A Review on Transit-Oriented Development in India

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Abstract— Worldwide, urbanization is increasing. With growing population and urban expansion, natural resources are being limited. Modern life depended on such food, space and land for a natural resource. Urbanization grown to 31.7% in 2011 from 17.30% in 1951. In the last ten years the growth rates of registered motor vehicles were close to three times that of the road network, according to Ministry of Road Transport and Highways. City authorities in different countries are facing a challenge to handle city growth and sustainable urban development is crucial. It has had its unintentional side effects, spread of resources, inefficient use, a worsening environment, higher levels of pollution, unequal distribution of wealth and opportunities. TOD integrates land use and transportation planning to solve this issue, aiming to build planned sustainable urban growth canters, walkable, living and high-density mixed-use municipalities. In recent decades many cities worldwide have, however, developed in the field of road transport rather than transit. Citizens want to be in close proximity to the transport system. This paper attempts to analyze all policies at different areas, cities and stations.

Index Terms— Land use, Mass transportation, Station Area Planning, Transit-oriented development, TOD

1 INTRODUCTION

Public transport has existed since the days of horse and buggy streetcars. For better or for worse, cities have been shaped by their mode of transportation and development has always focused on public transit. As development spread out of the cities and into the suburbs, development was increasingly focused on transit stops. At the beginning of the 20th century, the streetcars that served the first suburbs were generally developed by a single owner, who built public transport to add value to the surrounding residential development. The term "development-oriented transportation" better describes these primitive suburbs than transportation-oriented development, since public transit was built to serve development. As part of these public transit systems, small commercial and retail districts, which served commuters and residents, have developed around public transit stops. These districts, an early shape of contemporary TOD. (Dittmar and Ohland 2004).[1]

The first TOD agenda was developed by a study conducted in 1989 in the Bay Area of Quick Traffic (BART) to study the promoting high-rise housing near transit stations. The first TOD projects in the United States began in the late 19th and 20th centuries. The railways and suburbs were built around it. These early transit developments included a central transit depot, public space, small cottage-style houses, and a street layout and scale that provided a comfortable walking distance to the transit (Cervero 1993).[2]

TOD planning may begin on a smaller scale and move up or down to a larger scale.

2 TOD DEFINATIONS

There are several TOD concepts which fall under the new urbanism A new modern theory suggests that the suburban issue is solved by small, scalable communities. The concept of public transport was first and most popularly identified by the American architect and town planning planner Peter Calthorpe. According to Calthorpe (Calthorpe 1993),
"Community with mixed use at an average distance of 2 000 feet walk from transit and core business. TOD mix the use of residential, commercial, office, open space and the public in a walking environment and make transit, bicycle, foot or car convenient for residents and employees" [3]

TOD's main objectives are to:

• Reduce the dependency on private vehicles and facilitate the use of public transport through design, policy initiatives and compliance.
• Provide easy transport links for as many people as possible on foot – by densifying and improving connectivity.

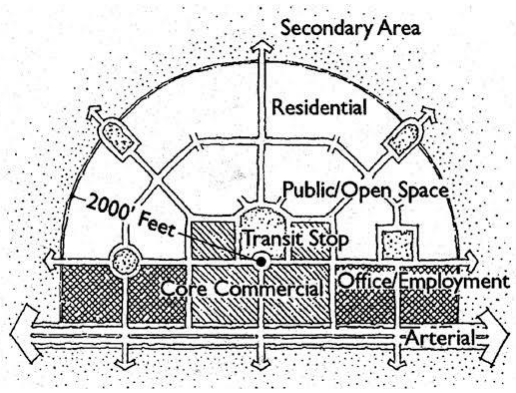

Figure 1 Neighbourhood unit
(Source: The Next American metropolis: Ecology, community and the American dream)

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Table 1 Transit-oriented development defined by different Experts

Experts	Description
Salvesen (1996)	Growth in a geographical location around a transit station with numerous properties claims and diverse ownership.
Cervero and Bernick (1997)	A dense, mixed-use environment that is based around transit stations encourages people to drive less and transport mass through design.
Maryland Department of Transportation	A place that is more densely situated within easy walking distance from a bus or rail transit centre, which includes a mixture of housing, work, shopping and city types.
Bae (2002)	A way to reduce car reliance, promote compact housing development and enable the use of mixed land.
Cervero et al (2004)	TOD is a tool for fostering intelligent growth, stimulating economic development and addressing the shift in demands and preferences of the housing industry.
Schlossberg and Brown (2004)	An integrated transit-oriented approach to transport and land use planning.
Boarnet and Crane (1997)	The concept of developing or restructuring land in the vicinity of railway transit stations in ways which will promote optimal use of the transport system and leverage railway public investment.
California Department of Transportation (2002)	Moderate to higher density housing, situated within easy walking distance of major transit stations, with a mix of home, job and shops for pedestrians without cars being excluded.
Hale and Charles (2006)	A dynamic, rather dense mixed pedestrianized area with high-quality public space and direct access to high-speed public transportation.

(Source: Measuring Transit-Oriented Development (TOD) At Regional and Local Scales – a Planning Support Tool)[4]

3. TOD PARAMETERS

The three key parameters for the transit system, namely distance, diversity and design, have been defined by Cervero and Kockelman (1997). Another researcher introduced more Ds. Translink listed six parameters of Transit-Oriented Communities mentioned in their TOD guidelines namely Density, Diversity, Design, Destination, Distance, Demand Management.

Table 2 Indication for Parameters

Parameters	Indication
Density	• Person per Sq./ Sq.km/ hector • Floor space index/ floor area ratio
Design	• Principles of city design such as parking, pathways, cycle lanes, etc.
Diversity	• Mixed use index • proportion of land use
Destination	• Availability, Fare, Frequency, Route
Distance	• Meters/kilometre to reach station • walking/cycling time
Demand Management	• Shift automobile trips to other modes • Increasing travel options • Allocation of more transit space, bike route and for pedestrian purposes.

(Source: By Author, Compilation from various resources)

4. TOD TYPOLOGY

According to a wide range of literature, the TOD policies for major cities and cities are classified in three sections.[5]

1. Area Level
2. City Level
3. Station Level

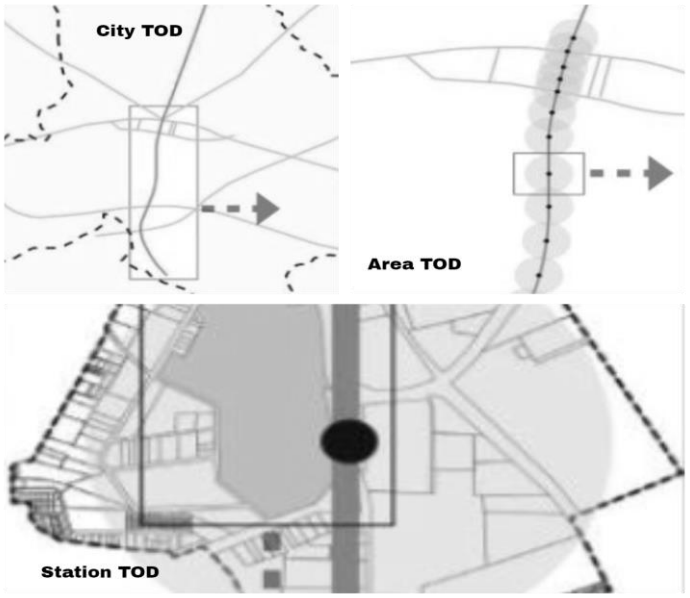


Figure 2 Levels of TOD

(Source: Transit Oriented Development Guidance Document, MoUD, 2016)

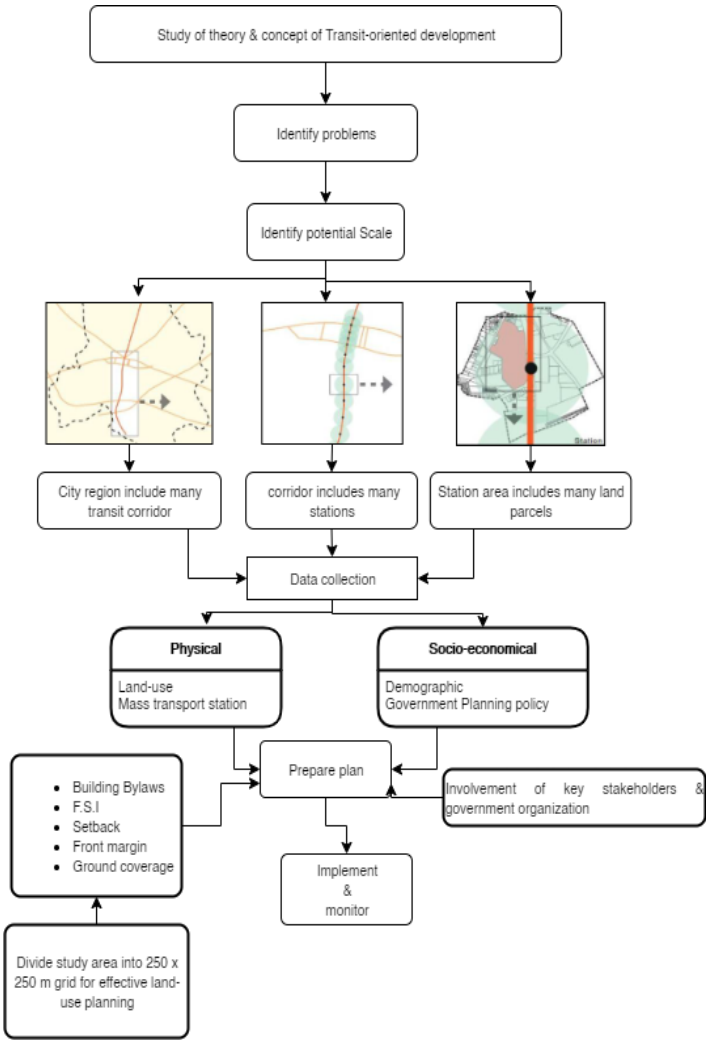
The following table shows therefore, as a separate list, the analysis of policies announced by the governments of the different cities on the scale of the above parameters and indicators.

Table 3 TOD assessment in India

City	Institutional Framework	Cityscape Quality	Safety, Comfort And Environment	Financial Model	Travel Behavior
Area level TOD assessment in India					
DELHI	• DDA • DDA Act • UTTIPEC	• Population – 19 Million • Three zones- Intense zone, Standard zone and TOD Zone • Ground Coverage 40% • No height restriction • At Least 50% of total FAR to be as per ZDP Use	• 50 percent size units varying between 32-40 sq. • affordability for LIG/ MIG group • 30% min. mandatory residential.	Sale of FSI	50% of parking should be shared parking.
BENGALURU	• Bus rapid transit system • MRTS • UADD • BDA • BMC	•84.3 Lakh population •Density 134 People/ Hectare •Within 150m radius from metro terminals	• No separate all-inclusive TOD policy. • To increase pedestrian connectivity within 500 m from the metro stations.	• The land-value capture policies are similar to Ahmedabad.	• There is still to be established public transport, feeder systems, walking space and metro accessibility.
MUMBAI	MMRDA	• Population- 124 Lakh • Density- 31700 People/ Sq. Km • 53% walking • 47% Motorized journey • 78% Public mass transport • Premium FSI- 2 to 8.	• Higher densities built-in, large parcel sizes with significant parking spaces. • Sustainable and safe transport systems.		• High pedestrian friendly •Ensuring adequate Accessibility for transportation • integrated traffic and pedestrian safety management
City level TOD assessment in India					
Navi Mumbai	MMRDA	• Mixed use • high density transport zone • Contours based development • Compact development	• Greens Road links • services within walking distance	Sell of FSI	•Multimodal - Transit • Inter connected Street Pattern • Walkability
Station Level TOD assessment in India					
Ahmedabad	• AUDA • GTPUD A, 1976 •Transit Oriented Zone (TOZ) •Local Area Plan (LAP)	• No Ground coverage restrictions • Max. FAR 4 Including paid FSI •12000 persons/Sq. Km	•Separate affordable housing for urban poor.	• Betterment charge on property within 250 m • sale of FSI, sale of identified land parcel through TP Schemes, • Public Private Partnership	• Multimodal Transit

(Source: Transit Oriented Development in India: A Critical Review of Policy Measures)[6]

5. METHODOLOGY



(Source: By Author, Compilation from various resources)

6. CONCLUSION:

With increasing urbanization worldwide, many cities facing numerous challenges. Specifically, with transportation. In order to improve the mass transportation of Indian cities, the preparation of land use planning and the expected growth and extension of public transport systems are needed. Land use and transport are autonomous. A TOD definition is commonly used in sustainable development; different people have described and interpreted TOD in various ways. Also, evolution method for TOD are varying at different scales. Each TOD station has its own characteristic, so we can't use same method for each. For example, when, transportation supply is insufficient the improper consumption of land use. on other hand land use is insufficient its cause burden on transport network.

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