



The Role of Transit Oriented Development in the Urban Area Development with Railway-Based Transportation

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ABSTRACT

The aim of this study is to optimize or exploit the use of land in around the city of Jakarta (Jabodetabek) area with eight principles of Transit Oriented Development (TOD) namely walkable, cycle, connect, transit or public transport, shift & transit, mixed use development, and compact. This research is a literature study with more in-depth interviews, and a triangulation process. In-depth interviews are carried out with some resource persons from the transportation regulator. The result shows the very high need for TOD area around the new and existing transit stations which are served by a regular and efficient transit system.

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Introduction

Based on the Governor Regulation Number 44, 2019, Transit Oriented Development (TOD) is a mixed residential and commercial area with high accessibility to mass public transportation where the station and terminal become the center of area with high density buildings [1]. Whereas based on the Governor Regulation Number 67, 2019, TOD is an area development around the transit point with the orientation to the easy movement of people, the enhancement of accessibility and connectivity to the area, activity mixture, the use of densed land for city rejuvenation and the increasing use of Mass Public Transports [2]. According to the Regulation of Agrarian Affairs and Spatial Planning Minister/Head of National Land Agency of the Republic of Indonesia Number 16, 2017, Transit Oriented Area hereinafter referred to as TOD is the area specified in the spatial plan as the central area of intra and intermodal integration in the radius of 400 meters to 800 meters from the transit node of mass public transportation mode with its function to utilize mixed and densed spaces at medium up to high intensity of space utilization [3]. Theoretically the definition of TOD is in accordance with Calthorpe in 1980 and has been published in 1993 with TOD principles like density, mix, and design, and subsequently completed to become 5Ds by adding Accessibility and Distance to the transit point [4]. TOD is a mixed area at the distance of 2,000 feet from the transit terminal and the center of commercial area. TOD area is a functional mixture of residential area, shopping complex, offices, public facilities and open space in an environment which is pedestrian friendly, comfortable for the residents and employees to go by public transport, on foot or by bicycle. TOD is a change of paradigm in the society with an automatization--oriented development which needs changes of life style in some cases.

In the modern context, [5] explain that TOD emphasizes the planning of residential, commercial, retail, and public service complexes around a new or existing transit station to be served by a regular and efficient transit system. In general, TOD results in financial benefits for the users and for the transportation system [6]. According some researchrs are; [7]; [8]; [9]; [10], TOD is a multipurpose residential or commercial area intended to maximize the access to public transportation. TOD is a multipurpose community which encourages people to live near the transit service and reduce their dependence on driving. Urban planners and designers promote TOD to encourage a sustainable urban development around the node of public transportation. TOD is a compact multipurpose development which facilitates walking, cycling, and the use of public transportation through an urban design. TOD comprises greenfield and rebuilding projects, usually around a railway.

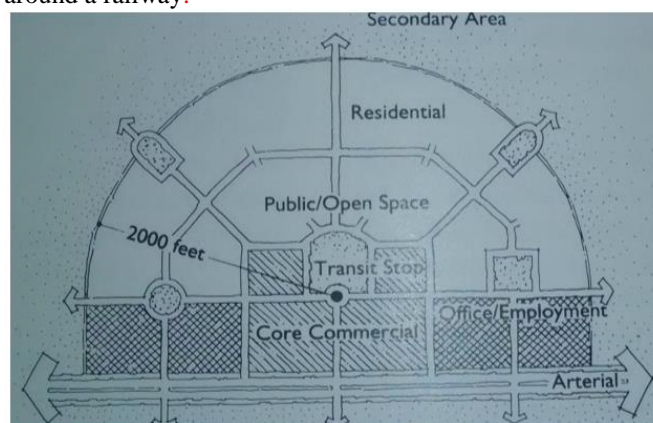


Fig 1. Transit Oriented Development (TOD).

Sources: Concept of TOD [4].

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TOD is a compact multipurpose development which facilitates walking, cycling, and the use of public transportation through an urban design. TOD comprises greenfield and rebuilding projects, usually around a railway station although a few of them are at bus and ferry terminals. Added, [11]; [12] explains that density, mixed use, and quality pedestrian friendly environment are consistently identified as the key elements of a physical design necessary for the success of TOD. Residential or commercial areas used in mixture are intended to maximize the access to public transport. A mixed area with high density (residential and commercial) in the walking distance from a high capacity public transport station (usually in a buffer area of 800 m). Empirically, there is a positive relationship between the transportation component of TOD and accessibility, but there is a proof that it is mixed more with the components other than transportation. Such as the high city density and diversity, or the closeness of land use to the transportation node.

Spatial plan in TOD is related to the integration of land use and transportation aspects, some researcher [13]; [14] explains that in some places the management of transit node-based transportation like railway services is not well-integrated, causing spatial chaos, particularly around the station. It is very important to prepare public transportation plan by maximizing the regional potential capacity using TOD model. TOD has become a promising concept to develop land use and transportation integration, so as to establish a more sustainable society. They state further that TOD can stimulate sustainable development by enhancing the interaction between transit node and the development around it. Whereas, [15] state that TOD planning around the existing transit node can only be effective if the assessment on the basic situation is done properly. Their research has helped describing the regional TOD policy by identifying which area of the railway station needs more attention than the others and at the same time, for each station, identifying the specific characteristics of TOD which need improvement. Another opinion, TOD must be approved and agreed in the perspective of the network system, with an understanding of nodes as a part that contributes to network performance [16].

To overcome the problems of modern urbanization in Indonesia's big cities, especially Jakarta as the Capital City, such as (1) Traffic jam which is in the third world rank among 403 cities; (2) The use of public transport which is approximately 27.15%; and (3) Based on AQI (Air Quality Index), the fourth worst rank in the world (Dubai, New Delhi, Santiago, and Jakarta), it seems that Transit Oriented Development (TOD) is the carefully thought solution for modern society. The aim of this study is to optimize or exploit the use of land in Jabodetabek area with eight

principles of Transit Oriented Development (TOD) namely: (1) to optimize the use of land in that area with the principle of Mix-use, Density, Compact; (2) to establish a walkable area around the transit center; (2) to enhance and encourage the habit of walking and cycling; (3) to reduce the dependence on private vehicles (riding motor vehicles); (4) to reduce traffic jam; (5) to reduce air pollution, and (6) to increase the value of land.

The study results of TOD area in Indonesia, such as; in Tangerang is planned with adequate facilities and infrastructure with the concept of TOD [17]. The another results showed that the city of Surabaya was dominated by transit variables, the city of Bandung and the city of Jakarta were both dominated by the variable density and transit [18]. Whereas, on other cities in Indonesia such as Bandung, Yogyakarta, Palembang, Semarang, the research done by; [19]; [20]; [21]; [22]. Their recommends in that the location of bus halts can be moved to near the dropout areas of the Railway Station. The transit areas with tendency to be Urban TOD need development and increase in the principle of density, whereas the transit areas with tendency to be Suburban TOD need demand management. The study examined the connectivity between stations and feeders at locations supported by some adequate infrastructure.

Research Method

This research is a literature study with more in-depth interviews, and a triangulation process [23]. The technique used was participant observation which was supplemented by in-depth interviews with key informants from transportation regulator such as Director General of Railways, Deputy Governor of DKI Jakarta Province, transportation and railway observers, representatives of academics as well as Developers of TOD. The data is collected based on observation and literature study, such as finding the data source; (1) legality; (2) cost structure; (3) government and institution; (4) land procurement and acquisition; Legal; (5) collaborative design and community inclusiveness, and (6) technology & industrial standards. The discussion of TOD is also through the development of railroad-based regions with comparison of theories of several sources and TOD from many countries in the world such as Europe, Asia, and the United States.

Results and Discussions

Policy and Program

Based on several policies and programs on the Transit Oriented Development (TOD) Plan which the authors can collect from some resource persons, TOD has been mentioned in the Presidential Regulation of the Republik of Indonesia Year 2018. In general, according to Zulfikri, Director General of Railways, the government has two policies: National Railway Policy and Urban Train and TOD Potential Policy [24]. National Railway Policy needs to develop railway facilities and infrastructures during the period of 2015-2019 through; (1) Increasing capacity and connectivity (development of railway tracks including double tracks and track reactivation, improvement and maintenance/rehabilitation of railway tracks and development of railway stations/operational buildings), (2) Improving the services (passenger and goods production, pioneer transportation and PSO transportation, LRT (Light Rail Transit) in South Sumatera, and MRT (Mass Rapid Transit) in Jakarta; (3) Improving safety through the ratio of railway transportation accident (accident ratio/1 million km) and the issuance of HR proficiency certificate, the worthiness of railway facilities and infrastructures [24]. Urban Train and

TOD Potential Policy contains the Urban Train Development Plan, including Jabodetabek (Jakarta, Bogor, Depok, Tangerang, Bekasi), through Alternative Urban Train Technology.

The supporting programs are; (1) Development of park and ride facilities at the railway station, (2) Development of residential and business areas integrated with public transportation network; (3) Development of feeder transport going to railway station; (4) Arrangement of area both around the railway station and along the track; and (5) Development of flyover/underpass to handle level crossings in coordination with the Ministry of PUPR [24]. Some regulations related to TOD in Jakarta such as Government Regulation Number 140, 2017 that appoints PT. Mass Rapid Transport (MRT) Jakarta as the Main Operator of TOD area for North–South corridor in the Phase 1 of Mass Rapid Transit Jakarta [25]. The other one is Government Regulation No. 44, 2019 concerning the Transit-Oriented Development with the scope; (1) principles of planning, classification and criteria for developing TOD area; (2) mechanism of developing TOD area; (3) technical guidance for utilizing TOD area; and (4) development and management [1]. The regulation states TOD as a mixed area of residential and commercial areas with high accessibility to mass public transportation, where the station and terminal for mass public transportation act as the center with high density buildings surrounding it. Whereas Governor Regulation Number 67, 2019 concerns the Organization of Transit Oriented Area with the scope; (1) criteria for establishment, principles of area development and typology; (2) institution; (3) mechanism of developing new transit oriented areas; (4) development of predetermined transit oriented area; (5) technical provisions on the use of space; and (6) incentive, disincentive and management for area value improvement [2].

The interview with Hapsoro, a resource person from the Directorate of Urban Transportation at the Directorate General of Land Transportation, explains the direction of policy and strategy for 2020-2024 in the urban mass public transportation system [26]. As the strategic issue of infrastructure development for 2020-2024, urban infrastructure improvement is carried out through: (1) Urban mass transportation; (2) Digital transformation for smart city; and (3) City infrastructure and basic services. The indicator target is to increase the use of urban mass transportation in terms of the number of urban railway-based mass transportation and the road being constructed and expanded. The policy direction from the government is implemented through; (1) Encouraging local government to develop a sustainable urban mobility plan as a part of incentive in the scheme of government support for six metropolitan cities; and (2) Developing a mechanism of central government support for providing transit-based urban mass public transportation. Urban mass public transportation system is developed in six metropolitan cities (Jakarta, Surabaya, Medan, Bandung, Semarang, and Makassar).

In general, [27] as urban transport observer stated that policies on developing urban transportation systems in Indonesia that use conventional approaches, namely predict and provide or predictions and provide, must be abandoned and replaced with a new approach, namely predict and prevent or predictability and prevention, namely by carrying out management or management efforts. Another regulation which supports TOD is the Regulation of Head of Jabodetabek Transportation Management Agency which plays the role in implementing TOD related to the Technical

Guidance in Transportation Aspects. In organizing the public transport oriented area in Jabodetabek [28] technical recommendations are given to ensure that the development plan of TOD area in Jabodetabek has fulfilled the transportation aspects and coaching is performed in arrangement, control, and supervision. Jabodetabek Transportation Management Agency has issued technical recommendations related to transportation aspects for some TODs, namely; (1) TOD Dukuh Atas, Jakarta; (2) TOD Gunung Putri, Bogor; (3) TOD Rawabuntu, Tangerang; and (4) TOD Jatimulya, Bekasi.

Based on the information from one of the TOD developers [29], there are still some obstacles. For example, the regulation has not been applied 100% in the development areas, some TOD areas are actually not for TOD area based on the spatial designation but the requirements should be fulfilled similar with a TOD area; the accessibility of supporting public transport that approaches the TOD area; the increase of road quality as the access to the area, including facilities for pedestrians and bicycle lanes (outside the development area). According to Siahaan, (2019), a transportation system observer, TOD policy and program are expected to have; (1) coordination between transportation plan and land use in TOD areas; (2) Scheme of government's land use in TOD areas; (3) TOD studies in every TOD node such as financial and economic feasibilities as well as environmental feasibility; and (4) Expert assistance for study, design and engineering. To plan TOD, people from middle low class should be paid attention: (1) There are three categories of urban people; (a) working in the downtown and able to buy a house in the downtown; (b) working in the downtown but not able to buy a house in the downtown and only able to buy a house in the suburban, but able to pay the transportation fees; and (c) working in the downtown, not able to buy a house both in the downtown and suburban, and not able to pay the transportation fees from suburban to the downtown, so they live in empty lands in the downtown at free of charge; (2) Residents as in point 1.b that are included in the low class need to be accommodated in TOD; (3) The farther from downtown the cheaper the price of a house, or the farther TOD from downtown the cheaper the price of a house in that TOD so the poorer the people the farther house in TOD they are able to buy; and (4) the construction of apartment houses in TOD for low class people should be subsidized by the government.

Based on [31] says further that it is necessary to have data of traffic and transit supported by a comprehensive survey on the residents, employees, and users to show the relatedness among land users, transportation, as well as social, economic and demographic characteristics. The TOD study by discussing several regulations can be said to support a number of TOD studies in several cities in Indonesia carried out by [18]; [32] with the suitability of regulations in each of these regions. This research also supports the rules of the Jabodetabek Transportation Management Agency (BPTJ) which plays a role in the implementation of the TOD on technical guidelines for transportation aspects [28]. The Jabodetabek Transportation Management Agency (BPTJ) has issued technical recommendations regarding transportation aspects in the TOD, such as: TOD Dukuh Atas, Jakarta; TOD Gunung Putri, Bogor; TOD Rawabuntu, Tangerang; and TOD Jatimulya, Bekasi.

Benefits of TOD

Some benefits of TOD plan according to [30] are; (1) Improving the life quality of residents (24 hour activity), business, mobility choices (transit, walking and cycling), health, inter-resident relations, access to shopping and recreational places, clean environment, good school, affordable housing, moderate living costs; (2) Enhancing the mobility (walking and cycling orientation), mix of land use, access to transit node, increasing the number of transit users, children and elderly mobility; (3) Reducing capital for infrastructure and operational costs (road does not need many lanes, water, drainage, public building and other facilities) (saving 5-25 percent, high ratio of residents/infrastructures); (4) Having social benefits, such as cheaper living cost, promoting jobs/housing relationship and city revitalization; (5) Developing economy, for example making investment more effective and efficient, reducing travel time and cost, reducing business cost due to traffic jam, increasing business opportunity, increasing property value, attracting investment from development institutions, companies, pedestrian; traffic opens business opportunities such as cafe, food, care center, bakery, florist, laundry; (6) Improving safety and security, for example improving the quality of facilities for pedestrians by cycling and reducing motor vehicle accidents; (7) Having environmental benefits, for example reducing the vehicle's kilometers which will reduce pollution, energy consumption, and greenhouse gas; (8) land conservation, for example using less land (high ratio of building/land) and reducing agricultural land conversions.

From the social benefit, to provide good and safe connection to the adjacent plot, TOD is supported by the government because it will enhance the land value and act as a catalyst for city regeneration in the previous industrial area [33]. Understanding passenger movement is the key for the success of rerail and commercial TOD areas. The benefits of TOD in this study strongly support previous research by [34]. He stated that TOD investment can cause population agglomeration in densely populated TOD zones and cities; Households and communities can benefit from TOD investment; and private TOD investment outperformed the community's regime in terms of the total social welfare of the urban system.

Implementation

Governor Regulation Number 140, 2017 mentions the TOD management in Jakarta, dividing Jakarta into four areas; (1) Fatmawati area, which is called the Dynamic Upper Space; (2) Lebak Bulus area, which is called the Southern Terminus Gate of Jakarta; (3) Dukuh Atas area, which is called the International Transit Axis and (4) Blok M – ASEAN area, which is called Green Creative Hub. Study on Guidance for Urban Planning (GUP) is still being proposed to be ratified as governor regulation [25]. Now, some measures which have existed and will be implemented in Jakarta are; (1) development of MRT; (2) development of LRT Jabodebek & LRT Jakpro; (3) development of underpass and flyover; (4) Jakarta elevated track loop line; and (5) procurement of large, medium, and small bus fleets. Detail information obtained from Soehodho, Deputy Governor of DKI Jakarta Province for Industry, Trade, and Transportation, mentions the Integration of Public Transportation in the TOD concept of Bandar Kemayoran proposing two LRT lanes, lane 1 (East – West) and lane 2 (South – West), four stations in the area of Rajawali Station and PRJ. However, the GUP for this proposal is still being studied, GUP for Kemayoran has not

included the concept of TOD [35]. According to Hutchings, (2013), transit oriented development (TOD) project is fairly complicated and needs long time for implementation but it must incorporate the requirements of other sectors as early as possible.

Zulfikri gives detail information on Detail Program of Urban Train and TOD Potentials, development plan of Cisauk Station, Depok Baru Station, South Sumatera LRT [24]. The land in premium area for Station in South Sumatera to become a TOD has been provided as wide as 250,588 M², whereas for Jakarta TOD, there will be LRT Jabodetabek development with 13 stations and Total Premium Area of 433,968 M². The other potency of TOD is the development of Express Train Jakarta-Bandung. Three areas of development are Karawang, Walini and Gedebage. Access Fee can be offered to PT KCIC, with Access Fee for Karawang as wide as 250 Ha, Access Fee for Walini as wide as 1270 Ha and Access Fee for Tegalluar Bandung as wide as 300 Ha. The business model that can be implemented in the Access Fee management includes the rent and sale of land, business area and residence [24]. For TOD area at Bogor Station, based on information from railways observer Soemino Eko Saputro, Waskita Karya Realty in cooperation with PT KAI will build the area at Bogor Station using TOD concept as wide as 15 Ha. The development will be executed including eight towers as high as 18 floors and residential area as wide as 6.5 Ha comprising 1,500 units. The area will be arranged based on TOD concept [36]. Information obtained from the interview with [24] mentions there are 13 stations in which TOD concept is potentially implemented. In Jakarta, the stations are; (1) Taman Mini Station; (2) Kampung Rambutan Station; (3) Cawang Station, (4) Ciracas Station, and (5) RNI Pancoran Station. Whereas the stations outside Jakarta are; (1) Bekasi Timur Station; (2) Bekasi Barat Station; (3) Cikunir Station; (4) Cikunir 2 Station; (5) Jaticempaka Station; (6) Cibubur Station; (7) Perum PPD Asset; and (8) Cikoko Station.

The funding program for planning and implementation, according to [30] includes; (1) Providing fund for planning and implementing TOD in certain nodes, a. Providing fund for planning the coordination of land use, transit, housing, works and services, b. Providing fund for implementing TOD and incentive, c. Providing fund for pilot project, and d. Providing fund for housing incentive in the TOD area; (2) Legality of the authority to collect tax/fund for developing TOD area; (3) Fund and incentive scheme for private sector development; (4) contribution of government budget to transportation sector for developing TOD; and (5) priority for soft credit incentive to build housing in TOD. TOD implementation according to [36] involves four sectors; (1) public transit, with the supporting elements such as railway, bus, taxi, bicycle and pedestrian lanes; (2) integration with pedestrian network, up to date information and communication technology, and government; (3) environmental, financial and social sustainability; and (4) urban development assembled with city, building, structure and station.

Based on the information from lecture from Bandung Institute of Technology, there are four processes of TOD implementation, by [37] (1) Transferability: Can the concept of TOD policy be transferred to the cities in the developing countries?; (2) Level of readiness: How ready are the city, properties, and private entities as well as communities?; (3) Institutional arrangement and capacity: planning, assessment,

sales & marketing, and monitoring; and (4) TOD tools: To catch the increasing value of land. How feasible is the implementation? What tools are very likely to be adapted and successful? Lubis adds that TOD Regulation & Land Consolidation have been issued recently by the central government (Minister of Spatial and Agrarian Regulation). Local Government should make adjustment based on the local condition. Five key stakeholders that much support the process of TOD implementation are Central Government, Local Government, Civil Society, Transportation Operator and Private Developers. The transportation principles in establishing Transit Oriented Development are: (1) Public transport; (2) connectivity; (3) walking; (4). cycling; and (5) mode switch. In the transportation operator aspect, TOD enables transportation operator to get benefit from alternative income and increasing passengers [33]. In turn, this gives opportunities for better services to be offered to public.

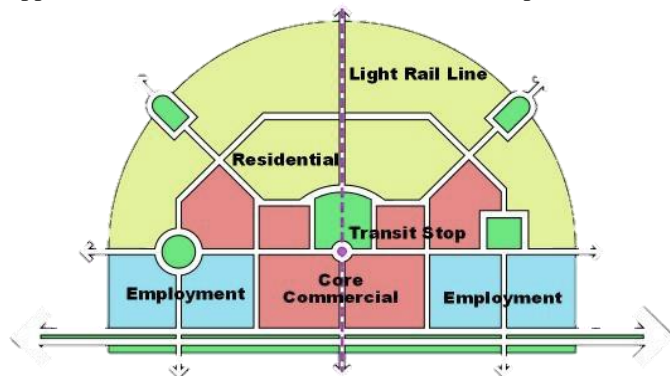


Fig 2. TOD Service Coverage.

Source: [37]

Some strategic plannings for TOD that need to be paid attention according to Lubis are; (1) The framework of strategic policy that connect the activity centers to the basis of rapid transit, electric railway which nearly always exist; (2) The basis of statutory planning that requires development to occur at density and the design needed for each center, preferably facilitated by a special development body; and (3) The mechanism of public-private funding that allows transit and TOD to be built and renewed through the relationship between transit and the activity centers to be served. Lubis exemplifies Senen area as the TOD, which has five activity centers; namely (1) Pasar Senen Station; (2) Commercial skybridge connecting Senen Station and mixed parking building (mixed-use); (3) Mixed parking building (hotel, office and apartment); (4) Commercial skybridge connecting the parking building and Pasar Senen; and (5) New Pasar Senen building (market and residence). This TOD area will integrate railway station, bus station, bus rapid transit, life style center, and residential area simultaneously and sustainably.

Result study in some countries, such as; on the Tokyu Den-en Toshi Line, in Japan, [38] explained that comparing the results of all train stations revealed that almost all indicator values for non-TOD stations were higher than TOD stations. The design input with TOD having the biggest impact on all inefficient units has been identified, indicating that the management of bus services and railway system must be improved. Station redevelopment, along with related investment in the surrounding spaces, is a typical TOD approach in Japan. The results of research in Japan, show that planning and TOD programs are inefficient in terms of passenger generation. The results obtained after adding the

year of operation as an input indicator and removing the transfer station show that the TOD station is performing efficiently and in line with expectations. Research by [39], discusses the strategy of city design and the transformation of this process supports the new role of station. In South Korea, the indicators of TOD implementation are also adjusted with the characteristics and policy of those areas. For the cities with high density, the analysis by [40] shows that TOD plan can have positive and significant impact on the establishment of a transit oriented city.

In China, the effect of TOD land development on all second and third class cities which is expected to have a metro system in 2020, will have more potential for TOD implementation than first class cities in the next city [41]. The results of research by [42] in Beijing, TOD provides insight to develop regional specific strategies and targets to improve the accessibility of certain metro station areas. Another example of TOD, in Chongqing (China) there is a re-provision of a big bus station in the basement of TOD project to improve transportation services, reduce traffic jam, and provide the flow of people through the retail area [33]. Research by [43], shows that in the next five years the second and third class cities in China will be more potential to implement TOD than the first class cities. [42] in their study in Beijing, China, reveal that TOD can improve accessibility by providing relatively high level of transportation connection and land use with high density, mixed use, cycling and pedestrian friendliness around the transit station.

Research on TOD in Hong Kong by [5] suggested to finance railroad infrastructure and advance transit-oriented design in rapidly developing Chinese cities. Whereas in Taipei, Taiwan also considers to maximize the number of subway passengers; maximize the quality of living environment; and optimize the social justice of land development [44]. The results of study in India, propose to focus on cities in India with mass transit systems to understand connectivity to transit stations and consider them in determining the zone of influence for TOD along the transit lines [45].

In USA, TOD strategy has been proposed as an efficient approach to resolve imbalances between land use and transportation systems [46]; [47]. In Washington D.C and Baltimore, USA, [48] explained the proposed TOD to encourage the use of public transportation, would be able to increase the population and mixed land use in the area around the transportation center and also connect connectivity between stations and the origin of travel / travel destinations. TOD research results in New York show that a combination of variables in different dimensions, including (1) land use, (2) station characteristics, (3) socio-economic and demographic characteristics and (4) important inter-capital competition in accounting for variability train transit passengers [49].

In Europe, the TOD concept for the integration of transportation and land use to obstruct uncontrolled transportation [50]. Urban planning and transportation in London, UK have been enhanced by strategic plans throughout the city [51]. For example, in Birmingham (England), Atkins redevelops New Street Station as a TOD that promotes pedestrian movement through downtown and as a catalyst for city regeneration to the South [33]. Another program in Leeds, England, predicts how people will move through the city and buildings based on visibility. It means people tend to move to the place or something they can see

[33]. This improvement project (biggest in Europe) has generated innovative transportation exchanges, place for gathering and destination in the heart of the city. TOD research in Copenhagen, Denmark, [52] states that TOD must support the development of a complete and very useful around the transit hub and must complete an environment that is accessible and can be passed on foot. TOD has been proposed as one of the most effective solutions to maximize the potential return on investment for existing and future rapid transit infrastructure projects in Toronto, Canada [53]. Research by [49] in crowded cities like New York and Hongkong shows that research on TOD in the future may pay more attention to how various aspects of station characteristics can be modified to enhance train protection. The same result is obtained from the research in Beijing [42] and in India [54].

In Jabodetabek area, Depok as a satellite city should have a sustainable transportation design like TOD Masterplan in strategic areas like railway station which is a requirement for a sustainable city. Study by [55] finds that TOD planning must be processed by understanding the existing condition through assessing the level of TOD. Therefore, the assessment of TOD level around the existing node is inevitable because transit node plays central role in TOD, so it is defined by 800 meter distance. In the metropolitan city of Bandung, research has also been done by [19], of which results explain that some locations in Bandung are potential and have opportunity for TOD, but there are obstacles in those locations. The research result shows that some cities with high density in Java Island such as Surabaya, Bandung and Jakarta are dominated by transit station. There have been adjustments in the theory of TOD implementation in Indonesia. The arrangement in TOD area related to Tangerang City Station, as studied by [17], will increase the economic growth, facilitate people in using integrated public transportation. Reducing the use of motor vehicles is aimed at making the area surrounding Tangerang City Station cleaner and more organized so it can reflect the image of good city.

The challenges of ongoing urbanization, extension and change of people's life style need transformation in five aspects, namely: (1) legal; (2) financial structure; (3) governance; (4) land supply and acquisition; and (5) social community development. All TOD matters must be organized in a higher level of regulation like Government Regulation and/or Law of land consolidation. It is feasible to establish National TOD Working Group and try to set higher standards. Atkins, a consultant, uses computer modeling to predict people movement through transportation project as done in Norway and identifies the possibility of traffic jam, population density or inefficient design [33]. How far can someone see the city and, if they move, what can they see then? Atkins' computer program determines the visual connectivity of a place. TOD standard according to Soemino, a railway observer, and Ardiansyah Andaru, a TOD practitioner from Adhi Karya, as government company can be classified into eight principles of TOD. TOD approach as the base for area planning is used by implementing the principles TOD: (1) walking (walkable); (2) cycling (cycle); (3) inter-connecting (connect); (4) there are transit or public transport; (5) there are transitions (shift & transit); (6) residential density; (7) diversity of buildings or mixing (mixed use development); and (8) tightening (compact) [36]; [29]. This opinion supports previous research [50], which they shows that TOD provides many benefits, such as facilitating cities to

reduce urban spread, increasing public transport passengers, increasing bicycle use and walkability, accommodating economic growth, and creating a sustainable environment.

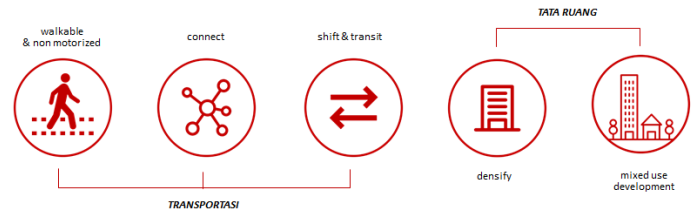


Fig 3. Principles of TOD Standard.

Sources: [29]

In the implementation it can be translated into planning, completed with walking path more than two meter wide to be comfortable (walkable), pedestrian crossing signs, separator between cyclist lane (cycle) and motor vehicle lane in order that cyclists feel secure and comfortable. The existence of lush trees makes the area shady and the lighting provides brightness at night so the place is secure as well as the separation of cycle lane from motor vehicle lane and the availability of sufficient parking area. The number of motor vehicles is reduced by providing comfortable pedestrian path. The front view of surrounding buildings is made attractive and comfortable to create a lively atmosphere. The pedestrian path and cyclist lane are varied and interconnected to business center and station (connect). In principle, all existing buildings are connected with the facilities. In the principle of public transportation, fast, high-frequency, reliable, easy and convenient public transportation is needed in order to reduce dependence on private vehicles. The network is integrated so as to create an integration of intra and intermodal transportation (public transport).

In another TOD detail planning (shift), it reduces the width of motorized vehicle lanes to be used as sidewalks for pedestrians and bicycle lanes, and wide sidewalks are equipped with furniture to make it memorable, comfortable and lively. In terms of buildings, the intensification of housing and commercial areas (density) around the station is carried out to create a high density and increase the number of vertical buildings so as to create a high residential density. In principle, an expansion is made to add value with high density in compact development.

Changes in building regulations were made in order to get a high Building Floor Coefficient and a greater percentage of Building Base Coefficient. The mixing of various buildings for residences, offices, business centers, malls, hospitals, schools and public spaces, parks, green open spaces is carried out both vertically and horizontally. Restructuring of the TOD area (compact) is carried out so that the residential areas around the station have a high percentage of Building Floor Coefficient and the area can be used for public facilities, parks, green open spaces, creating mobility of residents on foot and by utilizing public transportation. Nursalam, Head of Jabodetabek Transportation Management Agency, explains that actually the TOD meant in the Jabodetabek Transportation Master Plan is not like the current condition [56]. It is stated in the Jabodetabek Transportation Master Plan that if in a location there is a railway station, then the surroundings will be projected for developing a residential area with high buildings. Based on this concept, developer may ask access to the station. Meanwhile, the railway station will get benefits from such a condition. Furthermore, Nursalam says there should be regulations concerning the contribution that can bind private companies as the property

developer along the railway track and contribute to the railway development. The TOD development is related to spatial, area and connectivity planning.

The rules regarding the preparation of detailed spatial planning and the city zoning regulation mentioned in the Regulation of the Minister of Agrarian Affairs and Spatial Planning also need to be revised. TOD is a concept development that integrates the design of urban space to unite people, activities, buildings and public spaces through the easy connectivity for pedestrians and cyclists, as well as which is close to good public transportation services [56]. The rule concerning contribution has not existed yet, so what is considered as TOD today is still in the form of property development. Thus, the result of this study is in line with the related theoretical studies and previous researches. Thus, based on the opinions of the key informants and the comparison of the development of railroad-based TOD from several cities in Asia, Europe and United State.

Conclusions

The results of this research show that it is very necessary to develop TOD areas around new or existing transit stations that are served by a regular and efficient transit system. TOD is expected to increase accessibility by providing a relatively high level of transportation connections and high density land use, mixed use, cycling and pedestrian friendly around transit stations. TOD emphasizes residential, commercial, retail and public service planning around new or existing transit stations served by a regular and efficient transit system. TOD improves accessibility by providing a relatively high level of transportation connections and high density land use, mixed use, cycling and pedestrian friendly around transit stations.

The implementation of Urban Train development plan, including in Jabodetabek, comprises: (1) construction of Park and Ride facilities at the railway station; (2) development of residential and business areas that are integrated with public transportation networks; (3) development of feeder transportation to the railway station; (4) arrangement of the area around the railway station and along the track; and (5) construction of a flyover/underpass for handling level crossings in coordination with the Ministry of Public Works and Public Housing. It is necessary to have clear regulations and concept implementation in all projects of residential area development with high buildings. By just mentioning TOD area, the location of development will generate new traffic jams.

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