = 1 intersection

b) A three-way, or “T”, intersection = 0.75 intersections

c) A five-way intersection = 1.25 intersections

4. Divide the second measure by the first to calculate a prioritized connectivity ratio.

Scoring Criteria:

Percentage of intersections that have complete crosswalks
2 or higher - 5
1.5 or higher - 3
Higher than 1 - 1
1 or lower - 0

locate Development Near High-quality Public Transport

Transit Principle 4 – Tod Requirement

Objective A:
High-quality transit is accessible by foot.

Metric 4.A.1 Walking Distance to Transit
Walking distance to the nearest transit station

Definitions:
• The qualifying transit stations are accessible for everyone and a maximum frequency of every 15 minutes between 7 am to 10 om

o It is a rapid transit station (a bus rapid transit or a light rail)

o It is a non-rapid transit station that connects to a rapid transit station with 5 kilometers

• All development properties must be within 1000 meters walking distance to the rapid transit station or within 500 meters walking distance of non-rapid direct service.

• The walking distance is measured through walkways and crosswalks to the farthest building entrance, not by a straight line over buildings.

• All-accessible stations and walkways are defined as barrier-free for people with disabilities, including wheelchair users and people with low vision, according to local regulations or international standards.

Measurement method:
1. Identify the building entrances that are farthest from applicable transit stations.

2. Quantify the longest walking distance to the nearest station.

Scoring Criteria:

Maximum Walking Distance to Transit
The longest walking distance to a transit station is 1,000 m or less for rapid transit or 500 m or less for a direct service - Meets Tod Standard Requirement
The longest walking distance to a transit station is 1,000 m or less for rapid transit or 500 m or less for a direct service - Does Not Meets Tod Standard Requirement

Plan for Mixed Uses, Income, and Demographics Mix Principle 5 – 25 Points

Objective A:
Opportunities and services are within a short walking distance of where people live and work, and the public space is activated over extended hours.

Metric 5.A.1 Complementary Uses
Residential and nonresidential uses within same or adjacent blocks. 8 points

Metric 5.A.2 Access to Local Services
Percentage of buildings that are within walking distance of an elementary or primary school, a healthcare service or pharmacy, and a source of fresh food. 3 points

Metric 5.A.3 Access to Parks and Playgrounds
Percentage of buildings located within a 500-meter walking distance of a park or playground. 1 point

Objective B:
Diverse demographics and income ranges are included among local residents.

Metric 5.B.1 Affordable Housing
Percentage of total residential units provided as affordable housing. 8 points

Metric 5.B.2 Housing Preservation
Percentage of households living on site before the project that are maintained or relocated within walking distance. 3 points

Metric 5.B.3 Business and Services Preservation
Percentage of pre-existing local resident-serving businesses and services on the project site that are maintained on site or relocated within walking distance. 2 points

Metric 5.A.1 Complementary Uses
Residential and nonresidential uses within same or adjacent blocks. 8 points

Definitions:
• Two types of land use mix are distinguished:

o Internally complementary: residential and nonresidential uses form a complementary mix within the development, and

o Contextually complementary: the project's predominant share of floor area is dedicated to uses complementary to the uses predominant in the surrounding station catchment area

• A development is defined as internally complementary if residential uses account for no less than 15% and no more than 85% of the total developed floor area.

• A development is defined as contextually complementary if either:

o More than half of its floor area is dedicated to uses that are predominant in the station catchment area, or

o The development is internally complementary and located in a station area with a residential use balance between 40% and 60%.

• A station catchment area is defined as balanced when the residential to nonresidential uses ratio of floor area is between 50%/50% and 40%/60%.

Measurement method:
Identify the residential and nonresidential land uses and the proportion of each category within the station catchment area.

1. Identify zones with distinct typologies in the catchment area of the station (if any).

2. Select a typical block sample from each of the zones.

3. Calculate the percentage of predominant uses in each sample.

4. Calculate the weighted average of the predominant use in the area by factoring the results by the area of each zone.

Scoring Criteria:

Prioritized connectivity ratio is:
50% to 60% of the total floor area - 8 points
61% to 70% of the total floor area - 6 points
71% to 80% of the total floor area - 4 points
More than 80% of the floor area - 0 points

Metric 5.A.2 Access to Local Services

Percentage of buildings that are within walking distance of an elementary or primary school, a healthcare service or pharmacy, and a source of fresh food. 3 points

Definitions:

• Fresh food includes fresh fruits and vegetables, dairy products, or meat and seafood.

• Eligible sources of fresh food include small and large commercial grocery stores, public markets and street vendors, or any documentable weekly or more frequent local source of fresh food.

• If sources of fresh food are planned development, they can still be scored.

• Sources of fresh food outside the station catchment area but within a 500-meter walking distance of all development buildings are also eligible.

• Eligible elementary or primary schools include public and private institutions located within a 1,000 m walking distance of the farthest building entrance in the development and open to all local children, regardless of gender, religion, ethnicity, or capacity to pay fees according to their income level.

• Eligible healthcare facilities or pharmacies are open to all and located within a 1,000 meter walking distance of the farthest building entrance in the development.

Measurement method:

1. Map all buildings and primary building entrances.

2. Map all sources of fresh food.
3. Map all qualifying elementary schools and healthcare services.

4. Mark all buildings with entrances within a 500 m walking distance of fresh food sources and a 1,000 m walking distance of primary or elementary schools and a healthcare service or a pharmacy.

Scoring Criteria:

80% or more of the buildings are within the specified walking distance to defined types of local services
3 types - 8 points
2 types - 6 points
1type - 4 points
Fewer than 80% of the buildings are within the specified walking distance to defined types of local services - 8 points

Metric 5.A.3 Access to Parks and Playgrounds

Percentage of buildings located within a 500-meter walking distance of a park or playground. 1 point

Definitions:

• A playground or park should be at least 300 square meters of area and accessible to the public for 15 hours or more per day. If the park also has shared use for schools, school time can be subtracted from the opening hours.

• Parks outside of the station catchment area but within a 500 m walking distance of the project are also eligible.

Measurement method:

1. Map all buildings and primary building entrances.

2. Map all eligible parks and playgrounds.

3. Mark all buildings with entrances within a 500 m walking distance of eligible parks and playgrounds

Scoring Criteria:

Percentage of buildings within walking distance of a publicly accessible park or playground:
80% or more - 1 points
Less than 80% - 0 points

Metric 5.B.1 Affordable Housing

Percentage of total residential units provided as affordable housing. 8 points

Definitions:

• Affordable housing standards prescribe is local, provincial, and central policies should be used.

• If not available, 30% of mean income in Pakistan or Punjab or District is the threshold for affordable housing rent.

• Pre-existing substandard housing units on site that are upgraded to local housing standards as part of the project count as new affordable housing units.

• If there are not standards for low, middle and high income benchmarks in Pakistan, then use the following thresholds

o High household income is twice the national median (adjusted for household size)

o Low household income is two-thirds or less than national median (adjusted for household size)

• No points are accrued for adding affordable housing units to already predominantly low-income residential areas.

• Affordable housing status and pricing must be guaranteed for at least 10 years or according to applicable regulations.

• Infill projects are no more than 1 hectare (ha) in land area or a full block, whichever is smaller.

• Projects larger than 1 ha or a full block, whichever is larger, are defined as large projects.

Measurement method:

• Obtain data for metropolitan area housing unit rent and sale prices.

• Calculate the respective figures for 30% of the metropolitan median.

• Obtain equivalent data or estimates for the station catchment area.

• Calculate the ratio of housing units in the catchment area priced below 30% of the metropolitan median.

Scoring Criteria:

Ratio of dwelling units priced 30% below the metropolitan median to dwelling units priced above is:
Between 30% and 69% - 8 points
Between 20% and 29% or
between 70% and 79% - 5 points
Between 10% and 19% or
between 80% and 89% - 2 points
Under 10% or over 90% - 0 Point

Metric 5.B.2 Housing Preservation

Percentage of households living on site before the project that are maintained or relocated within walking distance. 3 points
Definitions:

• Households that are eligible have lived on the development site before public announcement of the project.

• Maintained: a maintained household is not relocated and kept in the same place. The housing unit is improved to new project or local building standards and safe from exposure to risks such as flooding, contamination, landslides for example.

• Relocated: a household is relocated on site or close to the site in freshly built housing with the, same or better quality, same or higher floor area, and same of lower cost of housing.

• Safe transitory housing must be provided during the progress and construction of the TOD

• Walking distance: for the purpose of preserving social and economic ties is defined as preferably 250 meters from the original dwelling site and no more than 500 m.

• Maintained or relocated housing units must be served by a public transport station as per Metric 4.A.1.

• Households that are offered an upgrade or relocation but choose to move away will be counted toward fulfillment of the metric if compensated on the basis of the post-project market value.

Measurement method:

1. Identify the number of eligible households on site before the project. If no pre-existing households were on site, the project accrues the full three points and no further measurement is needed.

2. Identify the number of eligible households maintained, rehoused on site, or that chose compensation.

3. Identify the number of eligible households rehoused within a 250 m walking distance of their previous address.

4.Identify the number of eligible households rehoused within a 500 m walking distance of their previous address.

5. Compare the figures obtained in Steps 2–4 to the figure obtained in Step 1.

Scoring Criteria:

Preservation of Existing Housing
100% of households are maintained, relocated on site or within a 250 m walking distance of previous address, or compensated according to their choice, or no households pre-existed on site - 3 points
100% of households that chose to have been relocated within a 500 m walking distance of the previous address - 2 points
Less than 100% of households have been maintained or relocated within walking distance - 0 point

Metric 5.B.3 Business and Services Preservation

Percentage of pre-existing local resident-serving businesses and services on the project site that are maintained on site or relocated within walking distance. 2 points

Definitions:

• Those businesses and services are eligible who serve local residents and have been on the project site for at least one year.

• The maintained or relocated space should offer the same floor area, the same of better standard, and same of lower costs of rent, mortgage and monthly fees. If the space is a rental, it must offer a long term lease.

• Relocation on site must offer transitory relocation within 500 meters during construction of TOD or compensation of loss of business.

• Relocated site also quality if the businesses are relocated within the TOD zone, 500 or 1000 meters from TOD transit station as in Metric 4.A.1.

Measurement method:

1. Identify the number of eligible businesses and services on the project site before project construction starts. If no pre-existing businesses were on site, the project accrues the full two points and no further measurement is needed.

2. Identify the number of eligible businesses and services maintained or relocated on site after construction.

3. Identify the number of eligible businesses and services relocated within a 500 m walking distance of the previous location.

4. Compare the figures obtained in Steps 2–4 with the figure obtained in Step 1.

Scoring Criteria:

Preservation Of Pre-existing Local Businesses And Services
All eligible businesses and services are maintained in situ or relocated within a 500m walking distance of previous address, or no businesses or services pre-existed on site - 2 points
Businesses and services not fully maintained or relocated within walking distance - 0 point

Optimize Density and Match Transit Capacity Densify Principle 6 – 15 Points

Objective A

High residential and job densities support high-quality transit, local services, and public space activity.

Metric 6.A.1 Nonresidential Density

Nonresidential density in comparison with best practice in similar projects and station catchment areas. 7 points

Metric 6.A.2 Residential Density

Residential density in comparison with best practice in similar projects and station catchment areas. 8 points

Metric 6.A.1 Nonresidential Density

Nonresidential density in comparison with best practice in similar projects and station catchment areas. 7 points

Definitions:

• Nonresidential use density is to be compared with a benchmark density or a similar case or project in the region to mark as baseline.

• The baseline project should be newly completed and comparable in size, type and land use, density/building regulations, within the city or region. The area should have real estate values above the average.

• The proxy indicators for comparison can be:

o Total number of jobs or daily visitors per hectare, if available OR

o Nonresidential floor area ration (FAR) as an acceptable alternative

• Nonresidential FAR is the sum of the nonresidential gross floor area (GFA) of building divided by the land area. The GFA is the sum floor area side the building, including wall footprints and floor openings but excluding subsurface basements, unenclosed areas, and roof areas.
• The gross land area figures used in the TOD Standard include building plots and local streets but exclude any land occupied by

o large public infrastructure on or traversing the development land (e.g., arterial roads, transport facilities, water supply, power, or telecommunication),

o local public facilities (e.g., local schools, neighborhood libraries, public sport fields, and playgrounds), or

o publicly accessible parks and natural constraints more than 1 hectare in area (e.g., bodies of water and wetlands, wooded land, or steep slopes).

• If a project is at least 85% residential in a predominantly non-residential area, it gets the same points as obtained for Metric 6.A.2 (residential density) up to a maximum of 7 points.

Measurement method

1. Calculate or estimate the nonresidential density for the total 1,000 m station catchment area and for the 500 m station catchment area.

2. Identify the densest district in the metropolitan area with land uses similar to the station catchment area being scored and a real estate value above the city average (as a proxy for desirability).

3. Calculate or estimate the nonresidential density in the district.

4. Compare the average nonresidential density of the station catchment area with the baseline density.

5. Compare the 1,000 and 500 m station catchment areas.

Scoring Criteria

Station Chatchment Area Nonresidential Density
The nonresidential density is higher than the baseline, and the 500 m catchment area is denser than the 1,000 m catchment area - 7 points
The nonresidential density is higher than the baseline, and the 500 m catchment area is less dense than the 1,000 m catchment area - 5 point
The nonresidential density is equal to or within 5% below the baseline, and the 500 m catchment area is denser than the 1,000 m catchment area - 3 points
The nonresidential density is equal to or within 5% below the baseline, and the 500 m catchment area is less dense than the 1,000 m catchment area - 2 points
The total density is more than 5% below the baseline - 0 points

Metric 6.A.2 Residential Density

Residential density in comparison with best practice in similar projects and station catchment areas. 8 points

Definitions:

• Residential density for a project or station catchment area is compared with the density best practice baseline as used in Metric 6.A.1.

• The proxy for residential density is gross household density, or dwelling unit density, calculated by dividing the total number of dwellings units by the gross land area as defined in Metric 6.A.1 and measured in hectares.

• If a project is at least 85% non-residential in a predominantly residential area, it gets the same points as obtained for Metric 6.A.1 (nonresidential density).

Measurement method:

1. Calculate or estimate the dwelling unit density for the total 1,000 m station catchment area and for the 500 m station catchment area.

2. Identify the densest district in the metropolitan area with land uses similar to the station catchment area being scored and a real estate value above the city average (as a proxy for desirability). Calculate or estimate the dwelling unit density in the district.

3. Compare the average dwelling unit density of the station catchment area with the baseline density as well as the two catchment area zones, accordingly.

Scoring Criteria:

Station Catchment Area Household Density
The Total Number Of Dwelling Units Per Hectare Is Higher Than The Baseline. The 500 M Catchment Area Is Denser Than The 1,000 M Catchment Area - 8 Points
The Total Number Of Dwelling Units Per Hectare Is Higher Than The Baseline. The 500 M Catchment Area Is Less Dense Than The 1,000 M Catchment Area - 6 Point
The Total Number Of Dwelling Units Per Hectare Is Equal To The Baseline Or No More Than 5% Below It. The 500 M Catchment Area Is Denser Than The 1,000 M Catchment Area - 4 Points
The Total Number Of Dwelling Units Per Hectare Is Equal To The Baseline Or No More Than 5% Below It. The 500 M Catchment Area Is Less Dense Than The 1,000 M Catchment Area - 2 Points
The Total Number Of Dwelling Units Per Hectare Is More Than 5% Below The Baseline- 0 Points

Create Regions with Short Transit Commutes Compact Principle 7 – 10 Points

Objective A

The development is in, or next to, an existing urban area.

Metric 7.A.1 Urban Site

Number of sides of the development that adjoin existing built-up sites. 8 points

Objective B

Traveling through the city is convenient.

Metric 7.B.1 Transit Options
Number of different transit options that are accessible within walking distance 2 points

Metric 7.A.1 Urban Site
Number of sides of the development that adjoin existing built-up sites. 8 points

Definitions:
• Existing built-up sites that adjoin the study TOD area are sites that are built-up, a site that was developed but has been cleared or land that is prepared for development as per the master plan

• Counted as built-up for this metric are sites that reflect development such as transport infrastructure (example motorways), water bodies (lakes and rivers), natural topography, or protected landscape.

Measurement method:
1. Measure the total area of developable sites/properties within the defined station catchment area.

2. Measure the total area of developable sites/properties that are built-up.

3. Divide the second measure by the first to get the percentage (area) of developable sites that are built-up.

Scoring Criteria

Number of sides that adjoin built-up sites:
More than 90% - 8 Points
Up to 90% - 6 Point
Up to 80% - 4 Points
Up to 70% - 2 Points
Less than 80% - 0 Points

Metric 7.B.1 Transit Options
Number of different transit options that are accessible within walking distance 2 points

Definitions:
• Transit options are transit lines, in addition to non-bus rapid transit and para-transit options that operate 7 am to 10 pm and have a service frequency of maximum 20 minutes or less.

• Different stations on the same transit line counts as on transit option.

• A dense bicycle share system for the public is also a transit option.

Measurement method:
1. Identify all applicable high-capacity regular transit services, as well as para-transit services and public bicycle station options, within walking distance, excluding the primary transit station used in scoring Metric 4.A.1.

Transit Line Options
Additional high-capacity transit line - 2 Points
Applicable bike share system - 2 Point
Additional regular transit routes - 1 Points
Up to 70% - 2 Points
Less than 80% - 0 Points

Increase Mobility by Regulating Parking and Road Use Shift Principle 8 – 15 Points

Objective A
The land occupied by motor vehicles is minimized.

Metric 8.A.1 Off-Street Parking
Total off-street area dedicated to parking as a percentage of the development area. 8 points

Metric 8.A.2 Driveway Density
Average number of driveways per 100 meters of block frontage. 1 point

Metric 8.A.3 Roadway Area
Total road bed area used for motor vehicle travel and on-street parking as percentage of total development area. 6 point

Metric 8.A.1 Off-Street Parking
Total off-street area dedicated to parking as a percentage of the development area. 8 points

Definitions:

• Total off-street area of parking is the sum surface area of parking, the total floor area of structured parking facilities including basement parking and the drives ways for entrances.

• Shared parking spaces and driveways are not counted. Also, parking for disabilities and essential service are no counted.

Measurement method:

1. Quantify the cumulative area of all nonexempt offstreet parking areas and driveways.

2. Quantify the total land area.

3. Divide the first measure by the second to calculate the ratio of parking area to land area.

Scoring Criteria:

Nonessential parking area is equivalent to:
0% to 10% of site area - 8 Points
11% to 15% of site area - 7 Points
16% to 20% of site area - 6 Points
21% to 25% of site area - 5 Points
26% to 30% of site area - 4 Points
31% to 40% of site area - 2 Points
more than 40% of site area - 0 Points

Metric 8.A.2 Driveway Density

Average number of driveways per 100 meters of block frontage. 1 point

Definitions:

• Driveways: entrance paths that intersect footpaths to connect off-street parking, loading areas, and drop-off locations.

• Driveways towards off-street parking and loading areas that encroach walkways are not counted as driveway for this calculation
Measurement method:

1. Quantify the total length of block frontage and divide by 100 m.

2. Quantify the total number of driveways that intersect a walkway.

3. Divide the second measure by the first to calculate a driveway density average.

Average driveway density is
2 or fewer driveways per 100 m of block frontage - 1 Point
More than 2 driveways per 100 m of block frontage - 0 Point

Metric 8.A.3 Roadway Area

Total road bed area used for motor vehicle travel and on-street parking as percentage of total development area. 6 point

Definitions:

• Street not used for private vehicles are excluded such as: plazas, sidewalks, landscapes, dedicated cycling lane, dedicated bus lanes, pedestrian priority shared streets (with speed under 15 km/hour).

Measurement method:

1. Quantify the total area of traffic lanes, including but not double-counting intersection space.

2. Quantify the total area of on-street parking.

3. Sum up both measures.

4. Quantify the total land area of the development site, extended to the centerline of peripheral streets.

5. Divide the figure obtained in Step 3 by the figure obtained in Step 4 to calculate a percentage of land paved for motor vehicle traffic and on-street parking.

Scoring Criteria:

Motor vehicle area is
15% or less of site area - 6 Point
20% or less of site area - 3 Point
More than 20% of site area - 0 Point

07

Transist Orinted Development

A Case Study of Jain Mandir

LAHORE
Rapid Mass Transit System

The Lahore Urban Transport Master Plan (LUTMP) study was conducted between April 2010 and March 2012 by Japan International Cooperation Agency (JICA), ALMEC Co., LTD. and Oriental Consultants on behalf of the Transport Department, Government of the Punjab. It acknowledges the worsening situation of traffic and the environment in Lahore on major arterial roads.

As the population was expected to grow at a rate of 4% along with the economy, the increase in transport demand was also expected to increase at much faster rate. The Plan forecasted the increase in incomes, and hence the ownership of motorized vehicles which was foreseen to exacerbate the traffic congestion, particularly at the Lahore Railway and Ravi crossings. The traffic volume was forecasted to exceed the road capacity by 2030 if no alternative measure were taken.
As this would be a threat to the quality of Life in Lahore, the development of road infrastructure was not the only solution that could solve the problem. Therefore, the Plan proposed the establishment of Lahore Rapid Mass Transit System, a combination of Bus Rapid Transit (BRT), Rail Mass Transit System (RMTS) and feeder route buses, as a sustainable solution for urban and transport development.

The Lahore Rapid Mass Transit System (LRMTS) has 4 planned lines, the green, orange, blue and purple in order of priority of phases, as shown in the map below by color. The green line, which was originally conceived as a Rail Mass Transit System (RMTS), is functioning under the name Lahore Metrobus System as Bus Rapid Transit system and has 27 stops from Shahdara to Gajjumatta.
The Orange line, a an RMTS, is fully constructed and operations are planned to be functional very soon as they are already performing test runs. The total length of the line is 27.1 kilometer with 26 stops. The total cost of the project is expected to reach USD 1.6 billion from which USD 300 million is financed by the Government of Pakistan (Smith, 2015). In addition, the Government of Punjab has borne the cost of land acquisition of PKR 13.80 billion (Nation, 2016).

Jain Mandir is in the North West of Lahore where the green and orange transit lines intersect (Figure 1) near Govt. MAO College Lahore green line station, and Lake Road Anakarli orange line station (connected through an underground walkway) in addition to several other feeder connections such bus number RT 15 and RT 06. This will from now onwards be referred as “transit stations” or “TOD stations”. This is one of the densest mesh in terms of current and planned transit lines and stations as shown in Figure 1 and 2.

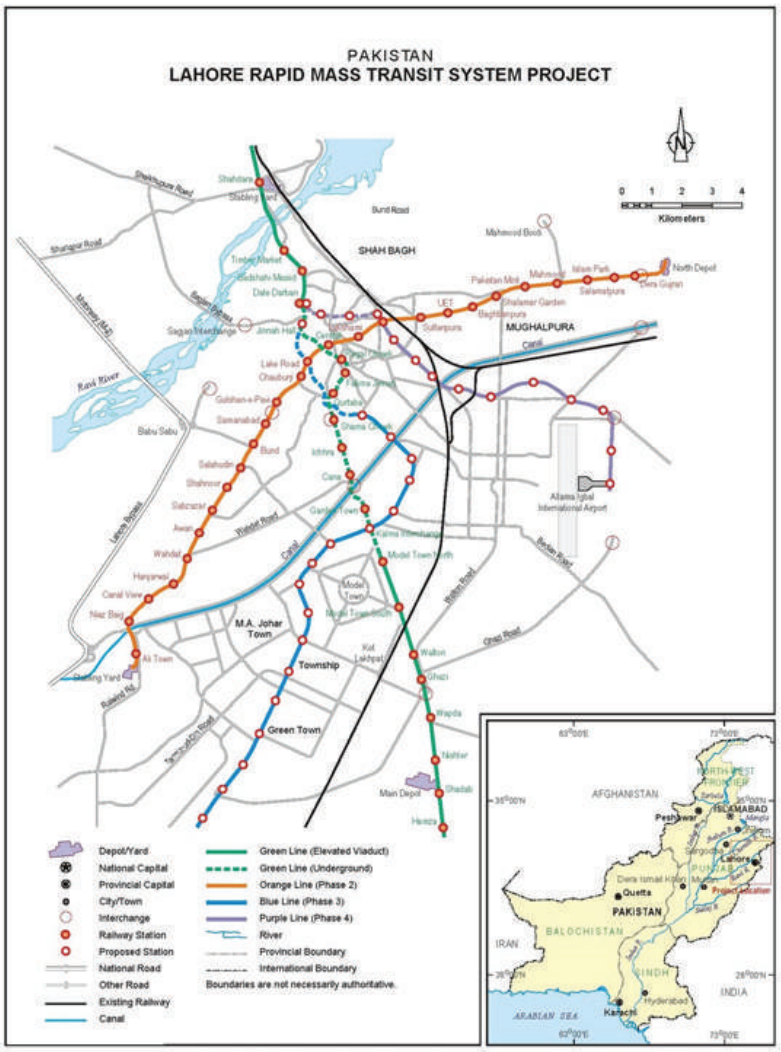


Figure 1: Lahore Rapid Mass Transit System

Figure 2: Lahore Feeder Routes Map - Jain Maindir Station Area Zoom

TOD Scale for Jain Mandir

Reiterating from the previous report, “Transit Oriented Development (TOD) is a planning and design strategy to ensure compact, mixed use, pedestrian- and bicycle- friendly, suitably dense urban development organized around the transit stations.” TOD promotes locating jobs, housing, shops and amenities, public and green spaces near the transit stations encouraging NMT (non-motorized travel) and the use of mass transit. TOD is intended to be inclusive and resilient. It also supports careful place making to soften the perception of high densities.

TOD has helped and can contribute as a policy instrument to reduce the carbon footprint and improve the air quality in megacities such as Lahore where excessive emission from motorized transport has damaged the environment. In addition, firm productivity and worker livability upon which the economic growth depends, are increased by TOD. Concentrating development within 1-kilometer radius of the transit stations leads to sustainable growth, connects households to jobs, and leads to optimal utilization of peak hour transport. It is important to note that the land use suggested within a TOD area of an 800-meter buffer or 1000-meter buffer around a transit station should be of mixed use nature. (Figure 3)

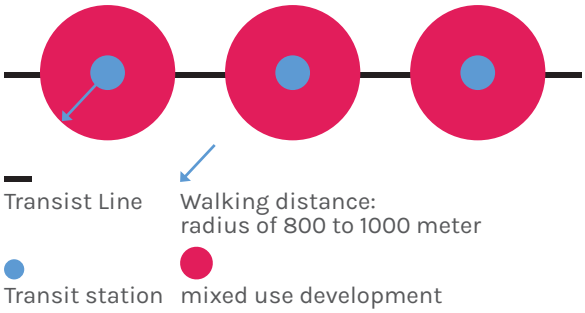


Figure 1: Transit Oriented Development

TOD is a realistic concept and has been applied in many cities around the globe such as Singapore, New York City, Tokyo, Hong Kong, Copenhagen, Delhi and Hyderabad. It can be applied to larger or smaller cities. Its basic premise is that land use and urban transport should be managed and planned simultaneously. This concept has not yet been applied in urban planning in Pakistan.

TOD is a response to current conditions, a) rising energy prices, b) road congestion, c) climate change, d) shrinking housing choices, e) increasing demand for urban living, f) interest in green building and walkable neighborhoods.

A radius of 1 KM by road from the station near Jain Mandir (MAO College and Lake Road (Anarkali) is the project area for this proposal, henceforth referred to as “station area” (figure 4). A station area should be 5 to 10 minute (800 m – 1 km) walking distance from the station facilities, focusing on transportation, open spaces and built-up areas around the transit station within a 5-10 minute walk.

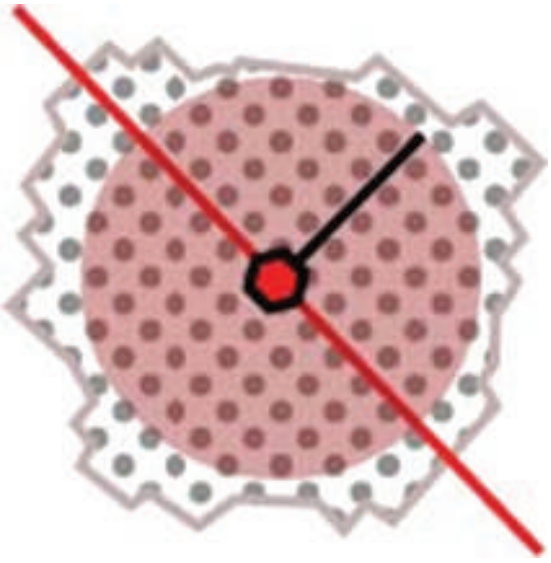


Figure 4: A depiction of “Station Area” across the built up

Jain Mandir Area Profile

- Local urban development context for TOD

o Located near major transit corridors and employment centers

o Existing opportunities to improve access to transit

o Existing opportunities for redevelopment of dilapidated buildings

o Land assembly will require dealing with multiple private owners

o Irregular property sizes and configurations

o Constrained right of ways

o Large block sizes or crowded streets do not allow easy pedestrian movement

o Current land uses do not support public transit usage

- Total Population: 52,312 persons
- Total area of station area: 1.96 square kilometers
- Station area density: 26,690 persons per sq. km
- Current numbers of dwelling units per hectare: 60-125 du/hectare

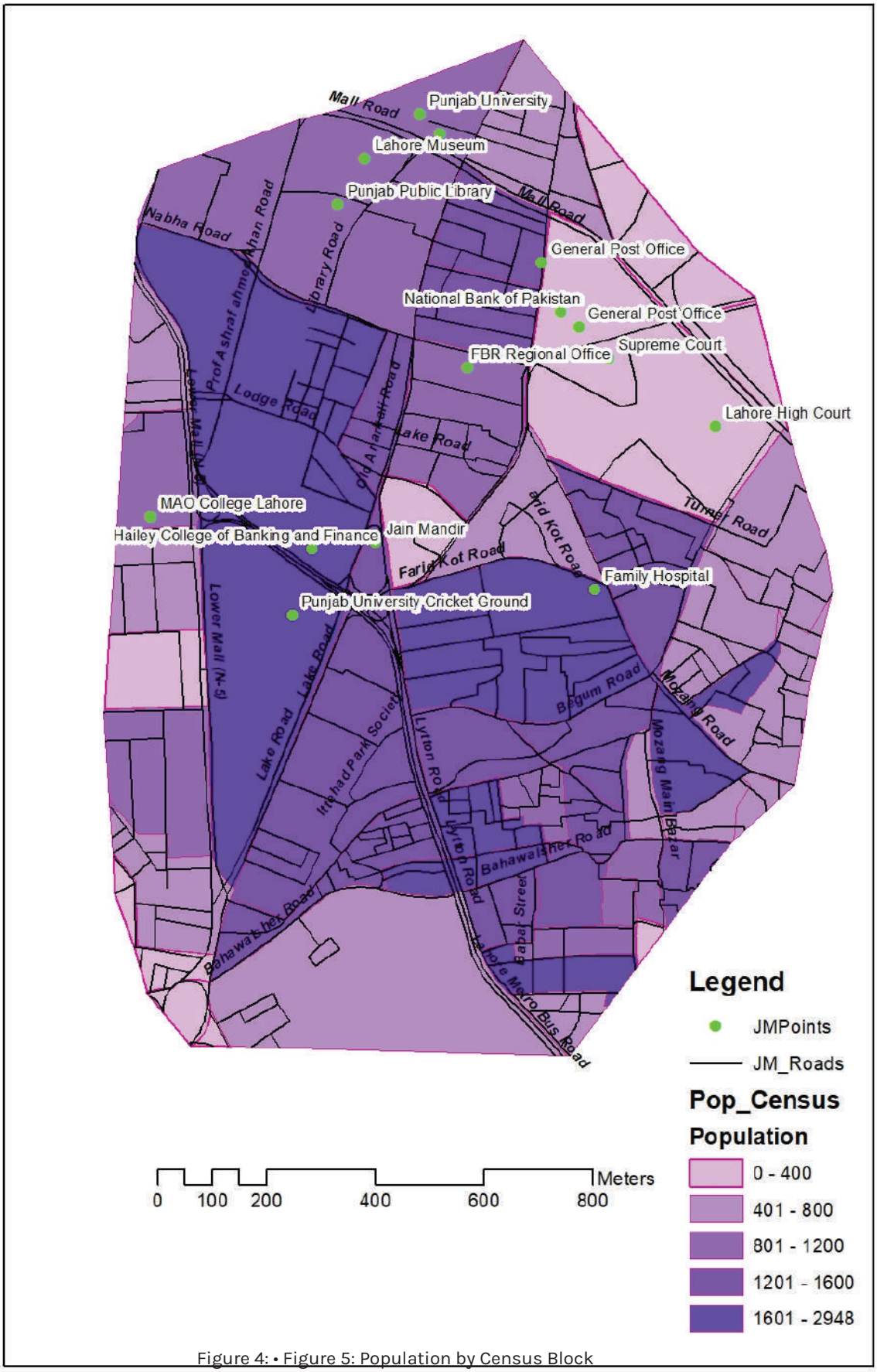


Figure 4: • Figure 5: Population by Census Block

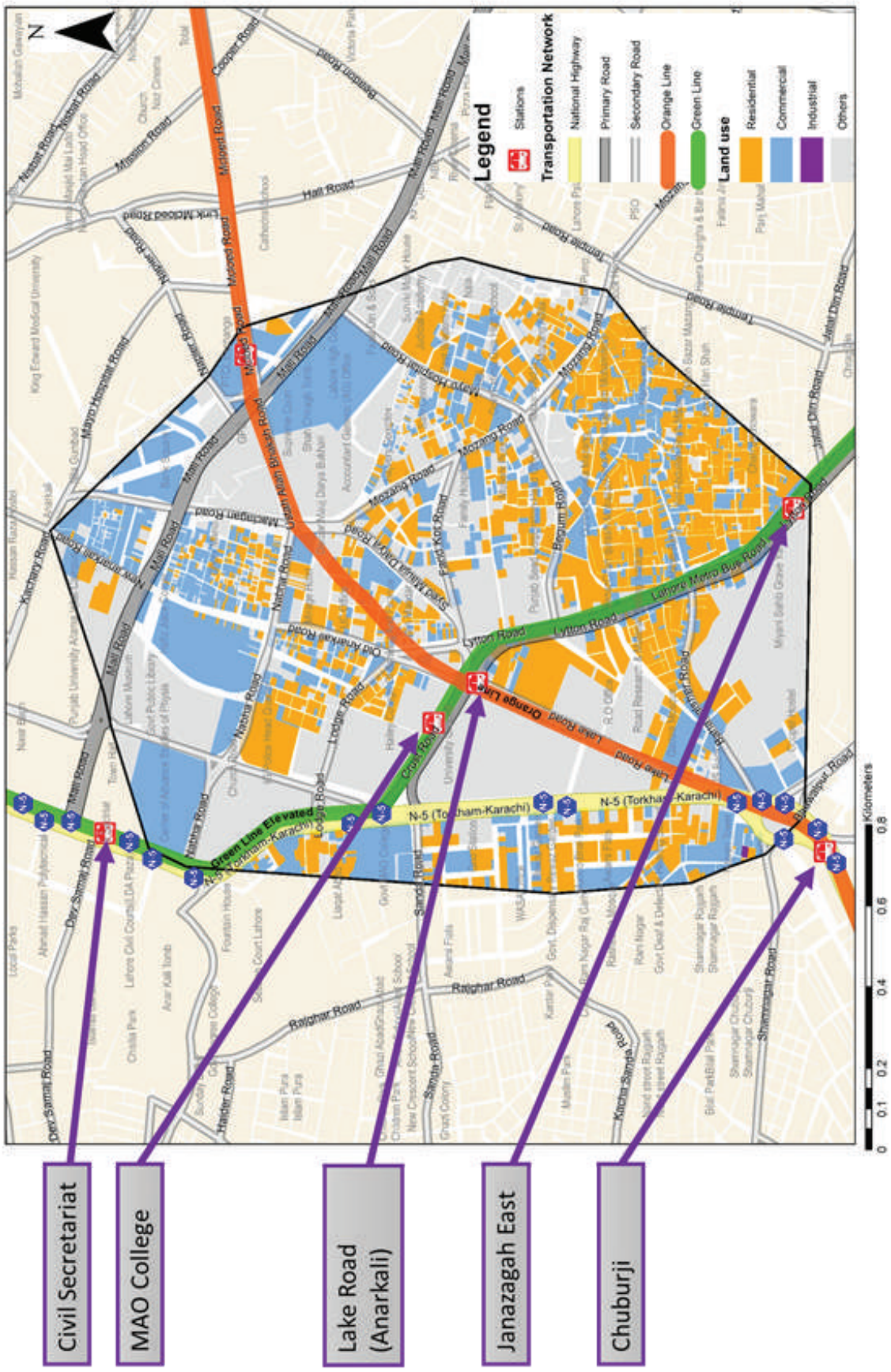
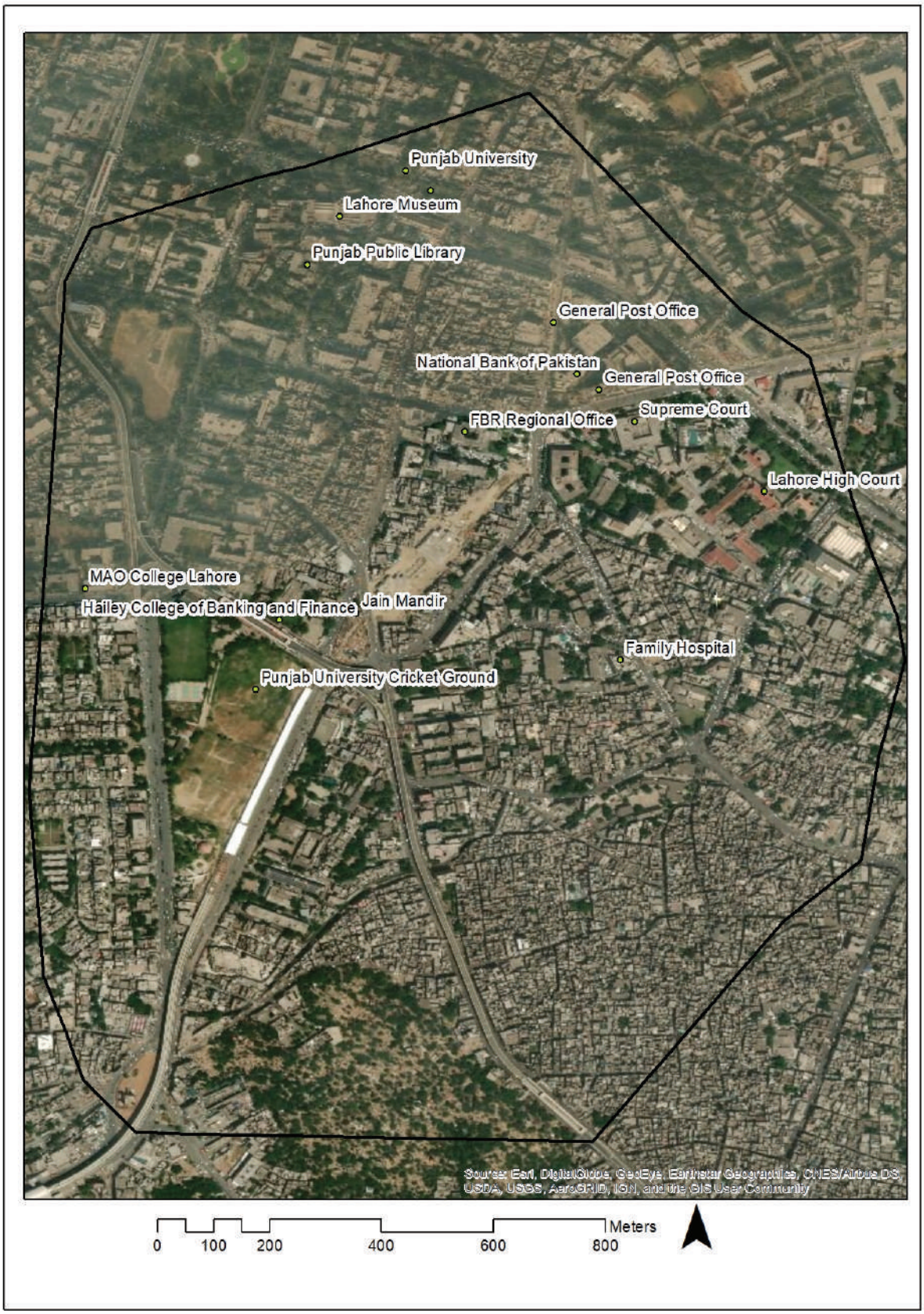
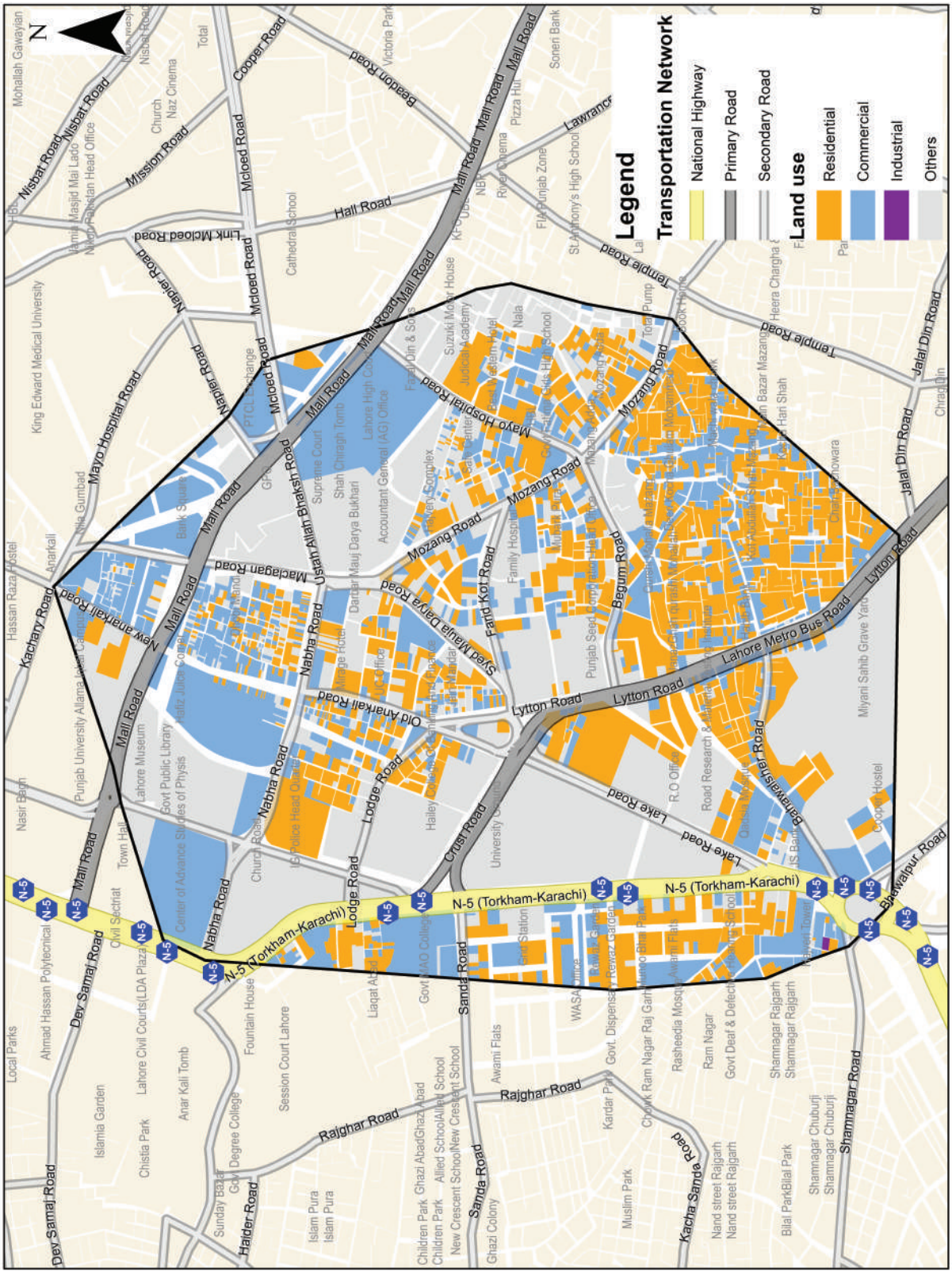


Figure 6: Transit stations of green and orange lines



• Figure 7: Points of Interest



- Figure 8A: Road network

Land Use

According to the Urban Immovable Property Tax (UIPT) data provided, an area of about 1.96 square kilometers of property land area (excluding roads) around Jain Mandir has been studied. This area falls within a radius of about 800 meters as per the data. The following figure 8B is the current distribution by land use for the count of properties, land area, covered area, and net tax for 7,863 properties located within this area.

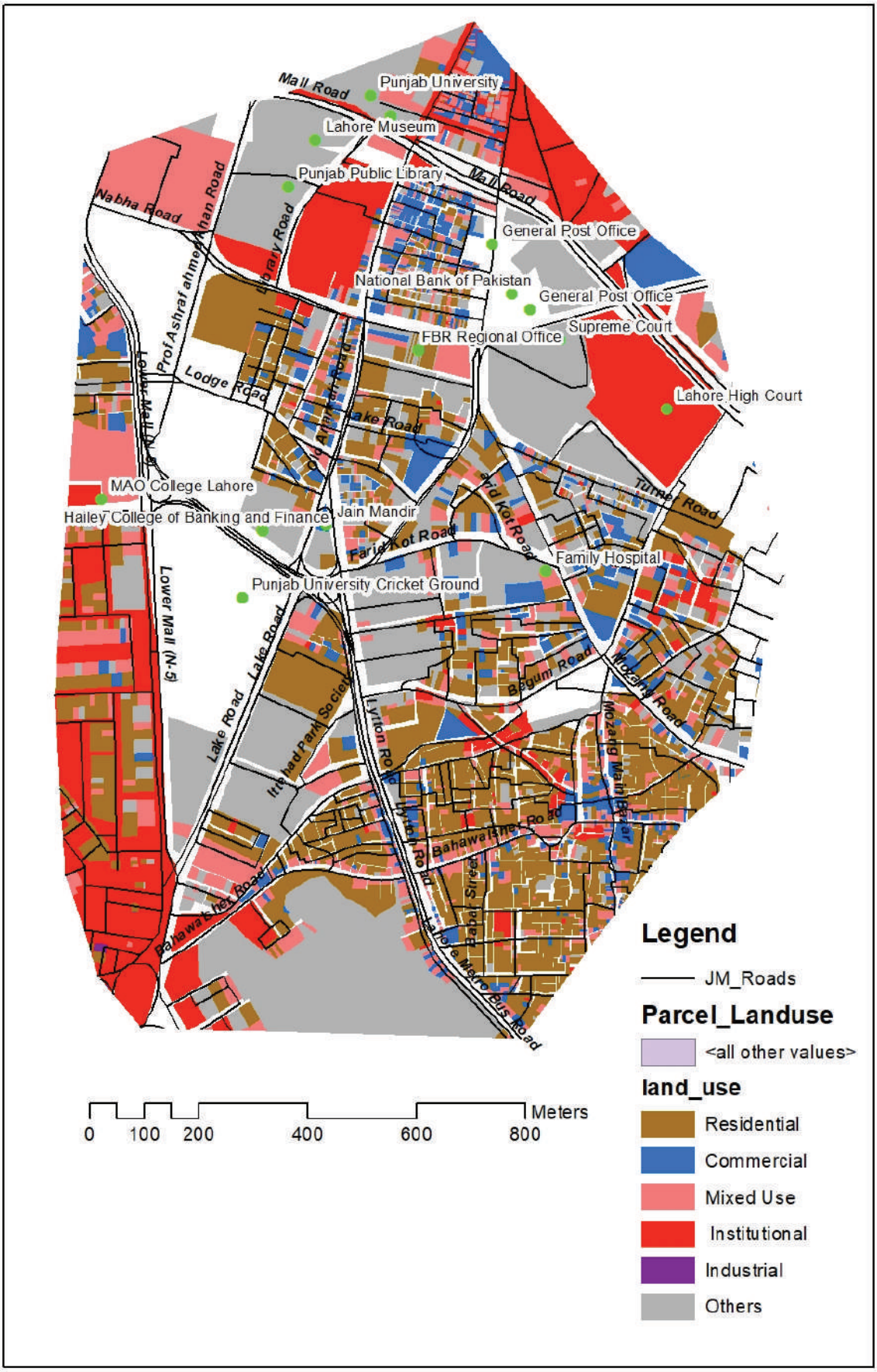
In terms of simple count, 56% of the properties are in residential use, 16% are in commerical use, 23% comprise of mixed use whereas only 0.01 % is in industrial use.

In terms of land area, 43% is occupied by properties that are in residential use, 14% by those in commercial use and 40% by properties in mixed use. The distribution of land use by covered area is also very similar to the distribution of land use by land area described above.

However in terms of net tax, while the majority of buildings are of residential use at Jain Mandir, the net tax attained from residential use is only 9%, 28% net tax is from commercial use and 62% net tax is from mixed use buildings.

Properties	Number	Land Area	Covered Area	Net Tax
Residential	4609	56%	43%	48%	9%
Commercial	1342	16%	14%	12%	28%
Mixed Use	1911	23%	40%	40%	62%
Industrial	1	0.01%	0.01%	0.01%	0.01%

Figure 8B: Distribution of Land Use by Property Count, Land Area, Covered Area and Net Tax (source: UIPT, Excise and Taxation)



- Figure 9: Land Use Map with Mixed and Institutional Uses

A New Mixed Use, High Density Corridor

For phase 1, Lake Road and Old Anarkali Road - segment of main road of 1.7 kilometers - to be declared a TOD central business corridor. Phase 2 could include transformation of Nabha and Mcloed Roads to convert them into high density, mixed use corridors.

The existing FAR of the station area is underutilized as the existing FAR is about 2.The spatial proposal is to build existing plots along the main Lake Road and Old Anarkali road (in red in Figure 10A) to FAR 8, 12 and 16 as per building regulations of LDA. The land use should be mixed use with spatial guidelines as per the next sections.

Figure 10A: New Mixed Use, High Density Corridor in Red

The current number of stories ranges from 1 to 11 and the average is 2.14. Therefore, there is a lot of room for infill, redevelopment and intensification of the parcels.

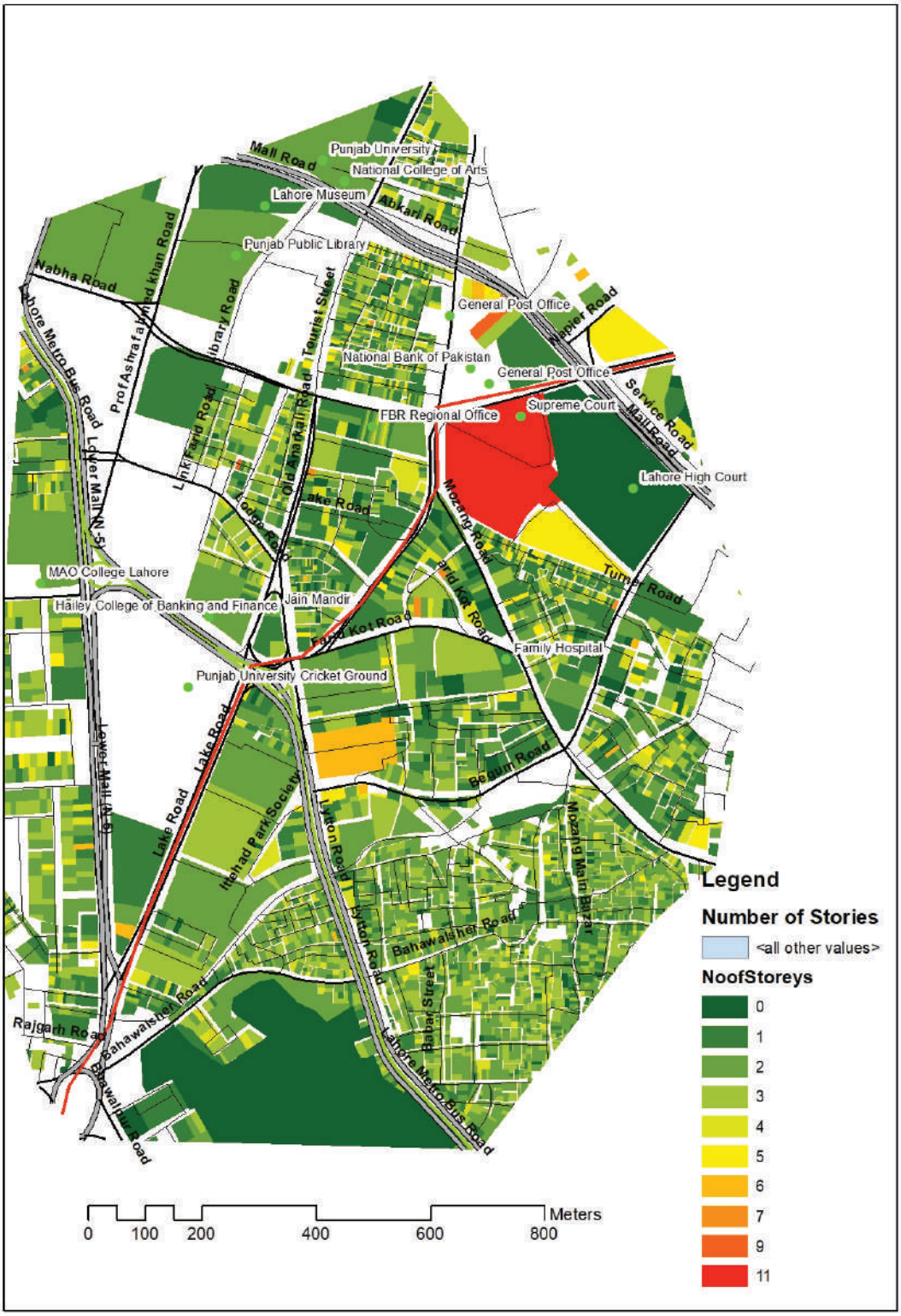
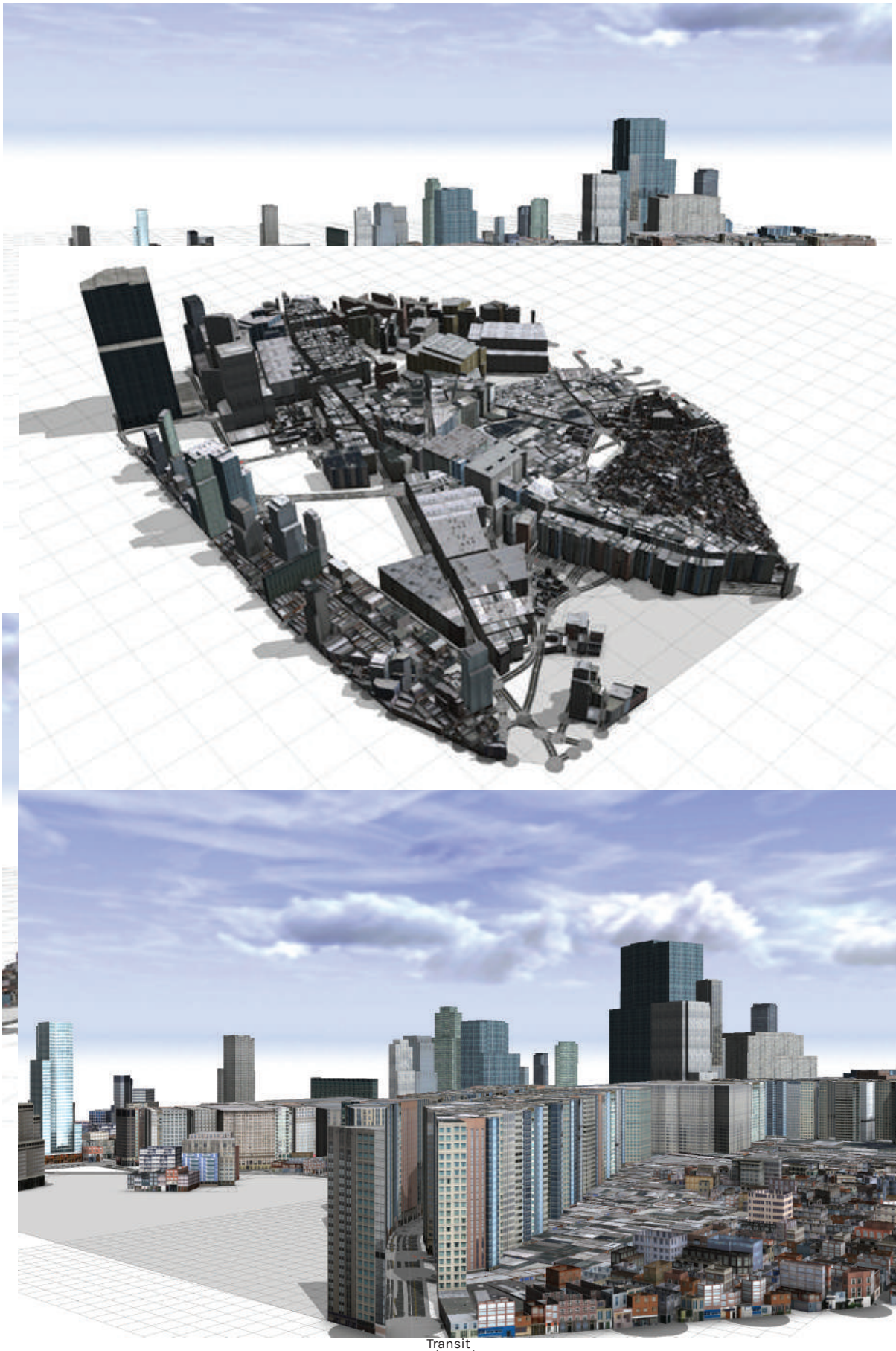


Figure 10B: Number of Stories across Station Area
Note: Zero no. of stories is largely open space or vacant space

The FAR distribution along main roads is 16, then further away the FAR is 12 then 8 then 4. If these corridors are built to TOD standards, and the parcels around it are converted to high density mixed use, then the future of Jain Mandir is expected to look as shown below.



Transit
Oriented
Development

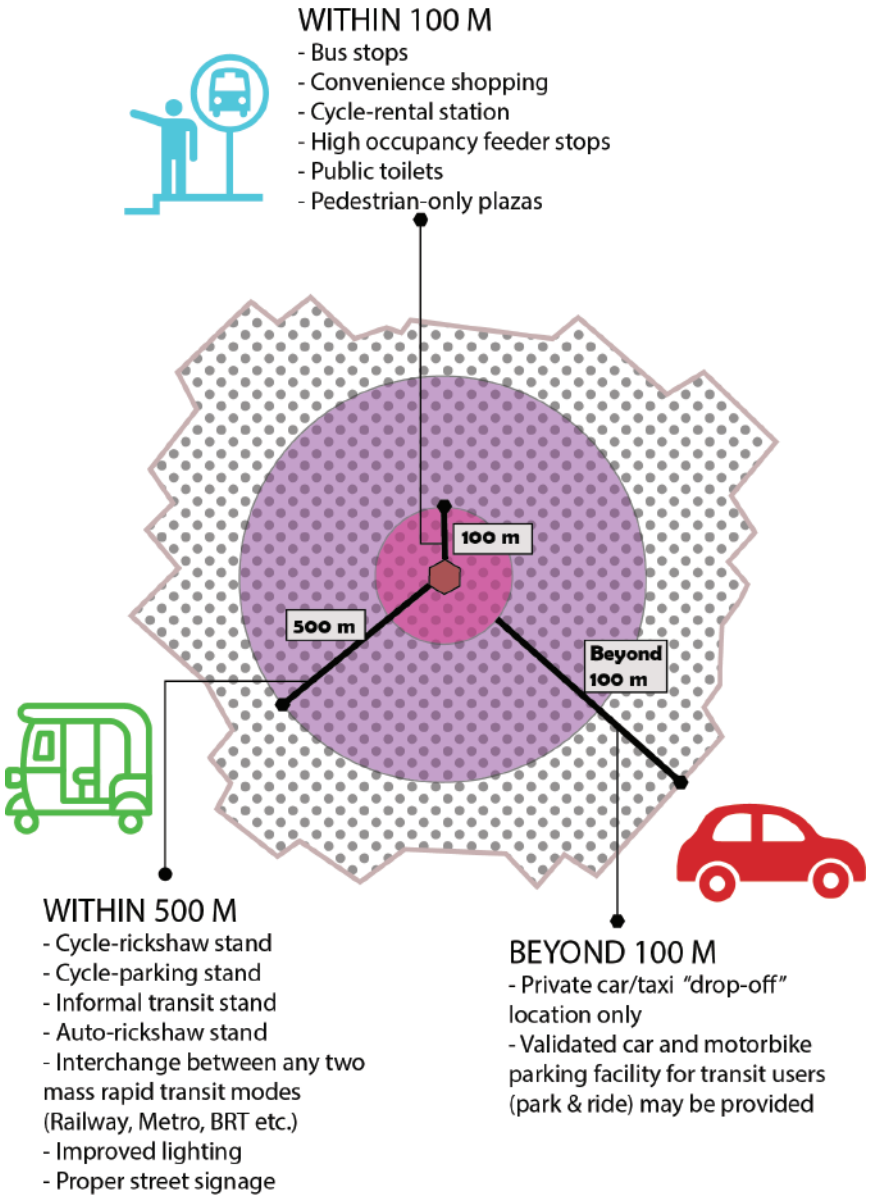
TOD Spatial Design Guidelines

The following are detailed planning and design guidelines to create a TOD plan for Jain Mandir for:

- Transit (Transportation)
- Open Space
- Development (Built Environment)

1. Transportation Spatial Design for TOD

This includes the various modes of transportation such as trains, buses, walking, bicycle, motorcycle, rickshaws, taxis and cars etc., and the infrastructure such as footpaths, transit stops and stations, intersections that allow residents to safely and conveniently commute from one destination to another, using any mode of transportation.



a. Well-designed transit system

Context specific and high quality transit system should be designed which is sensitive to the nearby built environment, and the station should provide amenities such as retail to offer a smooth commuter experience.

• Transit stations and lines must be planned and constructed where there is enough demand for use and located near jobs and homes in urban areas.

• Jain Mandir station area has a population density of about 27,000 per sq. km and an average FAR of 2.

• The number of commercial properties, a proxy for the number of shops and employment, is 1,342.

• The population density and shop density can help determine potential ridership.

• Even though the green and orange line are both constructed, it is important to note the rule of thumb for cost efficient method of transit alternatives is:

o Bus Rapid Transit system is a consideration and apt for the demand of more than 2,000 passengers per hour in one direction

o Metro Rail is to be considered for demand greater than 15,000 passengers per hour in one direction

• Redesign feeder bus network: Jain Mandir station line should have as many connections as possible for a robust transit network.

• At Jain Mandir station area, the green and orange transit lines intersect near Govt. MAO College Lahore green line station, and Lake Road Anakarli orange line station. The stations will be connected through an underground walkway. In addition, there are several other feeder connections such bus number RT 15 and RT 06.

• The transit system must provide amenities such as bathrooms, secure parking of bicycles and motorbikes, and waiting rooms as done in Daweoo stations of Pakistan.

b. Multimodal seamless integration

There should be seamless integration of transit modes, systems, and routes.

• A multi-modal commute pattern survey is suggested to study the current modes of transport used and their frequency, demand usage and capacity.

• All forms of public transit such as buses, green line, and orange line should be well integrated with the same ticketing system, easy and proximal physical transfers and access to information about the different transit modes and times.

• Usually a lack of coordination between agencies for different modes of transit hinders seamless integration. The following agencies should work in coordination: Lahore Development Authority (LDA), Traffic Engineering & Planning Agency (TEPA), Environment Protection Department, Lahore Transport Company (LTC), Punjab Masstransit Authority (PMA), Lahore Metropolitan Corporation, Excise and Taxation, Urban Unit, WASA, Waste Management Companies, Communication and Works Department, Punjab Horticulture Authority and such.

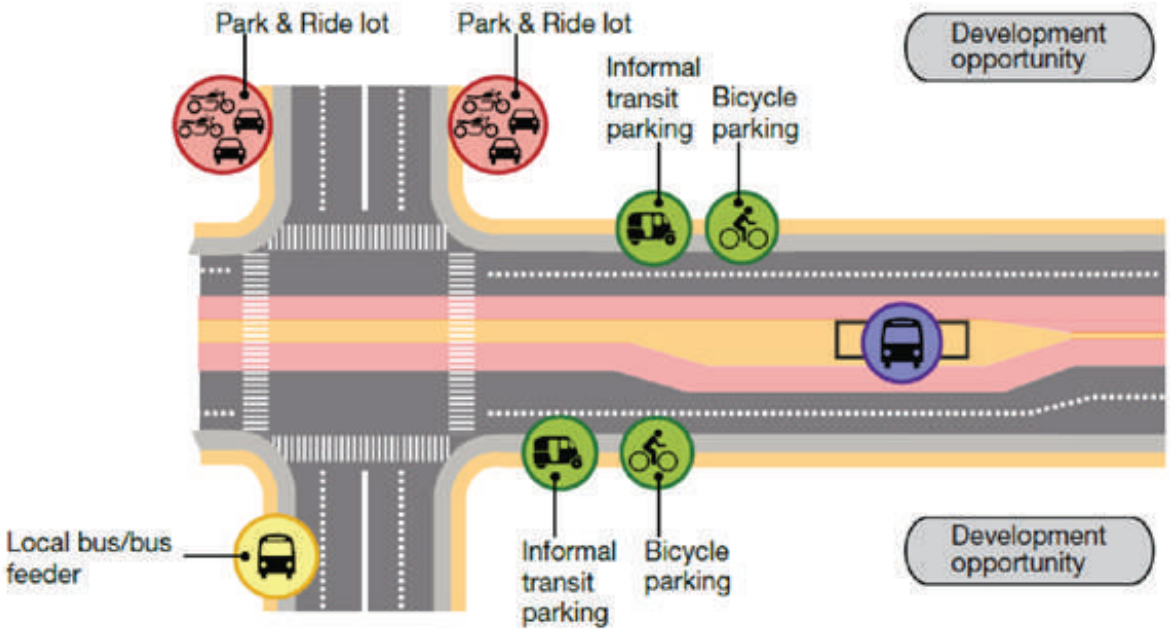


Figure 11: Multimodal options at transit stations

• The acceptable walking distance from origin to bus station or feeder route connecting to station area should be within 500 meters.

• Bus stops to be located within station premises along the road right of way.

• Parking shall be provided for 2-wheelers and cycles within 500 meters of transit station

Within 100 m Approximately walking distance from exits[5]	Facility/amenity and preferred location
Beyond 100 m	Bus stops; vendor zones; convenience shopping; cycle-rental station, high occupancy feeder stop, public toilets; pedestrian-only plazas
Within 500m	Private car/taxi "drop-off" location only; validated car parking facility for metro users (park & ride) may be provided.
	Cycle-rickshaw stand; cycle-parking stand; informal transit stands, auto-rickshaw stand, interchange between any two mass rapid transit modes (Railway, Metro, BRT etc.)

Figure 12: Facilities by walking distance from transit station

c. Compete Streets

Complete streets is to provide equitable distribution of road space and safe access to all commuters, specially pedestrians and cyclists including motorized transport and transit users.

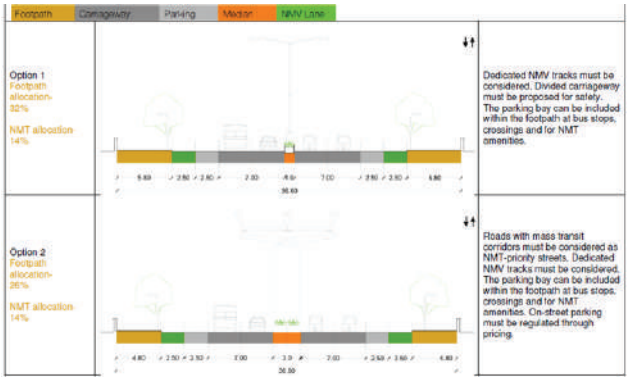


Figure 13: Complete streets side section for main roads (sub arterial) roads in Station Area

- Multi-utility zones should be provided on all collector and arterial roads, to assist trees, street furniture, planting for storm water management, bus stops, street utilities, informal transit and ride-sharing services/ NMT stands, paid idle parking, etc.

- Right of way minimum by FAR type are provided in the LDA building regulations 2019 in section 3.1.1 for commercial use as follows :

Zones	Max Ground Coverage	F.A.R	Storey	Height (Including parapet wall)	Plot Size	ROW of Road	Parking Requirement
Low Rise	65%	N.A	G+3	Up to 50 feet	Up to 10 Marla but less than 1 Kanal	Min 30 feet	Optional for Apartments, Shops and Office Buildings. For rest of the uses, provisions mentioned at 3.11 shall be applicable.
Medium Rise-1	65%	N.A	G+6	Up to 90 feet	Min 1 Kanal but less than 2 Kanal	Min 30 feet	One floor on entire plot dedicated for parking as per section 5.7.6(a) for Apartments and Office Buildings. For rest of the uses, provisions mentioned at 3.11 shall be applicable.
Medium Rise-2	65%	1:5.5	G+9	Upto 120 feet	Min 2 Kanal but less than 4 Kanal	Min 40 feet	Parking requirement as per specific use mentioned in Clause 3.11
High Rise-1	65%	1:8	G+14+Service Floor	Upto 200 feet	Min 4 Kanal but less than 6 Kanal	Min 60 feet	Parking requirement as per specific use mentioned in Clause 3.11
High Rise - 2	65%	1:12	G+23+Service Floor	Upto 300 feet	Min 6 Kanal but less than 12 Kanal	Min 80 feet	Parking requirement as per specific use mentioned in Clause 3.11
Skyscraper	50%	Above 300 feet increase in F.A.R @ 4% Proportionate to height * (e.g if height is 400 ft then F.A.R will be 400*0.04=16)	(No Restriction), NOC from CAA	Above 300 feet	Min 12 Kanal and above	Min 80 feet	Parking requirement as per specific use mentioned in Clause 3.11

• Parking regulations under clause 3.11 of LDA building regulations 2019 are as follows :

a)For Cars

CATEGORY	CAR SPACE
Government or Semi Govt. Offices, Pvt. Offices, Court or Tribunals, Commercial Including Large Stores & Retail Shops	One car space for1600 sq ft of floor area
Hotels/Motels	a. One car space for every 6 rooms, provided that in case of family suites, each room will be counted separately as one room for calculation of parking spaces b. One car space for every 800 sq ft (75 sq m) of shopping area. c. One car space for every 1000 sq ft (92.95 sq m) of office area. d. One car space for every 500 sq ft (46.47 sq m) of floor area under restaurant, café and banquet hall.
Hospitals	One car space for 1400 sq ft of floor area Note: If owner is unable to provide a parking within the building, he may provide the parking within a radius of 200m from the boundary of the plot provided the owner(s) gets the conversion of land to a permissible use of hospital (under the land use Rules). If parking is designated outside the vicinity of hospital, the provision of properly marked pedestrian walkway for easy access of general public shall be mandatory, else NOC/Clearance shall not be granted by TEPA.
Exhibition Halls	One car space for 1000 sq ft of floor area
Restaurants , Clubs & Cafes	One car space for 500 sq ft of floor area
Marriage Halls, Banquet Halls & Community Centers	One car space for 500 sq ft of floor area
Cinema, Theatres & Concert Hall	3 car spaces for 1000 sq ft of floor area
Cultural Institutions (Parks & Monuments) Post Offices & Police Stations	One car space for 2000 sq ft of floor area
Schools, Colleges And Educational Institutions	(a) One car space for 2000 sq ft of floor area. (b) One car space for 40% of car parking shall be reserved for motorcycle or buses
Taxi Stands And Bus Terminals	1 Car per 5-Busses and 1-Car per 10-Taxies
Bus Terminals/Truck Stands On Highways	1 Car per 5-Busses and 1 car per 10-Taxies
Hostels	1 Car per 5-Rooms and 1-Motor Cycle for Each Room

b) For Motorcycle

In addition to car parking space, an area equal to 16% of the total car parking area shall be provided for motor cycle.

NMT – Non-motorized travel standards

• All markings on road for NMT including bicycles should be clear and in distinct colors.

• Bicycles boxes can be used at major signals to give cyclists safety.

• No NMT path should abruptly end because of change in ROW or an intersection. Ramps should be provided to shift to pedestrian footpaths in such cases if a path is interrupted.

• Cyclists should be given a clear view of 25 meters straight and 60 meters ahead on slopes.

• Footpaths should be continuous without any encroachments for pedestrian mobility and the width of footpaths should be at least 1.8 meters in residential areas and at least 2.5 meters in commercial areas.

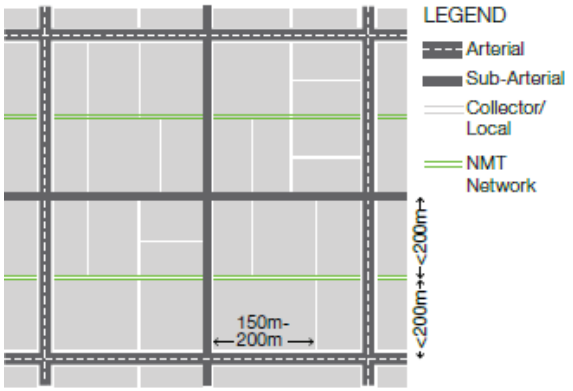
Street network to provide easy access to transit station

• Block size should be 150 meter by 200 meter to provide walkable distances and proximity to locations

• Block length should not exceed 200 meters.

• Preferred density of street intersections is 50 intersections per square km.

• There should be crossing in the middle of the block at every 200 meter on average, a minimum of 5 safe crossing at ground level per kilometer



Block Sizes & Street Hierarchy | *source: MOUD, 2016*

Figure 14: Block Size & Street Hierarchy

d. Traffic Management

This section has approaches of traffic calming and reduction of vehicular trips in the station area for traffic management including the reduction of parking demand.

• Discourage the use of private vehicles by methods of congestion pricing, registration fee and high value public transit

• High traffic should be dispersed to many parallel streets of human scale rather than concentrating cars on a few major arterials roads.

• Traffic calming: the station area must promote a safe space for walking and cycling for NMT commuters by reducing the speed and quantity of motorized vehicles. For streets with Right of Way (ROW) less than or equal to 12 meters within the influence area, the maximum speed of motorized vehicles should be limited to 20-30 kmph. The driveways can be narrow with bendy paths and trees or street furniture to reduce speed.

• For other streets, speed should not exceed 40-50 kmph.

• Streets meant primarily for NMT movement should also be limited to a maximum speed of 20 kmph by design.

• Speeds should be limited to 50 kmph on the arterial roads and sub-arterials streets. On collector and local streets, speed should be limited to 30 kmph.

• Pedestrianization: Streets with right of way 18 meters or less, if pedestrian traffic is greater than 8000 per hour in both directions together, the entire street should be notified for pedestrianization.

Parking

• 70% of parking slots should be short term parking near the station (on street and off street parking).

• Park and ride lots may be provided at transit station terminal for privately owned vehicles.

• Disability parking should be provided on street at a rate of one for every 25 parking spaces. These parking spaces should be given 1.2 meters for access.

• For any new or redevelopment or transformation or intensification or retrofit projects greater than 2,000 square meters, at least 50% or 100% of total parking facilities will be offered as shared parking facility.

• Shared parking: parking spaces are maximized in the influence area by sharing spaces between uses, the demand for which is different during various times of the day. Parking required for offices during the day can used as parking for housing during the night for example.

• Parking fees is to be increased exponentially with decrease in distance to the Jain Mandir transit station area.

• Maximum parking rates are suggested to be variable with market forces as are real estate prices; however, minimum parking rates can be fixed.

• Approximate proportion of parking spaces to be provided at/ near transit stations (of the total space available)

Mode	% of total number of spaces allocated* within 500m of transit stations
Cars/ Taxis	5%
2 Wheelers	10%
Auto Rickshaws	25%
Cycle Rickshaws	40%
Cycles	10%
Vans/RTVs/any Metro Feeder services, etc.	10%
	100%

2. Open Spaces Spatial Design for TOD

These are open green spaces for the public in between development and transportation such as parks, sidewalks, plazas and patios where social interactions and recreation is carried out. This can be of public or private ownership but accessible by all residents.

e. Walkability

This involves providing a favorable pedestrian environment that is continuous, forms a network and offers a range of experiences and services. The issue faced in Pakistan is the lack of technical capacities and sensitivity towards pedestrian needs. There are lack of a walkable uses because of conflicting land use and building regulations, and enforcement. There a multiple encroachments on all footpaths or nonexistent footpaths. The solution can be to formulate NMT cells within the relevant authorities to address the needs of walking.
Sidewalks to be designed using a three-section strategy :

1. Service zone: contains space allocation for urban furniture, trees, vegetation, storm water management and infrastructure

2. Pedestrian flow zone: is strictly dedicated to pedestrian movement, free of all obstructions. This zone must cater to all users with different abilities and age groups moving in both directions.

3. Front-of-building zone: transition zone from public to private property, could be utilized for outdoor seating, street signage, porches, planting etc.

• Street trees: there should be at least 125 trees per km per footpath

• Compound walls, if present, should be transparent above a height of 100cm. High-security government buildings may be exempted.

• Street Lighting: Spacing should be uniform with frequency based on the minimum illumination required.

• Street Furniture: Benches, trash, bollards, vending kiosks, signage to be provided adequately.

• Public Facilities: Provide accessible public toilets at every 500-800 meter distance – preferably located close to bus stops for easy access by pedestrians and public transport users.

• Primary building access for pedestrian from the main street should be at shortest walking distance from nearest bus-stop.

f. Public Realm

This section helps provide visual interest at the pedestrian scale through thoughtful landscaping and building design, which will encourage people to use the public realm and help contribute to an active street life. In Pakistan, the lack mechanisms or allocation of budgets with public agencies hinders the investments in public realm improvement

• A neighborhood park accessible by 800 meter walking or bicycle journey, and a public sports venue accessible by walking or biking at 1,200 meters.

• Important local landmarks, including heritage buildings, religious buildings such as Jain Mandir, and monuments, must be preserved to keep the community's history alive.

• TOD design can serve to increase access to historical locations; as pedestrian zones can be created around important monuments and buildings, improving connectivity between important historical sites.

• Local contact should be considered for architectural features of a TOD project. Existing buildings can be used as prototypes, and properties of local architecture, including construction materials and facade colors, can influence TOD design.

g. Urban parks and open spaces

This section encourages the creation open areas such as amenity spaces, green spaces, playgrounds, parks and natural areas, plazas, civic squares, etc. within a five-minute walking radius of residents.

• The station area should design green spaces that are open to the general public, and access to these areas should be prioritized for non-motorized means of transit.

• Public parks and playgrounds have multiple advantages such as improved air quality, reduced heat island effects, improved physical and mental health and comfort of residents.

• While retail and playgrounds should, ideally, be no further than 600 meters away from any point within a neighborhood, schools and markets should be less than a 1 km away.

3. Development (Built Environment) Spatial Design for TOD

These are the built areas and parcels that support activities such as housing, retail, commercial, industrial and employment. In TOD station area, buildings and open spaces must be interlinked and support each other for easy access and also support transit use by sufficient density.

h. Compact development

Employment and residential densities are to be optimized along the transit corridor or station area, based on carrying capacities of transit and informal transit infrastructure, to promote walking and transit use.

• High density suggested FARs are 8 for high rise zone 1, 12 for high rise zone 2 and 16 for skyscrapers as per the LDA building regulations. This should still be dependent of Traffic and Environment Impact Assessments.

• Maximum permissible FAR and densities in various TODs shall be based on the capacity of public transport modes, circulation network and the physical infrastructure thresholds of the area.

• New FAR allowances and increases above current caps can be taxed or otherwise monetized to fund infrastructure while increased future property taxes could fund operation and maintenance of public transport systems as discussed in the Land Value Capture section below.

• Minimum Ground Coverage: The minimum Ground Coverage requirement for all plots, blocks and projects within TOD influence zones is 50%. In developed areas of project area, this norm would apply to redevelopment and infill development projects only.

• Densification through redevelopment, infill, intensification and transformation within existing urban areas is to be prioritized over development in urban expansion areas, to minimize acquisition of land for development in peripheries/suburban/ agricultural/environmentally sensitive land.

• New growth in urban extension should be in the form of dense growth along LRMTS corridors, to create a compact city.

• Underutilization of FAR (below 3.0 and the corresponding minimum density) is not permissible for any new or redevelopment projects. Development of empty sites within 800 meters of transit station must begin within 5 years of operationalization of transit station.

• To establish articulated densities along transit corridors, Building codes can be changed to increase the maximum FAR permitted and allow for development on smaller plot sizes.

• Land consolidation can be facilitated for larger developments as described in the land amalgamation section below.

• Minimum standards must be prescribed for urban areas that begin to be transit supportive developments such as minimum heights and FARs.

• Infill sites: are empty sites within existing urban area which may have opened up for development.

• Redevelopment sites could be any of the following:

1. Low density areas with gross density less than 250 du/ha

2. Shopping/ commercial centers

3. Industrial areas/ clusters

4. Resettlement colonies

5. Unauthorized colonies

6. Urban Villages

• Retrofit – Areas which have existing gross density higher than 250 du/ha may not be suitable for redevelopment, but may need retrofitting.

i. Mix of uses

Lahore requires the promotion of more efficient land use patterns to provide residents access to retail, commercial and public services, employment and recreational facilities without needing to travel by motorized vehicles.

Selective plots along the main transit corridor shall be applied with vertical mixed use requirements incorporating 2 or more uses. There must be a diversity of land uses measured by the various types of land uses around 800 meters of each station. Areas with commercial uses, grocery stores, restaurants, laundry shops, schools, healthcare and other retail shops allow residents a happy living experience. ***The following mixed uses are permitted in the LDA land use rules 2019 draft with relevant right of way width :***

a	Permittd Uses	General Criteria	Road Width	Definition
i	Commerical on ground floor and offices-cum-residential area on upper floor;	i) In Established area, mine area, min Area 10 Marla & Other than Established built up Min 1 kanal	Min 60 feed road in established area and other distructs Min 80 feet Road other than established area	A permise where retail shopping facility is located a ground floors and upper floor are used for residential or offices and may include resturant and common facilityes
ii	Place of worship	i) NOC form relevent district administration etc.	Min 40 feed road	Area/ place reserved for communal prayers
iii	Parking plaza/Parking site;	MIn 2 Kanal	Min 40 feed road	A premise under for parking of vehicles may be run on commercial or non-commercial basis
iv	Amusement park/Play land	Min 4 Kanal	Min 40 feed road in established built up area and other districts Min 100 feet road in approved scheme	an area used for recreation or amusement
v	Park, memorial and monument;	Min 8 Kanal		A piece of land used for green spaces and recreation a piece of land used for and usually equipped with facilityes for recreation

• Density of social infrastructure measures the frequency of educational, health and cultural services around 800 meter radius of a transit station.

• Residential uses should be no less than 15% and no more than 85% of the total developed floor area.

• A minimum of 30% of overall FAR or covered area of a building shall be mandatory for residential use, and a minimum 5% of FAR for commercial use and minimum 10% of FAR for community facilities are also mandatory within prescribed land uses.

• The remaining land use will depend on the zoning of the area, if the area is predominantly a commercial area, then the remaining buildings will be of commercial use, and so on for residential and industrial uses. (Figure 15 below).

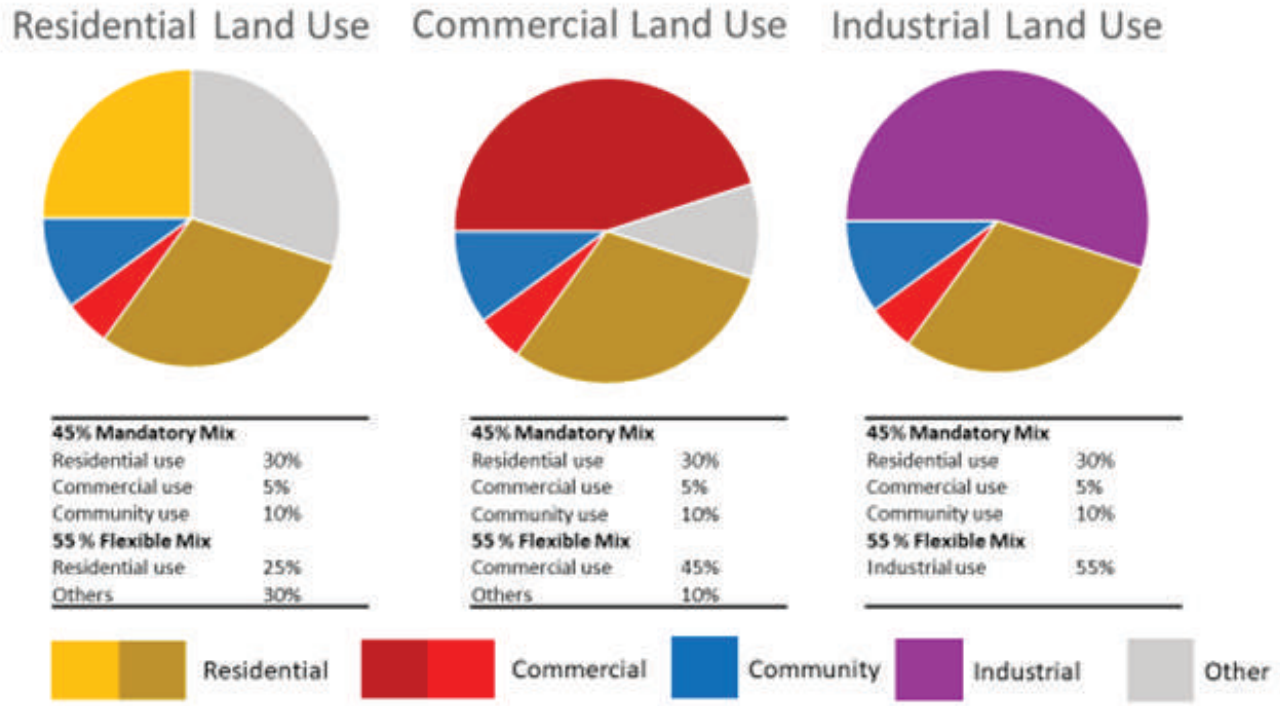


Figure 15: Mix of uses proposed in TOD zone

• Access to local services: Basic access from the housing to amenities and retail shops should be provided.

o Retail at a maximum of 600 meters trip

o A playground at maximum of a 600 meter trip.

o A primary school at maximum of a 1 km trip.

o A space destined for open or movable markets that is at maximum of a 1km trip.

• Active ground floor

o Boundary Walls: Boundary walls along any edge facing a public open space, pathway, road, park, etc. shall be prohibited. In case enclosure of sites is required, translucent fencing shall be used.

o Setbacks: In the transit station area, provide zero front setback and other setbacks no greater than 5 meters for private buildings and 10 meters for public buildings, and for any of the other façades.

S. No.	Use	Maximum Setbacks	
		Public Row >24m	Public Row <24m
1	Commercial, retail, offices and non residential uses	3m	3m
2	Institutional/ industrial etc.	3m	5m
3	Residential	5m	5m

Figure 16: Maximum setbacks by ROW and dominant land uses

• A minimum of 50% of total street frontage length of any TOD project should have an active frontage with a mix of at least two types of uses with different peak hours of activity stacked vertically, to provide round-the-clock 'eyes on the street'.

o Active Frontage: Active frontages include arcades, shop-fronts, entrance doorways, access points, entry/exits and transparent windows of active areas facing the primary access street. It is considered visually active if 20% or more the length of its abutting building frontage is visually active.

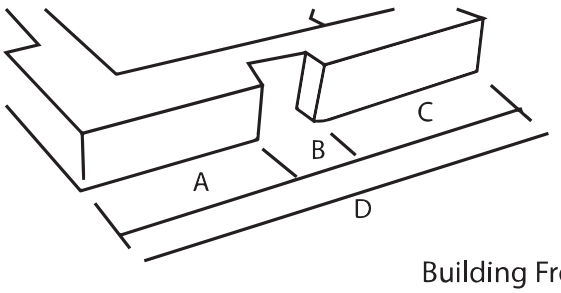
Various types of active building frontages | *source: MOUD, 2016*

Figure 17: Active building frontage features

o A maximum length of 20 meters of an unwatched frontage (e.g. gaps in frontage, fences or building walls of properties where there are no access points, doors, or windows) is permitted at any one instance.

o Two stretches of unwatched or non- active frontage must be punctuated by an active frontage of minimum of 6 meters

o Building frontage calculation at setback line:



Building Frontage at Setback line
(A+C)/D * 100

c. Housing diversity

Provide a diversity of housing choices, which includes a mixture of types, styles, price ranges and rental lease, within a 10-minute walking distance from the transit station, to create equitable TODs.

• Housing is essential for TOD areas as they complete the objective of walkable and accessible neighborhoods.

• Housing must be provided within walking distance to a transit station.

• The minimum standard for gross density permissible for any TOD project is 250 du/ha. Currently as per the data provided, residential and mixed dwelling in the station area are between 59-125 du/ha.

• A requirement of 30% residential use of total FAR is applicable.

• An additional 15% of the built-up area in the station area should be for lower income groups of the society. This is an initiative to support affordable housing as part of the TOD mandate.

• A minimum of 15% of FAR for all housing projects to be allocated to rental or for-sale housing with unit sizes no larger than 25 sq. meters.

Formal supply of affordable housing stock within TOD station area

• All apartments/group housing private and government scheme with a plot size exceeding 2000 sq. meters must compulsorily reserve a minimum FAR for affordable housing units, as mandated by local acts or policies.

• Ensure all TOD projects provide for the needs of diverse income groups including Economically Weaker Sections (EWS), Lower Income Groups (LIG) & Middle-Income Groups (MIG) as an integral component of the housing units with relevant unit sizes.

d. Informal sector integration

The Jain Mandir TOD proposal must strive to achieve inclusive development in TOD station area by addressing the needs of the informal sector in all aspects of policy, planning and design for street vendors, settlements and transportation services

• Vending zones shall be provided at regular intervals (approx. 10-minute walk from every home/workplace).

• Vending spaces should be marked in addition and adjacent to the walking path, especially along high pedestrian volume areas to activate the street and make it safe.

• Determination of vending zones as restriction-free-vending zones, restricted vending zones and no vending zones.

4. Non permissible uses in station area

Uses that have the following features are not permissible within 800 – 1000 meters of the stations:

• Large land-intensive uses not allowing public thoroughfare at required frequency.

• Uses that discourage or hinder safe pedestrian movement or create pedestrian unfriendly environment.

• Uses that primarily depend on private motorized modes, or generate a lot of truck/ heavy vehicle traffic.

• Any use that has high parking requirement that cannot be “unbundled” to an off-site location

Based on this, the following uses are not allowed:

1. Car-sales showrooms
2. Banquet halls
3. Automobile-repair/ services/ vehicular servicing shops
4. LPG Godowns
5. Electric Substation 220 KV
6. Bus Depot (permitted only if clubbed with terminal and in the form of mixed-use development site)
7. Stand-alone multilevel parking without on-site mixed use.
8. Open ground parking lot (if provided shall be counted as FAR consumption)
9. Any trade or activity involving any kind of obnoxious, hazardous, inflammable, non-compatible and polluting substance or process shall not be permitted.

Other uses not permissible in LDA land use rules 2019 draft are as adapted below. It is suggested to allow shopping malls in permitted land use as this will be prime commercial activity buildings with residential on the upper floors.

1. Educational institution;
2. Health institution;
3. Auto workshop;
4. Marriage, banquet hall; Marquees
5. Library;
6. Hotel/motel;
7. Guest house;
8. Petrol pump, gas station, LPG or LNG Storage or Filling Station;
9. Shopping mall,
10. Area Development Project - Plot size not less than 24 Kanal and not more than 200 Kanal.

Land Amalgamation

Land amalgamation is proposed for infill development and redevelopment, and intensification and transformation. The way this works is that the landowners contribute a certain percentage of their land to the authorities, and receive compensation in return in form of money, services roads and land etc.

In the project station area, vacant plot and underutilized parcels have potential for urban infill in TOD areas. This land could be amalgamated to develop high density and efficient spaces.
There are several blighted and dilapidated structures that could be redeveloped by amalgamating them into bigger plots and buildings.

Land Value Capture

The following part of the report focuses on multiple administrative, regulatory and financial measures that can be adopted to capture the land value and hence generate own source revenue. The administrative measure recommended here is the establishment of a separate agency to plan, implement and monitor the TOD in areas along the mass transit lines. In pilot phase the agency could be established as a directorate of LDA but ultimately it has to assume province level role along all mass transit locations. The regulatory measures discussed here include options of (a) establishment of TOD zone within 1 square km rea of the mass transit stations, (b) restructuring Urban Immovable Property Tax burden on land area instead of land improvements (building investments), (c) allowing increased FARs in the TOD zone and (d) imposition of betterment levies. Each of these recommendations is discussed below in detail.

5. Establishment of new Urban Redevelopment Authority

A new urban renewal authority has to be established with a province-wide jurisdiction and a very clear mandate. However, as mass transit network is presently most developed in Lahore, the other option is to have a dedicated directorate with a local authority such as Lahore Metropolitan Corporation or Lahore Development Authority (LDA). Such directorate can gradually transform into a center of excellence in TOD and provide services on province-wide basis. As described in the LVC section 3, a dedicated government authority is usually the response to a situation requiring the delivery of hard infrastructure or other government services.

The idea is to create a comprehensive urban renewal authority with mandate and powers for rezoning, capabilities in master planning, and the intent to produce new property value. The authority will have the mandate to deliver quality TOD and transit infrastructure, construct access points, built TOD style housing, and public amenities. The authority can also partner with the private sector to complete the aforementioned provisions.

A good example of such an authority is in Singapore, the Urban Redevelopment Authority (URA). The Urban Redevelopment Authority is the national urban planning organization of Singapore. The URA adopts long term and comprehensive planning approach in creating strategic plans such as the Concept Plan and the Master Plan, to guide the physical development of Singapore. URA provides planning approvals for development through “Development Control, Urban Design and Conservation” guidelines. In addition to planning, URA is the main land sales agent of the government, through which they

attract private investment to build development projects for social and economic goals. The authority also has a successful conservation program, through which they have successfully conserved buildings in addition t entire districts/ neighborhoods. URA als manages all public car parks outside th estates of Housing Development Board. It set the bylaws for parking infringement and fines (URA, n.d.)

URA must be appreciated for its seamles combination of factors for capturing land valu through master planning, rezoning an successful delivery of municipal infrastructur (for example, street networks and public ope spaces). URA has also had cooperative relation with the private sector for delivery c infrastructure, including other government departments involved in transportation and housing.

The proposed mandates of this new urban redevelopment authority will be to:

• Acknowledge and accept the broader and imperative role of integrated land use planning and development of transport master plans.

• Capture value of land through TOD and transit infrastructure development and also carry out the much needed task of comprehensive urban renewal, the need of the hour in many parts of Pakistan and Lahore.

• Demarcate jurisdiction areas as does the Walled City Lahore Authority for example, of TOD zones where attention will be paid and where development will be transit oriented and high density

• Focus on urban design and conservation efforts for urban renewal of old areas.

• Coordination with relevant agencies to avoid overlap and operations in silos, such as with Punjab Mass Transit Authority, The Urban Unit, Excise & Taxation, Waste Management Companies, WASAs, WAPDA, and LDA for example.

A matrix detailing the functions and responsibilities of the proposed agency is attached as appendix to this document. A major part of the assigned function revolves around effective coordination with other existing agencies. This coordination job is based on a study which indicates that after funding and planning a major barrier to TOD implementation is lack of institutional coordination.

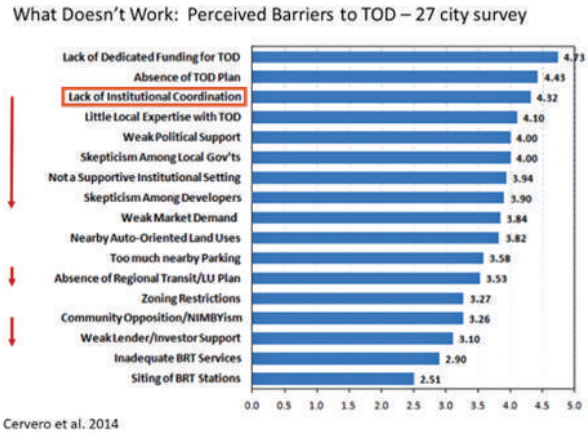


Figure 20: A major barrier to TOD is lack of institutional coordination

6. Four Local Context Scenarios for Land Value Capture

The next 4 subsections attempt to use the data provided to calculate the potential impact of various regulatory measures that can be undertaken in the TOD regime. The focus is the area around Jain Mandir and is based on the UIPT data provided. An increase in value of land and improvements is calculated in order to assess the amount that can be charged in extra fees or increased taxation to capture the land value. Four hypothetical scenaiors have been created, or in the other words four models have been designed to calculate the increase in value of land and covered area using UIPT annual data.

I. Land Value Capture Scenario 1 – Allowing Change in FAR to 8, 12, 16

The average FAR for the data in Jain Mandir is approximately 1.85 as per the ratio of total covered area to total land area for each property, and the net annual tax from the study area at the current FAR is PKR 75.2 million.

While keeping the land use mix unchanged, if the FAR is raised to 8 as per the LDA building regulations of high rise 1 zone, the net annual tax will increase to PKR 580 million, 5% of current total provincial receipts. The net tax increases by a multiplier of 7.72. Likewise, if the FARs are allowed and raised to 12 and 16, high rise 2 and skyscraper zones of LDA building regulations

regulations respectively, then the net tax increases to PKR 871 million and PKR 1.16 billion (10.71% of current total provincial receipts) respectively. The net tax increases by a multiplier of 11.6 and 15.4 respectively.

This could be the value of net tax once the FAR is literally raised and built up; however, this value can also be the increase in land value due to the new development and TOD zone, and it could be levied as a betterment levy or rezoning fee.

Sum of NetTax @ FAR 2	Sum of Net Tax @ FAR 8	Sum of Net Tax @ FAR 12	Sum of Net Tax @ FAR 16
75,220,111	580,797,324	871,195,986	1,161,594,647

SITE REQUIREMENTS: COMMERCIAL & PUBLIC BUILDINGS

3.1 Different categories of Plots falling in Central Business District, Other Commercial Areas/ roads specified in the Master Plan/Any other Local Area Plan/ Action Area Plan and Converted Plots

3.1.1 Allowed Coverage, FAR, No. of Storey, Height, Plot Size and Minimum ROW of Road are as under:

Zones	Max Ground Coverage	F.A.R	Storey	Height (Including parapet wall)	Plot Size	ROW of Road	Parking Requirement
Low Rise	65%	N.A	G+3	Upto 50 feet	Upto 10 Marla	Min 30 feet	Optional
Medium Rise-1	65%	N.A	G+6	Upto 90 feet	Min 1 Kanal	Min 30 feet	Atleast One basement on entire plot dedicated for parking
Medium Rise-2	65%	1:5.5	G+9	Upto 120 feet	Min 2 Kanal	Min 40 feet	Atleast One basement on entire plot dedicated for parking
High Rise-1	65%	1:8	G+14+Service Floor	Upto 200 feet	Min 4 Kanal	Min 60 feet	One car space for 1600 sft carpet area
High Rise - 2	65%	1:12	G+23+Service Floor	Upto 300 feet	Min 6 Kanal	Min 80 feet	One car space for 1600 sft carpet area
Skyscraper	50%	Above 300 feet increase in F.A.R @ 4% Proportionate to height * (e.g if height is 400 ft then F.A.R will be 400*0.04=16)	(No Restriction), NOC from CAA	Above 300 feet	Min 12 Kanal	Min 80 feet	One car space for 1600 sft carpet area

Figure 21: Net Tax Result of LVC Scenario 1 – change in FAR to High Rise 1, High Rise 2 and Skyscaper Zones (PKR)

II. Land Value Capture Scenario 2 – Change in FAR and Building Land Use Mix

In this scenario, the FAR is increased from an average of 1.85 to 16 and the land use is converted to 100% mixed use. Within the mixed land use, Jain Madir area is proposed to be a predominantly commercial area. Hence, the land use mix proposed for each building is 67% commercial and 33% residential.

If the study area's FAR is increased to 16, and the land use mix is changed to 67% commercial and 33% residential for each building, the total annual net tax rises to PKR 2.1 billion assuming all properties are rented at category A main road rates), and PKR 558 million assuming all buildings are owner occupied. This study finds that the overall value based on gross annual rental value is PKR 46.66 billion is this scenario.

		Commercial	Residential
	Total covered area mean @ FAR 16 sq. yards	1,295	2,951
	Total covered area mean @ FAR 16 sq. feet	11,655.98	26,559
	Total land area mean sq. yards	108	269
	Total properties	1,258	1,014
	Proposed total properties	2,667	1,333
	Existing Land Use Mix %	16%	56%
	Proposed Land Use Mix %	67%	33%
Rented	Land tax for 1 property [Category A Main Road]	12,912.42	6,194.69
	Covered area tax	1,190,974	502,484
	Total	38,524,371,072	8,138,860,776
	Tax @ 5 %	1,733,596,698	366,248,735
Owned	Land tax for 1 property [Category A Main Road]	2,582	1,239
	Covered area tax	238,195	100,497
	Total	7,704,874,214	1,627,772,155
	Tax @ 5 %	346,719,340	73,249,747

Total Value @ Rented PT	46,663,231,848
Total Value @ Owned PT	9,332,646,370
Net tax @ Rented	2,099,845,433
Net tax @ Owned	419,969,087

Figure 22: Net Tax Results of LVC Scenario 2 – change in FAR and building land use mix (PKR)

III. Land Value Capture Scenario 3 – Premium rate

The first hurdle to accomplish LVC is how to quantify the land value appreciation that may occur as a result of government intervention. According to a study of 61 cases of mass rapid transit in developed and developing economies, the price premium for properties within the catchment area of the mass transit station is 5% for residential properties and 30% for commercial properties. Leveraging this information and applying it on the data for Jain Mandir, the premium applied on net tax provides a total net tax value of PKR 95.8 million from PKR 75.22 million, a 22% increase.

	Residential (5%)	Commercial (30%)	Mixed Use (30%)
Net Tax @ FAR 2	6,700,086	21,306,460	47,006,209
Net Tax Premium Applied	7,035,090	27,698,398	61,108,071.95

Figure 23: Net Tax Results of LVC Scenario 3 – Premium rate (PKR)

IV. Land Value Capture Scenario 4 – TOD though Tax Incentives and Land Value Tax

Public authorities have the right to recapture incremental land value growth, through property taxes or developer incentives such as provision of affordable housing. Tax on land value creates social and economic consequences different from tax on improvements i.e. tax on covered area in the local context. What is beneficial to the public should be taxed less such as job growth, investment, commerce, while what is undesirable should be taxed more such as traffic congestion, pollution, and land consumption leading to urban sprawl. Therefore, the tax burden should be greater on land base value and less on the improvements, the covered area base value in the local context.

However, the current tax system places a higher burden on improvements as buildings comprise of higher aggregate value in real estate. The UIPT tax valuation table charges for example, PKR 120 per square yard of land area and also PKR 120 per square feet (1/9th square yard) of covered area- a ratio of 1:9. The current system discourages private investment in areas where property values are increasing. It encourages the monopolization and speculation of land with lower base value evaluation, taxing only 10% of the value. If this phenomenon is reversed, new private investment will be attracted in TOD zones and mixed uses as improvement will be taxed less.

The above discussion about shifting the burden of property tax on land area instead of built-up area is carried out in a simulation using Jain Mandir data in figure 24. The plan is so designed that overall tax revenue remains the same so that the government could be indifferent to this in terms of collection figures.

The most dominant income category in Jain Mandir is category C with a 49% occurrence. The rates for land area per square yard and for covered area per square feet for the category C main road commercial and residential are taken, and reversed. Land area is charged 90% of the base value and covered area is charged 10% of base value, instead of the original 1:9 ratio. The ratio of land to covered area base value is now 9:1 in terms of valuation rates.

The results are, for the same overall tax net and value, the new rate on land area for rented properties in category C (the most dominant category in Jain Mandir) shifts from 56 to 657 for commercial use and from 14 to 150.7 for residential use. Similarly, the new rate of covered area per square feet shifts from 56 to 6.1 for commercial use and from 14 to 1.5 for residential use. This method and switch in rates shifts the burden from covered area and improvements to land value. Now more built up spaces with high covered area will be taxed comparatively less then less built up spaces with high land area and lower covered area.

This is shown when the properties in Jain Mandir are divided into fully developed (FAR<2) and underutilized (FAR<2). The fully developed commercial properties are taxed 52% less than the existing rates and the underutilized commercial properties are taxed 37% more. Similarly for residential properties, fully development properties are taxed 42% lower and underutilized properties are taxed 10.23% higher. This shifts tax incentives and positively impacts private investments and developments.

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	Building Use	Category	Commerical	Residential
Total Properties	Mean FAR		1.5	1.5
	Total properties		1,258.0	1,014.0
	Mean Land Area		107.6	269.3
	Mean Covered Area Sq Feet		1,295.1	2,951.0
	Mean Covered Area Sq Yard		143.9	327.9
	Land base value Rented	C	6,025.8	3,770.7
	Covered base value Rented	C	72,526.1	41,313.9
	Total tax for old values	**C**	**4,446,823.1**	**2,057,208.2**
	New land base value	C	70,696.7	40,576.1
	New covered based value	C	7,855.2	4,508.5
	Rate new land base value*	C	**657.0**	**150.7**
	Rate new covered based value*	C	**6.1**	**1.5**
	Total tax for new values	C	4,446,823.1	2,057,208.2
FAR >= 2 Fully Developed	Mean FARmorethaneq2		3.6	2.5
	Total properties		259.0	163.0
	Mean Land Area		89.1	174.6
	Mean Covered Area Sq Feet		2,664.8	3,761.6
	Mean Covered Area Sq Yard		296.1	418.0
	Land base value Rented	C	4,988.1	2,444.2
	Covered base value Rented	C	149,228.0	52,662.1
	Total tax for old values	**C**	**1,797,388.3**	**404,204.2**
	New land base value	C	58,522.3	26,301.5
	New covered based value	C	16,162.6	5,746.8
	Rate new land base value*	C	657.0	150.7
	Rate new covered based value*	C	6.1	1.5
	Total tax for new values	C	870,452.6	235,074.5
	% Change		-52%	-42%
FAR < 2 Underutilized *Rate if instead of 10% land and 90% covered area proportion is taxed, base value proportion is 90% land and 10% covered area	Mean FARlessthan2		1.0	1.3
	Total properties		991.0	851.0
	Mean Land Area		112.6	287.5
	Mean Covered Area Sq Feet		926.1	2,795.7
	Mean Covered Area Sq Yard		102.9	310.6
	Mean FAR		0.9	1.1
	No.of properties (crosscheck)		991.0	851.0
	Land base value Rented	C	6,305.4	4,024.8
	Covered base value Rented	C	51,860.7	39,140.2
	Total tax for old values	**C**	**2,593,915.8**	**1,653,004.1**
	New land base value	C	73,976.8	43,310.3
	New covered based value	C	5,617.0	4,271.3
	Rate new land base value*	C	657.0	150.7
	Rate new covered based value*	C	6.1	1.5
	Total tax for new values	C	3,549,485.1	1,822,134.1
	% Change		37%	10.23%

7. Betterment levy under LDA land use rules

28. Betterment fee. – The Authority may levy betterment fee in an area under the Act on annual basis.

Under section number 28 of draft LDA land use rules, the Authority may levy betterment fee in an area under the Act on an annual basis. The increments in land value (a certain proportion over a number of years) mentioned in the sections above can be charged as betterment fee in the Jain Mandir area demarcated as TOD zone.

Betterment levies are a form of tax or fees levied for a specific demarcated area or jurisdiction which has received benefits and gain in land value from a public infrastructure investment such as accessibility and enhanced connectivity through a public transit system.

There are many ways to implement betterment levies. The United States uses a variant of it called Business Improvement Districts or Special Assessment Districts. These districts charge a special assessment on the increase in land value due to public infrastructure improvements. The amount or assessment is then used to repay for the costs or debt taken from the capital markets. The UK enforced a betterment fee of 40% of land value gains that was attributed to public infrastructure investments.

For developing countries, betterment levies has been challenging due to the fact that it is difficult to quantify land value increases due to infrastructure projects. A successful LVC betterment levies for funding public infrastructure has been in Colombia called contribucion de valorizacion (valorization contribution). The levy is charged in proportion to the total capital investment and operating costs at the early stages of investment (Suzuki, et al., 2015). When construction is completed, the levy rate is reset in proportion to the land value increments. Revenues from betterment levies in Bogotá had increased from 7.7 percent of property tax collections in 2003 to 60.3 percent in 2008 (Suzuki, et al., 2015). In 2011, Bogota earned about USD 1 billion from this levy and invested it back to public infrastructure. This fee had relatively less default rates than property tax in Bogota.

		Proposed Agency	Existing Agencies													
		Punjab Urban Redevelopment Authority	Lahore Development Authority	Metropolitan Coorporation	Excise and Taxation	Urban Unit	WASA	Waste Management Companies	Traffic Engineering & Planning Agency	Environment Protection Department	Parking Company	Cantonments	Punjab Mass Transit Authority	Walled City Lahore Authority	Punjab Horticulture Authority	Communication and Works Department
Functions	Urban Immovable Propety Tax	Coordination			X	X										
	Building Regulations	Coordination	X	X												
	Land Use Rules	Coordination	X	X												
	City Planning	Coordination	X													
	Land Acquisition	Coordination	X	X								X				X
	Urban Design	New Function														
	Urban Renewal	New Function														
	Land Value Capture	New Function														
	Maintenance and conservation of buildings and neighbourhoods	New Function												X		
	Mass transit	Coordination											X			
	Urban Services	Coordination	X	X			X	X	X		X	X	X	X		
	Roads	Coordination														X
	Environment	Coordination								X					X	
	Horticulture	Coordination													X	

08

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