YOUR GUIDE TO
# Transit Oriented Development

# *What is TOD?*

Transit Oriented Development or TOD is densification around nodes and corridors of public transit so that households can live in close proximity to their jobs. It enables them to walk to work or use public transit when required instead of depending on private vehicles.

**Transit Oriented Development can help:**
- Reduce the need to commute
- Enable healthy and active lifestyles by creating walkable communities
- Improve access to affordable housing for all income groups
- Increase job opportunities for low-income people and working families
- Reduce traffic and congestion in the streets
- Reduce pollution caused by vehicles
- Improve cities revenue by bringing in more housing and jobs
- Enable efficient use of available land

# *Transit Oriented Development Essentials*

- High quality public transit network
  - Bus Rapid Transit (BRT) (Ahmedabad)
  - Metro (Delhi)
  - Commuter Rail (Mumbai)
- Intensification of land utilisation for higher Household per sq.km, People per sq.km and Jobs per sq.km
- Affordable housing in close proximity to public transit to enable lower income families to access jobs
- Pedestrian and bicycle infrastructure to ensure access to public transit (last mile connectivity)
- Mix of activities and uses to reduce distances travelled for work or for recreation
- Urban design that enhances quality of the built and open spaces for all user groups

# Constructs of Transit Oriented Development



- **Urban Density**
- **Urban Diversity**
- **Urban Design**
- **Housing**
- **Mobility**

# *Urban Density*

Urban Density refers to the number of people, households, buildings or jobs per unit area in a city. It guides utilisation of land as a resource. Higher density close to public transit can mean more jobs and residents in close proximity of public transit. A Transit Oriented Development is driven by higher densities  as compared to the neighbouring areas.

## Population

- Minimum of 175 person per ha of developed area for TOD (Source:  MoUD TOD guidance document)

## Household

- Minimum 250 Dwelling Units (DUs) per ha gross residential density (Source: MoUD TOD guidance document)
- 74 DUs per ha (King's Cross)

## Building

- Built Space per unit area measured in terms of FAR/FSI
  - Maximum 4 FAR in TOD influence zone (Ahmedabad)

## Jobs

- Jobs per acre (Source: Florida DOT)

| TOD Place Type | Employment Target | Heavy Rail | Commuter/ Light Rail | BRT/Bus |
|---|---|---|---|---|
| Regional Center | Station Area Total | 60,000 - 80,000 | 40,000 - 60,000 | 20,000 - 40,000 |
| | Gross Density (jobs per acre) | 200 - 250 | 100 - 200 | 50-125 |
| Community Center | Station Area Total | 18,000 - 24,000 | 12,000 - 18,000 | 6,000 - 12,000 |
| | Gross Density (jobs per acre) | 65 - 90 | 45 - 65 | 20-45 |
| Neighbourhood Center | Station Area Total | 2,000 - 3,500 | 2,000 - 3,000 | 1,000 - 2,000 |
| | Gross Density (jobs per acre) | 20 - 30 | 15 - 20 | 10 - 15 |

- Jobs : Household Ratio Goals TOD Station Area

| TOD Place Type | Heavy Rail | Commuter/ Light Rail | BRT/Bus |
|---|---|---|---|
| Regional Center | 6:1 | 6:1 | 6:1 |
| Community Center | 3:1 | 3:1 | 3:1 |
| Neighborhood Center | 1:1 | 1:1 | 1:1 |

- Gross employment density – 926 jobs per ha

  (King's Cross)
- Gross employment density – 2700 jobs per ha

  (Canary Wharf)

# *Urban Diversity*

Urban Diversity refers to the variety and mix of uses, inhabitants and economy in an area. Greater diversity in Transit Oriented Development can lead to an inclusive community and smaller travel time and distance. A Transit Oriented Development is characterised by a higher variation in the diversity of the following:

## Population

**Household Type** (Source: Census)
Male Headed | Female Headed

- Unmarried
- Married
- Widow
- Divorced/Separated

**Income Group by Household** (Source: MoHUPA)

- EWS - annual income < Rs. 3,00,000
- LIG - annual income Rs. 3,00,001 to Rs. 6,00,000
- Within TOD, 20% of all residential units occupied by EWS ( Source: NMSH)

# Housing

- Tenure (Source: Census)
  - Owned (Owner Occupied)
  - Rented
- 15% of FAR for all TOD projects to be allocated to rental or for sale housing with unit sizes no larger than 25 sq.m (Source: MoUD TOD guidance document)

  Size (carpet area) (Source: MoHUPA)
  - EWS – 25 sq.m
  - LIG – 48 sq.m
  - MIG – 80 sq.m

  Size (Source: MoUD TOD Guidance Document)
  - 50% units of 32 - 40 sq.m
  - 50% <= 65 sq.m

## Economy

**Jobs** (Source: ILO)

- Formal Jobs: Formal employment generally includes job and social security. Labour laws are applicable to them.
- Informal Jobs : They include informal sector employees and informal employees in the formal sector who do not generally have formal (explicit or implicit) contracts of employment. They may have little or no social protection and make no declarations to taxation authorities. For example, paid domestic workers employed by households, street vendors and own-account workers engaged in production of good exclusively for own final use by their household.

**Spaces for street vendors**

- Informal units for urban street vendors (Source: URDPFI)
  - 3 to 4 retail units per 10 formal shops
  - 5 to 6 units per 1000 Government or Office Employees
  - 3 to 4 units per 10 formal shops in Wholesale Trade and Freight Complexes
  - 3 to 4 units per 100 beds in a Hospital
  - 1 unit per 2 bus bays at a Bus Terminal
  - 8 to 10 units at each major entry for a Regional or District Parks
  - 2 to 3 units per Neighbourhood Parks

- 1 unit per 1000 residents
- 5 to 6 units per 1000 Industrial employees
- Area per employee - 15 sq.m (Source: Knoll Workplace Research)

## Use

**Activities**

Areas with multiple uses, for example:

- Connaught place in Delhi
- Andheri and Chembur in Mumbai
- King's Cross, London (39% of land is under public use)

**Land Use** (Source: URDPFI)

- Residential
- Commercial
- Industrial
- Transport and communication
- Recreational
- Institutional
- Public Semi-public
- Land use composition in a TOD area: 30% residential, 30% commercial, 85% of the streets to have mixed use development (Source: NMSH)
- Example of mixed use: King's Cross (6% retail, 43% office space, 51% housing, leisure etc.)

# *Urban Design*

Urban Design defines the physical form of an area. It forms a framework for arrangement of built and open spaces, transport systems, services and amenities.

## Built Form

### Urban Form

- Street Width : Building Height ~ 1:2 to 1:3 for appropriate sense of scale and enclosure

### Massing

- Horizontal and vertical articulation of building to breakdown the scale
  - Ground Coverage
  - FAR
- Delineation of different uses in different floors through variations in material and building place

## Active Street Frontage

- Streets with mixed use development
- Compound walls, if present, should be transparent above a height of 100 cm (Source: MoUD TOD guidance document)
- Active frontages include arcades, shop fronts, entrance

doorways, access points, entry/exits and transparent windows of active area facing the primary access street

## Open Spaces

- Streetscape
  - Street design as per Indian Road Congress codes and standards
- Privately owned open spaces (includes open spaces around buildings within a property)
- Public open spaces
  - Per capita open spaces: 10-12 sq.m per person
    (Source: URDPFI)

# *Housing*

Housing provision in a Transit Oriented Development in close proximity of transit is essential to ensure access to public transit, particularly for lower income households and to ensure transit ridership. Housing in a Transit Oriented Development must include:

## Affordable Housing

- Any housing that meets some form of affordability standards, which could be income level of family, size of the dwelling unit or affordability in terms of EMI size or ratio of house price to annual income (Source: High level task force on Affordable Housing for All)
- 2500 housing units with 80% in affordable category (Source: Portland TOD zone)

## Housing Diversity

**Tenure** (Source: Census)

- Owned (Owner Occupied)
- Rented

**Size** (Source: MoUD TOD Guidance Document)

- 50% units of 32-40 sq.m
- 50% <= 65 sq.m

- King's Cross – 2000 residential units, 650 Student housing units

**Composition/Configuration** (Source: NBC)
- Detached
- Semi-detached
- Row
- Group
  - Apartments (1,2,3,4,5,6, and more than 6 dwelling rooms) (Source: Census)

## Proximity to Transit
- 80% of the population within walking distance from transit station (Source: NMSH, MoUD TOD Guidance Document)

# *Mobility*

Mobility solutions in a Transit Oriented Development should encourage and enable people to use public transit over private vehicles. The three main enabling factors for this are: public transit, parking management and non-motorised transport. Some of the indicators related to mobility are:

## Average Trip Lengths

(Source: National Transport Development Policy Committee, 2013)

- Walk : 1-2 km
- Bicycle: 2-4 km
- Public Transit: 6-7 km
- Metro: > 12 km

## Public Transit

### Quality

- Fleet Size (Source: IUT SLB)
  - Buses per 1000 population > 0.4 for metro cities
  - Buses per 1000 population > 0.6 for mega cities
  - BRTS Ridership > 2000 PPHPD (Source: NMSH)
  - Rail Systems (Metro and Rail) Ridership > 15000 PPHPD (Source: NMSH)

- Fleet Maintenance (Source: IUT SLB)
  - 75 -100% buses should adhere to urban bus standards
- Frequency (Source: IUT SLB)
  - Average waiting time for passenger < 4 minutes

**Access**

- Population in catchment area

  (Source: MoUD TOD Guidance Document)

  - 80% of the population within walking distance of public transit stop
- Last mile infrastructure (Source: MoUD TOD Guidance Document)
  - Total length of 12+ m streets with unobstructed footpaths as a percentage of the total length of streets in the city

## Parking

**Pricing**

- Parking price tied to the commercial rental rates within the TOD zone

**Location**

- Elimination of on-street parking in CBD area
- Private sector driven off-street parking

**Regulation**

- Remove parking minimums
- Mumbai TOD plan - WRI Report recommends:
  - Within 250 m of a station, for every 100 sq.m floor space of buildings
    - 0.35 Equivalent Car Space (ECS) for Residential
    - 0.45 ECS for Commercial
  - Within 500 m of a station, for every 100 sq.m floor space of buildings
    - 0.70 ECS for Residential use
    - 0.90 ECS for Commercial use
- 5% of parking space needs to be dedicated for bicycle parking in public buildings including commercial, educational, hospitals and government buildings in TOD areas. (Source: Mumbai TOD plan - WRI Report)
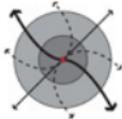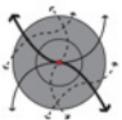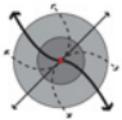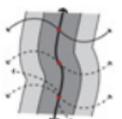- King's Cross - 0.43 parking space per housing unit

## Non-Motorised Transit

- Percentage of roads with footpaths
- NMT mode share in total daily trips
  - Share of formal and informal public transport and NMT (excluding walk) shall be 80% of all vehicular trips (Source: NMSH)
- Percentage of main roads (arterial to collector) with cycle tracks (Source: MoUD TOD Guidance Document)
- Encroachment of NMT lanes by vehicle parking (Percentage)
- Bicycle share standards (Source: ITDP, MoUD)
  - Minimum system coverage area: 10 sq.km
  - Station density: 10–16 stations per sq.km
  - Bicycle per resident: 10–30 bicycle per 1000 residents (within coverage area)
  - Docks per bicycle ratio: 2–2.5 docking spaces per bicycle
- Bicycle share performance metrics (Source: ITDP, MoUD)
  - Average number of daily uses: 4-8 daily uses per bicycle
  - Average daily trips per resident: 1 daily trip per 20 to 40 residents

# Types of Transit Oriented Development

| Type | Station Area Characteristics | Land-use mix and density | Transit Modes | Peak Frequency of Transit |
|------|------------------------------|--------------------------|---------------|----------------------------|
| **Urban Centre** | Significant centre of commercial or institutional activity | Moderate-to high-density mix of residential, commercial, employment, and civic/cultural uses | All; Commuter/ suburban rail, light rail or tram, rapid bus | 5-10 min |
| **Urban Neigh-bourhood** | Residential areas surrounding or supporting one or more urban centres | Moderate-to-high densites and a mix of residential and local retail services | Metro, rail and local bus, monorail, light rail or tram | 5-15 min |
| **Suburban Centre** | Origin and destination for commuters, with local residential or commercial activities | Moderate-to high-density mix of residential, commercial, employment and civic/cultural uses | All; Commuter/ suburban rail, light rail or tram, rapid bus | 5-10 min |
| **Transit Corridor** | Local focus of economic and community activity without distinct center | Moderate-density mix of residential, commercial, employment and civic/cultural uses | Light rail or tram, rapid bus, local bus | 5-15 mins |
| **Regional Transit Terminals** | Primary centre for state, regional and local long-distance buses | Moderate-density mix of retail, commercial and residential uses | Light rail or tram, Rapid bus, local bus | 5-15 mins |

| Major Challenges | Morphology | Examples |
|---|---|---|
| Integrating high-density housing into existing employment/retail scenario | | Parel-Worli, Mumbai, King's Cross, New Street Station, Canary Wharf |
| Expanding last mile connectivity through pedestrian and NMT infrastructure and affordable housing opportunities | | Jayanagar, Defence colony, Lajpat Nagar |
| Improving retail, connections/access to transit | | Noida, Whitefield, Goregaon |
| Developing opportunities equitably and uniformly along the corridor | | Ahmedabad BRTS, Versova-Andehri-Ghatkopar Metro |
| | | ISBT Anand Vihar, Delhi, Vytilla Mobility hub, Kochi |

**Legend**

● Transit Station

↗ Primary Transit

↗ Secondary Transit

↻ Feeder Transit

◎ 1/4 & 1/2-Mile Radii

*High*

Land-Use Inensities

*Low*

# Economic Potential for Transit Oriented Development

*Metro, Rail and Bus Investments*

## Metro Development

- Total of 835 km of corridor approved in India
  - 36% corridor operational
  - 63% under construction
- Additional 343.6 km corridor approved
- Total 910 stations and 115 interchanges
- Rs. 2.16 trillion in investment
- Estimated* construction potential of $0.28 billion per station to $1.06 billion per station based on the permissible FAR
- Estimated* jobs generation of 6998 per station to 10497 per station

## Railway Development

- Regional Rapid Transportation System (RRTS) in Delhi NCR is being developed for regional connectivity by NCRTC
- Expected to halve the travel time

- Phase I consist of 381 km & 48 stations
- Three corridors proposed:
  - Delhi - Sonipat - Panipat
  - Delhi - Gurgaon - Alwar
  - Delhi - Ghaziabad - Meerut
- Indian Railways has 43000 ha of vacant land, which is not required for operation purposes in foreseeable future.
- Rail Land Development Authority will redevelop 400 A and A1 Category stations across the country on 'as is where is' basis.

# Bus Terminals with Commercial Development

- Modern bus terminal at Amritsar, developed by Department of Transport, Government of Punjab under a PPP framework
- Uttarakhand government developed a bus terminal at Dehradun on a similar format
- Andhra Pradesh Government (erstwhile) intended redevelopment of their bus depots and bus terminals at various locations to capitalise on the land available
- KSRTC attempted a similar exercise for their bus depots at various locations in Karnataka under a PPP format

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*These values were calculated with the following assumptions

- TOD is developed in an influence area around a transit station
  - Influence area is upto the distance of 800m around a public transit station or corridor
  - Area of Influence Zone for a station = Area of Intense Zone (Area within 300 m radius around metro station) + Area of Standard Zone (Area within 800 m radius around metro station - Area of Intense Zone)
- Cost of construction is considered as Rs. 2500 per sq.ft

**FAR** (Source: Mumbai, Delhi, Ahmedabad)
- Standard Zone:
  - Lower Limit: 3
  - Upper Limit: 5.4
- Intense Zone:
  - Lower Limit: 3
  - Upper Limit: 5.4

**Job Densities** (Source: Florida DOT
- Standard Zone:
  - Lower Limit: 40.5 jobs per ha
  - Upper Limit: 60.75 jobs per ha
- Intense Zone**:**
  - Lower Limit: 81 jobs per ha
  - Upper Limit: 202.5 jobs per ha

# *Organisations*

## National Institute of Urban Affairs

National Institute of Urban Affairs (NIUA) is a premier institute for research, capacity building and dissemination of knowledge for the urban sector in India. It conducts research on urbanization, urban policy and planning, municipal finance and governance, land economics, transit oriented development, urban livelihoods, environment & climate change and smart cities.

for further information visit: **www.niua.org**

## Prosperity Fund - Foreign & Commonwealth Office, Government of UK

The Prosperity Fund was the FCO's dedicated annual fund supporting prosperity work overseas from 2011 until March 2016. Through targeted projects, it aimed to support the conditions for global and UK growth: Openness, Sustainability, Opportunity and Reputation. The FCO Prosperity Fund was succeeded by the Cross-Government Prosperity Fund on 31 March 2016.

# Notes

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