

Issues and Challenges in Implementing Transit Oriented

Prashanth Shekar Lokku
Research Scholar
National Institute of
Technology, Warangal
Telangana, India



Prashanth Shekar Lokku is a Post Graduate Civil Engineer, specialized in Traffic & Transportation Engineering with a working experience of more than 5 years. Now he is a full time research scholar in NIT Warangal

Dr CSRK Prasad
Professor and Head
Transportation
Division, Civil
Engineering
Department,
National Institute of
Technology, Warangal
Telangana, India



Dr CSRK Prasad is a professor in civil engineering department in NIT Warangal from last 20 years of experience. He has strong academic and practical knowledge in Traffic Engineering and Transportation planning areas.

Summary

Rapid growth in urbanisation is taking place all over the world, especially in developing countries like India. Metropolitan cities and class I cities are facing more problems related to traffic and transportation, environmental and social related issues. This puts people's lives in dangerous situation. To make the city liveable and also to keep the future generations on safer side, transportation engineers and planners have a comprehensive solution through implication of Transit Oriented Development (TOD). This paper will discuss in detail how TOD will address the above said problems and suggestion to implement best optimal TOD. Since Indian cities were already overcrowded and land use diversity and number of mix use buildings proportions were very good. Hence Indian cities have potential to grow into successful grow into TOD projects, but absence of integration between land use and transport and absence of appropriate street designs provides a barrier for construction of TOD projects. Metro cities are having fewer opportunities to develop TOD concept as they are highly dense in build environment. In other words, in these cities green field or brown field development is highly not possible. So the vision has to move from metro cities to class I cities or medium populated cities to adopt TOD. Integration of landuse has to take place at initial stage of public transport projects for Class I and Class II cities so on.

1. INTRODUCTION

Transit-oriented development (TOD) is the break through solution for urban planner and Transportation Engineers to mitigate social, environmental and economic problems. Urbanization is taking place in a tremendous way around the world. Transportation engineers or planner have a solution to control private vehicles usage and make the sustainable lives within the city through the concept of TOD. TOD is well known and implemented in developed countries like Northern America and Australia in early 1960's. While the concept is not defined and using the similar designs, until Peter Calthorpe published 'The New American Metropolis' in 1993. However those concepts are based on green field development which may not suite the developing countries where cities are not planned and highly dense. It is the same case in Indian Cities as they are densely populated and are not planned. To implement concept like TOD, there should be definite unique formulae for each country or community. For that there is a need to understand various influencing factors like demographical features, traffic conjunction level, transportation network, landuse, environmental, social, economic, political and institutional issues etc.

Mass Rapid Transit System (MRTS) is the solution for many problems like air pollution, traffic conjunction, increase of vehicle population and delays in travel. To make it success landuse planning also has to take place along with Transit corridor. In India, first rapid transit system was the Kolkata Metro, which started in 1984, followed by the Delhi Metro in 2002, the Bangalore Metro in 2011 and the Chennai and Mumbai Mass Rapid Transit System in 2014. And also in seven other cities Metro Rail projects are under construction. Most of the Indian cities were planned much earlier than the introduction of metro rail projects. Therefore, much of the anticipated developmental impact of the metro rail projects are not easily integrated into current Master Plans. The efficiency of a public transport system is heavily dependent on demand thresholds. TOD is one of the techniques used to provide the desired development density and connectivity for transit.

With this growing desire to improve and upgrade the situation, India has in recent times witnessed an influx of foreign techniques and methods being advocated by upcoming planning institutes. Transport systems such as BRTS and monorails have shown sharp increase in advocacy. Incentives such as congestion pricing, parking pricing, car pooling, high occupancy vehicle priority etc are stemming up as typical proposals. Authorities are looking at techniques which are financially attractive and technically viable. It is however felt that endorsing these techniques is much simpler than practically and successfully applying them in the Indian scenario. It is important that a transport planning technique or programs needs to be studied and analysed with the aspirations of Indian public. Transit Oriented Development (TOD) is one of the techniques which is gaining rapid encouragement

2. HISTORY OF TOD

2.1. Definition

A Transit-Oriented Development (TOD) is a mixed use community within a typical 500m walking distance of transit stop and core commercial area{1}. The design, configuration, and mix of uses emphasize a pedestrian-oriented environment and reinforce the use of public transportation, without ignoring the role of automobile. TOD's mix residential, retail, office, open space, and public uses within comfortable walking distance, making it convenient for residents and employees to travel by transit, bicycle or foot, as well as by car.

2.2. History

The concept of TOD is not new, but literature on the topic has seen resurgence in recent years. Peter Calthorpe's *The Next American Metropolis* (1993) is the major work responsible for reintroducing these concepts to the planning and development professions. Development of TOD concept can be categorise into three major stages {2}. Stage 1 is known to be Development Oriented Transportation (DOT), the era is in between year 1850 to 1930. During the early twentieth century, DOT more aptly describes many towns and

cities than TOD, as private developers built transit services to serve their development rather than vice versa. Stage 2 is known as Auto Oriented Development in between 1930 to 1960 happened after world war. At this moment saw a precipitous decline in transit use and the dismantling and abandonment of many rail systems. To the extent that transit was still in operation, it relied much more heavily on buses as the primary mode of transport in most regions. With the exception of some of the commuter suburbs around older cities, which continued to function reasonably well as transit-based communities, most transit had become a last resort rather than a reliable transportation option tied to development. As congestion worsened, a new generation of transit systems was planned and built. They were built primarily to relieve congestion, funding was provided entirely by the public sector, and little or no additional land was purchased by the transit agencies to ensure that there would be any link between current transit investments and future development patterns. Stage 3 known as TOD. Since the 1960s, many research reports have stated that transit systems have the potential to provide residents with improved quality of life and reduced household transportation expenditure, while providing a region with stable mixed-income neighbourhoods that reduce the environmental impacts of growth. Financing for transit has been focused on cities through value capture, where low density development and auto-dependency predominate.

3. TOD IN INDIAN CONTEXT

As urbanisation is taking place in India in rapid manner. Cities in India are facing so many problems related to social, environmental and economical. To maintain sustainability it is need to be integrate between transport system and landuse. In other words it would say TOD implication. Following table reveals the number of project in public transport sector. It is good sign that so many projects coming up in India that encourage people to use public transportation instead private vehicles.

Status	BRTS	Metro Rail	Mono Rail	LRT
Operational	12	6	1	-
Under Construction	7	7	-	-
Under Planning	9	19	4	1
Under Proposal	1	4	14	5

With growing menace of Traffic and transportation demand and rapid urbanisation in India, the so far relatively dormant profession of urban and transport planners has started gaining attention. The authorities are looking to the planners for solutions to handle the urban sprawl as well as the hazards. Traffic problems which were once considered a part of life have suddenly come to notice as hazards. With the Ministry of Urban Development (MoUD) taking a bold initiative, Authorities in metros and class I cities are not just looking at finding short term solutions to traffic problems by carrying out Short Term Traffic Improvement Schemes but also envisioning the long term traffic and transportation needs of the city in the form of Comprehensive Mobility Plans. With the objective of ensuring safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and such other needs within our cities. The MoUD has formulated the National Urban Transport Policy.

The current Indian context is placed into a supply chasing demand scenario. The TOD has a major bearing on the real estate which is very unstable in the rapidly growing cities in India. A similar condition is also faced in the USA. Despite the benefits and trends favouring equitable and sustainable TOD, creating these types of places has proven difficult in practice. Green field and brown field development near transit is increasingly recognized by a range of stakeholders as an important real estate, community, and economic development model, but it remains a place market in the real estate industry, while public policy and financing structures remain inadequate at all levels of government. TOD that actively seeks to create or preserve a mix of incomes and amenities in communities faces even more challenges, as current policies and market structures actually work against the robust, diverse communities that are its goal. India with its growing urban

population has been under pressure for urban infrastructure. India has been chasing the demand for urban infrastructure mainly transport infrastructure in almost all its cities. The motor vehicle population in India has increased 100 times from 1951 to 2004, while the road network has expanded only eight times, and this does not even cover the period of sharp acceleration in vehicle purchases after 2003.

Basic trends that are evident in the million plus cities which determine transport demand are factors such as substantial increase in urban population, household incomes, and industrial and commercial activities. These changes have placed heavy demands on urban transport systems, a demand that none of the Indian cities have been unable to meet. With inadequate funds and critical need for provision of transit systems, Authorities are resorting to TOD as a probable solution.

The concept of TOD is essentially as an exaggerated form of Travel Demand Management technique, it ensures maximum use of mass transit at the same time reducing the trip length outside the long haul system. It is to minimise the traffic impacts of the new transit infrastructure by providing trip end landuses. That is and should be the primary objective behind the planning of TOD. However in the Indian context, TOD is considered primarily as a project financing tool. The other objectives can be strictly in the following order of priority

- Boosts transit ridership and reduces personalised traffic
- Provides a rich mix of housing, jobs and shops
- Encourages NMT and Pedestrians
- Create a sense of place
- Increases financial viability

4. CHALLENGES AND ISSUES IN IMPLEMENTING A TOD

Any project related infrastructure will have their own challenges. TOD is relating to many departments. TOD is not just a project, it would say community or village. In a broad manner challenges listed as Macro level and micro level.

4.1. Macro Level

Landuse is first and foremost important thing to understand for before giving any proposal. Density, diversity, mixed-uses, a pedestrian scale and a defined center are primary attributes for a TOD. Each transit station has to study in terms of density, diversity and it need to come up with the new designs. These designs have to in-corporate in the master plan for future years. Their involves political influences to approve plans. In current situation green filed development is not possible. The next possibility is brown field development; it is highly risk and will get opposition from the local residents itself. To overcome all these kind of issue TOD become a fuzzy.

The most crucial requisite for TOD is the availability of land for development or redevelopment. TOD requires reservation of land for the purpose, in the Indian scenario where the valuation of land is highly volatile, it is very difficult to evaluate the market value. With higher market value it is seen as a challenge to acquire private and in some cases government land parcels. In the NCR, in recent times, that green field, government initiated land acquisitions have also ran into trouble. The issues of compensations rates, when a transport corridor is announced, the land values increases overnight, so fixing a rate is very difficult, issues of rehabilitation of the owners and the people whose earning depends on the land. Overall in a democratic and politically driven country such as India, it is near to impossible to bind the people from not causing deterrents to the cause of development. In case of redevelopment or brown field TOD, the matter of integrating the existing structures and landuses and road network in the overall plan is crucial. In this case, the area for TOD may be same but the potential of gaining from it is limited, since the policy will have to be tailor made for the population affected. It is hard to be acquired from private as well as public agencies. The state governments want their rural land to be developed without their expense at the same time they would not prefer to get their hands off potential high value land parcels, hence essentially the land parcels for TOD

should be identified prior to the project sensitisation. A special land acquisition act is essential for going ahead with TOD or special land pooling or other land development techniques and needs to be addressed case specifically.

Street Design is also a most complex thing. If available Right of way is not sufficient according to the design proposals then it will be misery for the planners. In some parts of city land acquisition is highly possible. To fulfil the major objectives of TOD, street design elements are the key roles. Street design elements are to provide the walking environment and cycling facilities. Traffic circulation plans with in TOD is also plays major role on successor side of TOD. Integration of Non-Motorised Traffic (NMT) tracks with the Road network has to be taken care. Traffic signalling at the intersections has to be prioritise for the NMT. Segregation of NMT with Motorised traffic for safety and to create pedestrian friendly environment is really a big challenge for urban planners.

Parking is major issue in current any city in India. Particularly in Central Business Districts (CBD) parking is a nightmare for authorities. In the area of TOD placement of Parking will play the major role in inducing the public towards Transit facility and at the same time encouraging to use private vehicle to reach station. So the placement of parking facility should be provided in such a way that it create minimum trouble on the roads to reach station.

Financing TOD in Indian is become most challenging job. Globally, one of the larger issues with implementing TOD is with respect to identifying and addressing systemic financing gaps. While the TOD Policy has been introduced in Delhi and is up for testing through the launched pilot project, it is crucial to look at financial tools and mechanisms that can render it effective. Comprehensive financial planning for continuous flow of required resources for implementation and sustainable operation is fundamental to achieve the set target. Furthermore, the economic condition of the city, political will and capacity among stakeholders are factors that can dramatically influence TOD outcomes. To develop a shared understanding of these issues and opportunities, WRI India, in association with Citi foundation and C40 is organizing a day long workshop on "Financing TOD in Indian Cities – challenges and opportunities" with the goal of deeper inquiry.

The framing recognizes finance as a key barrier to transit-oriented development and seeks to convene investors, financiers, experts, and city officials to engage in discussions about these aspects in implementing TOD. The workshop aims to be interactive and will consist of a limited number of presentations and group discussion around key issues in financing TOD. The objective is to collaboratively explore the key concepts of financing TOD, including what needs to be financed, what mechanisms exist, and their feasibility in the Indian and in specific Delhi's context.

The target audience includes Field experts, City officials, financiers, Banks, Developers, Transport providers and operators, capital providers from Delhi as well as representatives from other Indian cities which are in process of adopting the strategy of Transit Oriented Development. The goals and expected outcome of this workshop is knowledge building & sharing amongst stakeholders along with deliberative discussions on options and possible ways forward for TOD Financing in the Indian context.

4.2. Micro Level

The term used Micro level because these issues are common for all cases. Here discussed one by one issues faced around the world. The restructuring of the existing patterns around transit systems and making of fully functional TOD is a long and slow process, likely taking several decades rather than a few years. Successful TOD project require a unified base of political support and inter-governmental coordination on the regional and local level. **Uncertain Market Viability** - In regions without a successful example of transit oriented development, real estate developers and lenders often question the financial viability of these projects. **Depressed Real Estate Markets** - The success of TODs is tied to the strength of the regional and local real estate markets. **Fragmented Land Parcels** - A collection of small, disjointed land parcels under multiple ownership inhibits the development of unified TODs. **Existing Land Use Patterns** - TODs rarely emerge where transit stations are surrounded by unattractive or unsafe land uses (i.e., industrial districts). The

population has been under pressure for urban infrastructure. India has been chasing the demand for urban infrastructure mainly transport infrastructure in almost all its cities. The motor vehicle population in India has increased 100 times from 1951 to 2004, while the road network has expanded only eight times, and this does not even cover the period of sharp acceleration in vehicle purchases after 2003.

Basic trends that are evident in the million plus cities which determine transport demand are factors such as substantial increase in urban population, household incomes, and industrial and commercial activities. These changes have placed heavy demands on urban transport systems, a demand that none of the Indian cities have been unable to meet. With inadequate funds and critical need for provision of transit systems, Authorities are resorting to TOD as a probable solution.

The concept of TOD is essentially as an exaggerated form of Travel Demand Management technique, it ensures maximum use of mass transit at the same time reducing the trip length outside the long haul system. It is to minimise the traffic impacts of the new transit infrastructure by providing trip end landuses. That is and should be the primary objective behind the planning of TOD. However in the Indian context, TOD is considered primarily as a project financing tool. The other objectives can be strictly in the following order of priority

- Boosts transit ridership and reduces personalised traffic
- Provides a rich mix of housing, jobs and shops
- Encourages NMT and Pedestrians
- Create a sense of place
- Increases financial viability

4. CHALLENGES AND ISSUES IN IMPLEMENTING A TOD

Any project related infrastructure will have their own challenges. TOD is relating to many departments. TOD is not just a project, it would say community or village. In a broad manner challenges listed as Macro level and micro level.

4.1. Macro Level

Landuse is first and foremost important thing to understand for before giving any proposal. Density, diversity, mixed-uses, a pedestrian scale and a defined center are primary attributes for a TOD. Each transit station has to study in terms of density, diversity and it need to come up with the new designs. These designs have to in-corporate in the master plan for future years. Their involves political influences to approve plans. In current situation green filed development is not possible. The next possibility is brown field development; it is highly risk and will get opposition from the local residents itself. To overcome all these kind of issue TOD become a fuzzy.

The most crucial requisite for TOD is the availability of land for development or redevelopment. TOD requires reservation of land for the purpose, in the Indian scenario where the valuation of land is highly volatile, it is very difficult to evaluate the market value. With higher market value it is seen as a challenge to acquire private and in some cases government land parcels. In the NCR, in recent times, that green field, government initiated land acquisitions have also ran into trouble. The issues of compensations rates, when a transport corridor is announced, the land values increases overnight, so fixing a rate is very difficult, issues of rehabilitation of the owners and the people whose earning depends on the land. Overall in a democratic and politically driven country such as India, it is near to impossible to bind the people from not causing deterrents to the cause of development. In case of redevelopment or brown field TOD, the matter of integrating the existing structures and landuses and road network in the overall plan is crucial. In this case, the area for TOD may be same but the potential of gaining from it is limited, since the policy will have to be tailor made for the population affected. It is hard to be acquired from private as well as public agencies. The state governments want their rural land to be developed without their expense at the same time they would not prefer to get their hands off potential high value land parcels, hence essentially the land parcels for TOD

should be identified prior to the project sensitisation. A special land acquisition act is essential for going ahead with TOD or special land pooling or other land development techniques and needs to be addressed case specifically.

Street Design is also a most complex thing. If available Right of way is not sufficient according to the design proposals then it will be misery for the planners. In some parts of city land acquisition is highly possible. To fulfil the major objectives of TOD, street design elements are the key roles. Street design elements are to provide the walking environment and cycling facilities. Traffic circulation plans with in TOD is also plays major role on successor side of TOD. Integration of Non-Motorised Traffic (NMT) tracks with the Road network has to be taken care. Traffic signalling at the intersections has to be prioritise for the NMT. Segregation of NMT with Motorised traffic for safety and to create pedestrian friendly environment is really a big challenge for urban planners.

Parking is major issue in current any city in India. Particularly in Central Business Districts (CBD) parking is a nightmare for authorities. In the area of TOD placement of Parking will play the major role in inducing the public towards Transit facility and at the same time encouraging to use private vehicle to reach station. So the placement of parking facility should be provided in such a way that it create minimum trouble on the roads to reach station.

Financing TOD in Indian is become most challenging job. Globally, one of the larger issues with implementing TOD is with respect to identifying and addressing systemic financing gaps. While the TOD Policy has been introduced in Delhi and is up for testing through the launched pilot project, it is crucial to look at financial tools and mechanisms that can render it effective. Comprehensive financial planning for continuous flow of required resources for implementation and sustainable operation is fundamental to achieve the set target. Furthermore, the economic condition of the city, political will and capacity among stakeholders are factors that can dramatically influence TOD outcomes. To develop a shared understanding of these issues and opportunities, WRI India, in association with Citi foundation and C40 is organizing a day long workshop on "Financing TOD in Indian Cities – challenges and opportunities" with the goal of deeper inquiry.

The framing recognizes finance as a key barrier to transit-oriented development and seeks to convene investors, financiers, experts, and city officials to engage in discussions about these aspects in implementing TOD. The workshop aims to be interactive and will consist of a limited number of presentations and group discussion around key issues in financing TOD. The objective is to collaboratively explore the key concepts of financing TOD, including what needs to be financed, what mechanisms exist, and their feasibility in the Indian and in specific Delhi's context.

The target audience includes Field experts, City officials, financiers, Banks, Developers, Transport providers and operators, capital providers from Delhi as well as representatives from other Indian cities which are in process of adopting the strategy of Transit Oriented Development. The goals and expected outcome of this workshop is knowledge building & sharing amongst stakeholders along with deliberative discussions on options and possible ways forward for TOD Financing in the Indian context.

4.2. Micro Level

The term used Micro level because these issues are common for all cases. Here discussed one by one issues faced around the world. The restructuring of the existing patterns around transit systems and making of fully functional TOD is a long and slow process, likely taking several decades rather than a few years. Successful TOD project require a unified base of political support and inter-governmental coordination on the regional and local level. **Uncertain Market Viability** - In regions without a successful example of transit oriented development, real estate developers and lenders often question the financial viability of these projects. **Depressed Real Estate Markets** - The success of TODs is tied to the strength of the regional and local real estate markets. **Fragmented Land Parcels** - A collection of small, disjointed land parcels under multiple ownership inhibits the development of unified TODs. **Existing Land Use Patterns** - TODs rarely emerge where transit stations are surrounded by unattractive or unsafe land uses (i.e., industrial districts). The

availability of undeveloped land is also a key factor. Neighbourhood Opposition - Opposition to higher-density or mixed-use developments from nearby neighbourhoods.

5. RECOMMENDATIONS

It is certain that TOD has been a success in many countries and is a very able technique of travel demand management and promoting public transport use. But considering the status of the transport sector, its bearing on society, the complexity of relation between various stakeholders and political motivation, it is imperative to address this concept in new light. TOD should be primarily a tool for demand management rather than a source of finance. A few points need to be studied in detail and improved before the implementation of such smart growth tool is practically possible. Otherwise TOD will just be part of reports and proposals and will never be a deserved success.

Transit stations located in dense city centers with vibrant local and regional economies. And few of them may be in predominately residential areas for providing a convenient means for commuters to travel to and from work and other destinations. Few stations may be located in areas that are experiencing rapid growth and change, while others may be in more established, mature areas where any change will be incremental. Every station area, whether existing or proposed, will face unique challenges and will require strategies specific to the area to create high-performing TOD projects with their own unique character, role and function.

In order to promote transit ridership, the transit oriented strategies must address land use and transportation and short term and long term solutions. The existence of mature and diverse land uses and densities along the transit stations must be recognized and using the existing population around the transit stations to generate ridership must be explored. Enhancing multimodal connectivity to areas not connected by the transit systems should be considered for generating and increasing transit ridership. The design principles for creating and encouraging TOD development around transit stations will have to be customized for the existing areas that the transit will serve. Strategies for providing incentives for parcel assembly must be explored. Strategies for retaining the existing high density development or phasing out existing development and for phasing in the high density development must be explored.

The areas around the transit stations must be developed as transportation hubs for the catchment areas around the transit station to provide connectivity within the catchment area and connect other areas in the vicinity that are not connected by the proposed transit systems. The proposed transit oriented policies must encourage the activities of the surrounding areas that could range from being an economic hub, residential neighborhood, industrial area, information technology area, business district, institutional area or parks and recreation. The main aim of the transit oriented policies must be to minimize private vehicle dependency and promote public transit ridership in the areas around the metro stations. Once the transit oriented policies are developed, implemented and enforced, the involved agencies must continue to promote public transit ridership and minimize private vehicle dependency on an ongoing basis. New strategies must be developed on an ongoing basis to ensure commuter satisfaction

High-quality transit service - The convenience, speed and extensiveness of the transit system enhance the accessibility advantages associated with station area properties and increase the likelihood of development in these locations. Availability of attractive, developable land - Very little transit-oriented development has occurred around stations sites that are already largely developed, where surrounding land uses are unattractive/unsafe, where surrounding land uses are primarily auto-oriented, or where station connections to surrounding neighborhoods are poorly designed. Larger parcels are also more economically viable for developers. Numerous, small parcels held by a variety of owners can create a barrier to station area development. Strong real estate markets - Successful station area development requires strong regional real estate markets with an active demand for residential and commercial projects. In regions where transit investments have had the greatest impact upon land use development, the investments occurred prior or during periods of rapid population growth. Supportive neighborhoods and communities - Few

successful station area development projects have occurred where surrounding neighborhoods oppose higher density or nonresidential developments. Parking management - Limiting the amount of parking in downtown areas and around station areas encourages transit ridership and more compact development around stations. Stations surrounded by park-n-ride facilities limit opportunities for station-area development. Political champion - Strong, individual leadership is often a common element in successful TOD projects and developments.

6. REFERENCES

1. UTTIPEC Report (2012), "Transit Oriented Development: Policy-Norms-Guidelines", Delhi Development Authority, New Delhi.
2. CHIA-NUNG LI et al., Why should cities change from DOT to TOD?, Proceedings of the Institution of Civil Engineers Transport 162, May 2009, Pages 71-78
3. JOHN RENNE AND JAN WELLS, State of the Literature: Transit-Oriented Development, December 2002
4. DITTAMAR H., AND OHLAND G., "The New Transit Town: Best Practices in Transit Oriented Development, Washington DC" Island Press, 2004
5. MARLON G BOARNET, NICHOLAS S. COMPIN "Transit-oriented Development in San Diego Country - The Incremental Implementation of a Planning Idea", Journal of American Planning Association, 1999