DEFINING LOCAL CONCEPT OF URBAN RAIL STATION AREA DEVELOPMENT THROUGH BEST PRACTICES APPROACH OF RAIL-TRANSIT ORIENTED DEVELOPMENT

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ABSTRACT

Basically, Rail-transit Oriented Development (ROD) is an integrated high density mixed use rail station transit area development for improving accessibility to public transport, enhancing pedestrian friendly environment as well as increasing urban mobility. Many developed countries have applied the concept of ROD for generating the compact development of rail station area.

Best practices approach is a selective observation towards several cases with various contexts in order to get generalization of related theories or concept on practices. In this approach, the study is oriented to some reasons that make cases being successful. There are two basic components of best practices approach, i.e. source site and target site. This research elaborated some cases in Japan rail station area development as source sites for best practices. The finding from elaboration of source sites was brought as a tool for analyzing the target sites, Jabodetabek rail station area.

The result shows different physical and cultural context between Japan and Indonesia cause the developed countries concept of ROD cannot be fully applied as it is. It needs some adaptation to be applied in Indonesia.

KEYWORDS

best practices, rail station area, Rail-Transit Oriented Development, urban development

1. BACKGROUND

The sustainable urban public transport system seems like a challenge for Asian developing countries that are generally dominated by road transport. Urban rail transit system is also mostly less developed in Asian developing countries [1]. The impacts that occur todays are road traffic overload as well as more time and energy consuming. Nowadays, carbon emission from transport in Indonesia reaches around 70 million tons [2]. That amount represents 3% from national total amount of carbon emission (2,250 million tons). Here, train is the most ecological mode of transportation (only 1% from total transport emission carbon) compare to other modes of

transportation. On the other hand, train is also the most efficient mode of transportation after ship since the energy consumption is only 0.002 liters/km/person. Although train is the most efficient and ecological mode of transportation, in the context of Indonesia urban mobility, people prefer use road transport (bus, private car and motorcycle) rather than rail transport (7.32%).

The main problem of rail station area in Indonesia is segregated development between rail transport system and rail station area. So far, government policy has only a little concern on integration between rail track service development and rail station area development as an important part of urban development.

2. BEST PRACTICES APPROACH

Best practices approach is a selective observation towards several cases with various contexts in order to get generalization of related theories or concept on practices. In this approach, orientation of the study is directed to some reasons why cases are succeeded. Best practices are also described as '*what works'*, that means something can work (successfully done) in certain context or environment. The same practice on different context or environment can give different result. There are two basic components of best practices approach, i.e. source site and target site [3]. Source site is a case that used for reference to make transformation of a target site. As a source site, cases in best practice approach should have capacity to be compared to target sites. In this term, theoretical basis are principally needed [4].

Best practices approach in the process of analysis could emphasize one or more aspects, i.e. function-oriented, process-oriented or innovation and transformability-oriented. There are stages of best practices approach, i.e.

1) Observation of target sites that is directed for finding the specific character of target sites;
2) Selection of source sites that referable for target sites;
3) Analysis of source sites that is directed for finding the techniques to achieve good result (explanation);
4) Conversion of finding from source sites into target sites (extrapolation).

3. RAIL-TRANSIT ORIENTED DEVELOPMENT

3.1. Definition

Urban form character of formal and informal settlement in developing countries has significant differences [5]. Urban form character of formal settlement is well-developed in line with urban planning while urban form character of informal settlement is irregularly developed. A part of urban area that is dominated by informal settlements in developing countries is along rail tracks or dilapidated land around underutilized rail station.

An ideal sustainable urban form is characterized by compactness and high density, mixed land use and connected street network that supported by well-connected public transportation (sustainable transportation) [6]. The future urban development should be oriented toward sustainable urban form [7] [8]. Principally, the concept of Transit-Oriented Development represents the concept of compact city that comprises the idea of sustainable urban form [9].

Rail-transit Oriented Development (ROD) is basically defined as TOD (Transit Oriented Development) concept with rail station as main transit node [10]. The idea of this concept is integration of urban form and urban transport in encouraging and easing urban mobility.

Principally, the delineation of ROD/TOD area is walking distance, 2,000 ft. (± 600 m) or 10-15 minutes, from rail station [11]. In this concept, commercial and public facilities should be placed in the short distance from transit node for enhancing community accessibility. Furthermore, location of ROD area should be or next to trunk line (main transit route) or feeder line (secondary route).

The spirit of ROD is creating node and place [12]. As a node, ROD area has a role as node of activity that enhance strong connectivity between living place and working, shopping, or other daily activity place through integrated urban form and transit system. Meanwhile as a place, ROD area should has a role as place making for comfortable, safely, securely, pleasingly living, working, shopping and other daily activities.

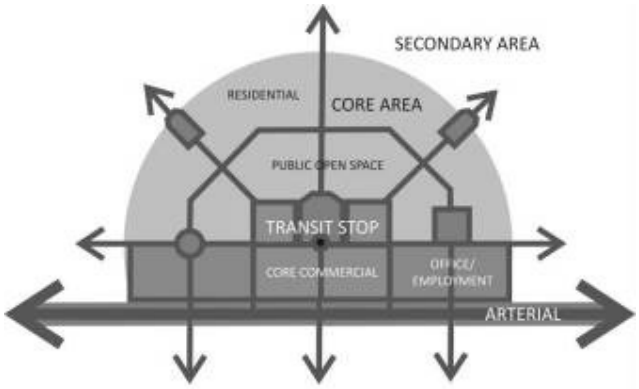


Figure 1. The Original Concept of Transit Oriented Development

3.2. Principles

The principles of ROD concept are basically contributed to compact and walkable urban form that is connected to high quality transit system. It enhances daily mobility inside neighborhood on foot as well as daily mobility outside neighborhood by public transportation modes. Generally, the concept of ROD has several principles toward pedestrian friendly community [13], i.e.

1) Density (high density concentration of buildings and dwelling units in the center of ROD area for the easiness on walking distance as well as generating potential user of public transport);
2) Diversity (suitable proportion and dispersal or concentration of mixed land use in the short distance that encourage walking for daily mobility inside ROD area);
3) Design for walkability (the presence of built environment form and space that promote comfort, safety and security for walking activity);
4) Distance to transit (walking distance from dwelling units or nodes of daily activity into transit nodes that promote transit ridership);
5) Destination accessibility (the need of good quality pedestrian connectivity for people walking and good intermodal system in facilitating people moving to destination).

Nevertheless, some previous researches showed different finding on different context. Several factors and circumstances, such as government regulations, development opportunities, market factors, as well as available public transportation service, have affected the proper TOD approaches [14]. The adaptation of TOD concept transformation into established communities is commonly take place in an incremental process. Hence, the proper balance between delivering sufficient development and preserving the local values could be realized. Each location has significant context while the basic principles of TOD are still kept [15].

Research with the case of low density area found transformation of TOD concept is focused more on intermodal quality as well as park and ride facilities. This research found commercial land use around rail station was not being main requirement [16]. On the other hand, research on high density area found the model of TOD was not concerned on density improvement. However it should be focused on public transit service, land use, street network and urban design [17]. Regarding the typology of linear urban form, there is not essential to concentrate the density in the core area because population and compactness are distributed equally in the city. The development should be focused more on enhancing quality of environment since the dense of main corridor that is susceptible to air and noise pollution [18].

4. TARGET SITES: JABODETABEK RAIL STATION AREA DEVELOPMENT

The commuter rail service in Jakarta urban area (Jabodetabek) was started in 2008. It was operated by PT KCJ (Kereta Api Commuter Jabodetabek), a subsidiary of PT KAI (Kereta Api Indonesia), Indonesian national railway company. The infrastructures are owned by PT KAI with some of the stations and lines are used concurrently with regular intercity trains. The service covered the area of the capital city of Jakarta and the surrounding urban area (Bogor, Depok, Tangerang, Bekasi).

The ridership of commuter line today (6 routes, 78 rail stations) is around 850,000 passengers per day with the highest ridership on the routes of Jakarta – Bogor/Depok and Jakarta – Bekasi. However it still less than 3.5% of all Jabodetabek commuters. Nowadays, the effort from local government and PT KAI to develop rail station area shows significant progress. It still needs proper concept to optimize rail station area development. There are 4 (four) target sites for this research, i.e. Bogor rail station area (terminus station, urban core), Sudirman rail station area (through station, urban center), Duren Kalibata rail station area (through station, general urban) and Depok Baru rail station area (interchange station, suburban).

Looking at various physical character of train station area in target sites and the distance of rail station area from the urban core activities, there are some considerations for selecting the source sites:

1) Rail station area with physical character of urban core, urban center, general urban and suburban located in urban and urban rural fringe area;
2) Rail station with commuter line services.

Some cases on Japan rail station area development area suitable as source site because this country was placed as the world best rail infrastructure in the year of 2015, as well as the world best four of the usage of rail as public transport mode (244.24 billion passengers per km). Rail track infrastructure in Japan is around 27,268 km that accommodate intercity rapid train as well as urban commuter train [19]. Moreover, Japan rail station areas have the complete physical character that represents urban core, urban center, general urban and suburban located in urban and urban rural fringe area.

5. SOURCE SITES: JAPAN RAIL STATION AREA DEVELOPMENT

5.1. General Concept

In the early 1900s, an integrated development between rail track service and rail station area in Japan was stimulated by rail transport private operators that not only developed the rail track but also developed the area surrounding rail station as lifestyle supporters [20]. In this term, rail

transport private operators were enabled to get chance from government to generate public transport system that encourages people mobility by train as main public transport in Japan. Besides, they also got chance to develop public amenities in rail station area to facilitate passenger's needs.

Gradually, rail transport private operators also developed housing districts along the rail track and created new attractors for leisure activities in many rail station areas in order to activate the rail track on weekend or holidays (place making). They also opened some new tracks that connected to potential destinations such as shrines and temples (place connecting) [21].

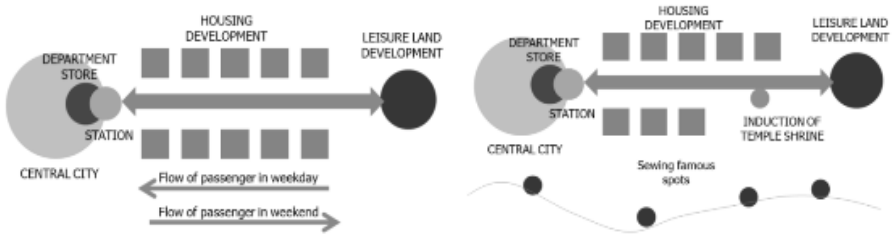


Figure 2. The Concept of Japan Land Development for Supporting Rail Transport

On the other hand, the concept of Rail-transit Oriented Development in Japan is well-known as RIC (Rail Integrated Community) [22]. Basically, RIC seems like ROD concept, concerns on high density mixed use rail station area development towards pedestrian friendly district. The significant difference is RIC does not focus only on physical form of rail station area but also the importance of government policy for supporting rail service operator contributes to rail station area development. In this concept, the high percentage of commuters who walked to rail station is encouraged to make the smaller number of parking area around rail station. Overall, there are 3 (three) stages of Japan rail station area development process, i.e.

1) First stage: land acquisition for rail station area development investment;
2) Second stage: infrastructure development;
3) Third stage: property (real estate) development that consist of dwelling units, commercial and leisure activities.

5.2. Elaboration of Source Sites

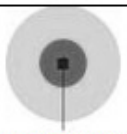
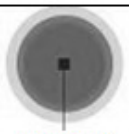
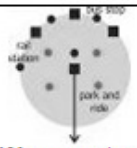
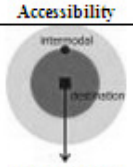
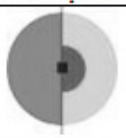
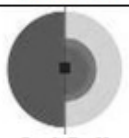
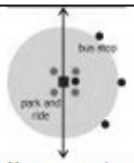
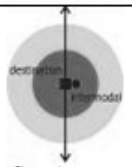
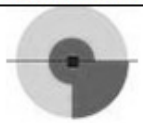
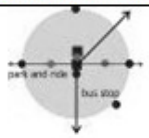
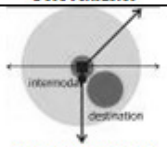
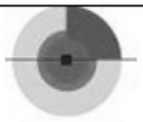
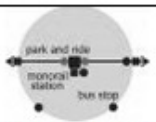
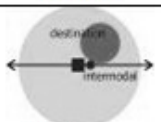
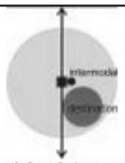
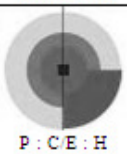
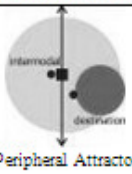
There are 6 (six) target sites to be elaborated, i.e. Namba rail station area (terminus station, urban core), Kuzuha and Takarazuka rail station area (interchange station, urban center), Kadomashi and Hirakata-koen rail station area (through station, general urban) and Fushimi-inari rail station area (through station, suburban). The analysis are based on 4 (four) principles of the concept of ROD urban form, i.e. density, diversity, distance to transit, and destination accessibility. Meanwhile design for walkability in this research is excluded based on the assumption that design for walkability essentially was formed through integrated implementation of the four other principles.

Regarding the principles of density and diversity, elaboration of source sites indicated some findings, i.e.

1) The stronger urban character of the area, the higher building density and land intensity (urban core BCR 80% FAR 6; urban center with weekdays attractor BCR 70% FAR 2; urban center with weekend attractor BCR 50% FAR 1; general urban with weekdays attractor BCR 60% FAR 2; general urban with weekend attractor BCR 40% FAR 1; suburban BCR 40% FAR 1);
2) There is the same land intensity in the core and peripheral zone of rail station area without significant attractor (1:1) and also rail station area with development limitation of historical zone;

3) The stronger urban character of the area, the bigger the land intensity difference between core and peripheral zone (urban center 4:1; general urban 3:1; suburban 2:1);
4) The stronger urban character of the area, the smaller housing percentage (urban core 30%, urban center 40%, general urban and suburban 60%).

Table 1. Elaboration of Source Sites

Rail Station Area	Character of Density	Character of Diversity	Character of Distance to Transit	Character of Destination Accessibility
NAMBA Urban Core	 BCR 80% FAR 6 Core > Peripheral 3:2	 P : C/E : H 10 : 60 : 30	 ≈ 130 m to transit node	 Core Attractor
KUZUHA Urban Centre	 BCR 70% FAR 2 Core > Peripheral 4:1	 P : C/E : H 10 : 50 : 40	 ≈ 160 m to transit node	 Core Attractor
TAKARAZUKA Urban Centre	 BCR 50% FAR 1 Core > Peripheral 4:1	 P : C/E : H 10 : 40 : 50	 ≈ 140 m to transit node	 Core and Peripheral Attractor
KADOMASHI General Urban	 BCR 60% FAR 2 Core > Peripheral 2:1	 P : C/E : H 10 : 30 : 60	 ≈ 180 m to transit node	 Core Attractor
HIRAKATA – KOEN General Urban	 BCR 40% FAR 1 Core > Peripheral 3:1	 P : C/E : H 10 : 30 : 60	 ≈ 170 m to transit node	 Peripheral Attractor
FUSHIMI – INARI Suburban	 BCR 40% FAR 1 Core > Peripheral 2:1	 P : C/E : H 10 : 30 : 60	 ≈ 160 m to transit node	 Peripheral Attractor

Regarding the principles of distance to transit and destination accessibility, elaboration of source sites indicated some findings below:

1) The average distance from housing or daily place activity to transit nodes in the whole rail station area is less than 200 m;
2) There are various modes of transport with various routes in urban core and urban centre rail station area;

3) The main attractor is generally located on core zone of rail station area. The main attractor that is located on peripheral zone is generally facilitated with good quality of pedestrian access. The main attractor that is located more than walking distance from rail station is facilitated by intermodal connector.

Transit can enhance greater ridership and cost-effectiveness by serving high density area with other complementary components, such as mixed uses and pedestrian connectivity. The transformation of ROD concept on source sites of rail station area development brought high ridership with balance number of daily passengers get in and get off at rail station (50:50).
In rail station area with high density, residents prefer to use transit because origins and destinations are located within walking distance to transit nodes. On the other hand, the size and density of attractors (employment centers) on connected rail-station area could be important aspect that increases transit ridership from rail station area with high percentage on housing. Urban core and urban center rail station area in source sites commonly accommodate high density of employment centers, that is shown at the high land intensity difference between core and peripheral zone, while general urban and suburban commonly dominated by high density of housing. Therefore, jobs-housing balance is an important character of rail station area correlate with transit usage. This condition generates large ridership on daily round-trip route. In terms of diversity of land uses within rail station area, specifically diversity on local scale of daily service, it can increase daily local mobility on foot.

On the other hand, the good system of transit on source sites on both of service and accessibility, enhancing people to use transit rather than private car. Good system of service means the quality of vehicle, frequency of service, schedule accuracy, as well as number of covered destination. Besides the good quality of transit, the transit nodes on source sites are easily reached in walking distance (less than 200 m). The availability of intermodal system connected to rail station gives an added value of transit service.

6. ANALYSIS

6.1. Elaboration of Target Sites

On the same point of view, the target sites were also elaborated based on 4 (four) principles of the concept of ROD. In this part, the analysis also looked at the possible adaptation of finding from source sites into target sites with the consideration of local context.

Regarding the principles of density and diversity, elaboration of target sites indicated some findings, i.e.

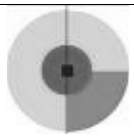
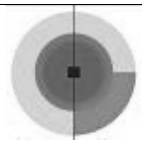
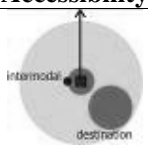
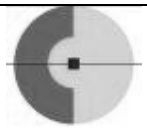
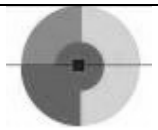
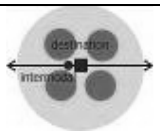
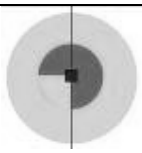
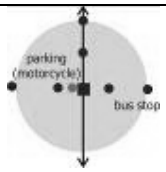
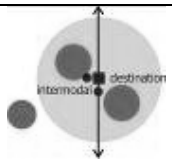
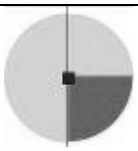
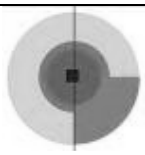
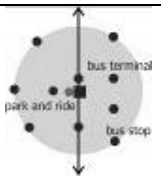
1) There is no significant pattern of density and diversity in relation to physical form of the rail station area although there are similar building coverage ratios (60%);
2) Land intensity is commonly higher on urban centre with high proportion of commercial/mixed/employment use; however the pattern of zone and land intensity is not clearly identified.

Furthermore, regarding the principles of distance to transit and destination accessibility, elaboration of target sites showed:

1) Fair access to public transit with various kind of IPT (Intermediate Public Transport) since they can be reached in the whole rail-station area without fixed transit stop, such as ojek (motorcycle taxi), becak (Non-Motorized Transport tricycle), bajaj (three-wheeled motorized taxi) as well as minibus. Bus Rapid Transit system can only be found at urban core and urban center area;

2) The main attractor is generally located on peripheral zone of rail station area. Nevertheless, the main attractor that is located on peripheral zone is not commonly facilitated with good quality of pedestrian access. However IPT non-motorized could be an alternative to reach the destination from rail station. Basically, IPT non-motorized has significant role in intermodal system.

Table 2. Elaboration of Target Sites

Rail Station Area	Character of Density	Character of Diversity	Character of Distance to Transit	Character of Destination Accessibility
BOGOR Urban Core	 BCR 60% FAR 1.2 Core > Peripheral 2:1	 P : C/E : H 10 : 40 : 50	 ± 140 m to transit node	 Peripheral Attractor
SUDIRMAN Urban Centre	 BCR 60% FAR 7 Core < Peripheral 1:2	 P : C/E : H 10 : 60 : 30	 ± 160 m to transit node	 Core and Peripheral Attractor
DUREN KALIBATA General Urban	 BCR 60% FAR 3.5 Core > Peripheral 3:2	 P : C/E : H 10 : 30 : 60	 ± 190 m to transit node	 Core and Peripheral Attractor
DEPOK BARU General Urban	 BCR 60% FAR 6 Core = Peripheral 1:1	 P : C/E : H 10 : 30 : 60	 ± 160 m to transit node	 Peripheral Attractor

There are different physical context between source and target sites. The tropical climate and the lower quality of infrastructure surrounding rail station, make the concept of ROD cannot automatically implemented. In addition, the emergence of informal sectors and activities on the cases of target sites, such as informal commercial activities, encroachment of traditional market activities into street space, informal parking, as well as the dominance of intermediate public transport and private vehicle (car and motorcycle) for daily mobility, principally are important living cultures that have to be considered in implementation of ROD concept.

6.2. Discussion

Learning from source sites, high density of housing in the rail station area is needed to generate large number of transit passengers. Meanwhile, the concentration of employment center on connected rail station area, specifically on core zone, is needed to attract high number of train commuters. Hence, jobs-housing balances among the connected rail station areas correlate with transit usage. In terms of diversity within rail station area, the proportion and distribution of local scale commercial and public facilities can encourage mobility on foot.

Concerning the need of high intensity of employment center or high density of housing in rail station area as required in ROD concept, almost all of the cases on target sites are possibly established. The exception is only the limitation of development due to historical area policy such as the limitation of building height in Bogor rail station area.

On target sites, the potential area of generator and potential area of attractor for transit ridership of commuter rail transport is clearly identified. Sudirman rail station has significantly showed as transit usage attractor that can be seen on proportion of 30:70 between commuter line passengers get in and get off. Bogor and Depok Baru rail station has significantly showed as transit usage generator. Bogor and Depok Baru rail station indicated the same proportion of 70:30 (70% daily passengers get in commuter line and 30% daily passengers get off from commuter line). Different from the case of Depok Baru rail station area, the physical form and proportion on mixed land use on Bogor rail station area does not indicate the potential area as generator of transit usage. It is physically identified has urban core character, that commonly has large scale of attractor as learned from source sites. The reason may direct to Bogor rail station scale of service since it covers not only the rail station area in the radius of walking distance but also covers the whole city of Bogor. Hence, Bogor rail station generates large number of transit usage. The other issue is insufficient employment center or suitable jobs in the city of Bogor that encourages local people commute for working in Jakarta urban center. Moreover, the main attractor next to Bogor rail station (Bogor botanical garden) is not a daily destination so it is not significantly identified as an attractor for daily transit usage.

Regarding the diversity within rail station area, the availability of local scale commercial and public facilities is distributed evenly in the whole area of rail station except in the case urban center rail station area i.e. Sudirman rail station area. Sudirman rail station area is dominated by large scale employment center. There is almost no local scale of commercial and public facilities. On the other hand the existence of informal traditional market that tend grow in the core zone of rail station area in suburban and general urban is worthy to be kept as a local scale commercial service as well as small scale employment for trader from outside rail station area. However, it needs re-arrangement in order to prevent disturbance on another daily regular activities.

Learning from source sites, the short distance to transit node would encourage people to walk and use transit. In the case of target sites, the distance to public transport (IPT) as short as on source sites, however there are two reasons for people prefer to ride their own car or motorcycle, i.e. pedestrian sidewalk is not walkable as well as the unsatisfactory service of IPT. Those reasons sometimes are also exacerbated by the high rate of motorcycle ownerships. For the future, the good service and system of public transport and IPT as well as good quality of sidewalk has to be considered to support the concept of ROD.

CONCLUSION

The concept of Rail-transit Oriented Development should be adapted wisely with the thoughtfulness on physical and cultural context of Indonesia rail station area. The focus of development is proper balance between delivering sufficient development and preserving the local values based on the basic principles of ROD.

1) The principles of high density and diversity should concern more on physical and demographic context. The balancing of jobs and housing that generate or attract transit usage will determine the density of housing and land intensity of employment centres for each type of urban form.

2) The approach for development of densely rail station area should be carefully executed towards land consolidation or infill development in order to renew or revitalize the district.

Meanwhile for the rail station area with potential vacant and open lands can be arranged for newly construction of high housing density or high-intensity land development.

3) The principles of distance to transit and destination accessibility should also consider the cultural context. Beside the improvement of public transport service and transit system, the existence of non-motorized IPT can contribute as alternative feeders for people who have disability in walking specifically on suburban area.

4) The government policy on improvement of public transport service and limitation on private motorized vehicles (car and motorcycle) ownership is urgently needed to support and establish the local concept of ROD.

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