The Fifth International Conference on Railway Technology
RAILWAYS 2022
22–25 August 2022
Montpellier, France

Proceedings of the Fifth International Conference on
Railway Technology:
Research, Development and Maintenance
Edited by J. Pombo
Civil-Comp Conferences, Volume 1, Paper 23.10
Civil-Comp Press, Edinburgh, United Kingdom, 2022, doi: 10.4203/ccc.1.23.10

The Principle of Urban Rail Public Transport Development Project Represented by Accessibility Index, Modes of Transport, Scale Intensity, and Policies Trends

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Abstract

In the developing countries, urban areas commonly suffer from several cases of urban sprawling leading to the decline of accessible liveability so the ideal concepts of public transport (bus, TRAM, BRT, LRT, monorail and MRT) had been introduced to provide the accessibility with the reduced time of trip consumption while the public transport network itself needs to be well connected. Particularly, a concept of the urban rail public transport (TRAM) infrastructure principally focused on effective reachability and tandemly with mass transit concepts as the trip proposal indicator was perceived in order to visualize the urban public transport accessibility index (TPAI) that usefully supports a non – driven virtualization. The contribution of this work was to purposively define the changes in the accessibility of future rail transit network investment plan. Besides, the evaluation was attentively performed on both unimodal and multimodal transports to investigate the urban mobility performance for the whole public transit networks, also a comparative feeder-bus function was considered. The accessibility of the responsive buffer station was mentioned as part of the creative urban methods such as transit oriented development (TOD). Explicitly, research was computed altogether via the objective-based walkability optimization model and a densely district inhabitant technique (DID) in order to interpret the effective grid locations. Notably, this data analysis disclosed the mechanics of public transportation. As a results, the developed models elaborately described the relationships within the city transport networks, accessibility index, the modes of

transport (included walk, bus and TRAM), the scale intensity, and the policies trends as the key factors to achieve the ideal concept for those urban rail public transport plans as a primary transport mode. Above all, the models effectively provided the supporting data for the urban plan guideline and the measurement criteria for an urban rail public transportation project.

Keywords: Accessibility index, Urban rail public transit, Unimodal transportation, Multimodal transportation, Urban phenomenon, Transit Oriented Development

1 Introduction

Urban life quality is directly committed to public infrastructure as the public transport service should be accessible throughout the area [1]. Also, the public transport network itself needs to be well connected [2]. Therefore, the contribution of this paper purposively illustrated the change of land use and future transit network investment as seen in Figure 1 The cities where enhanced the public transport capability as a mass transit network are proved the urban rail network (TRAM) option effectively [3-4]. The accessibility transportation modes models converging walkability, bus network, TRAM network that supports a non – driven virtualization investigated to decline the private mobility consume [5]. The economical scale aspects, there are previous studies presented to scope between the city scale sizeable and line capacity capability [6] that to be performed of urban rail project plan as seem in Figure 2 The compact city conceptual ideas appearances since 1950, especially in Japan has had compose gather with urban development plan [7] as seen in Figure 3. The research problems statement presenting are 1) The changes of accessibility observed as the population's accessible in different transit networks and 2) A comparative cases within public transport network (walk, bus and TRAM (project plan)) while commuted based on the unimodal and multimodal transportation models [8] through trip's capability that represented by three different building uses (mixed use, commercial use, and public facility use) 3) The study outcome simplified the assessment model for those urban's mobility perception which was notably essential of the urban rail infrastructure understanding. The relationship between the urban mobility and public infrastructure intensive plan would be shaped productively supporting policy.

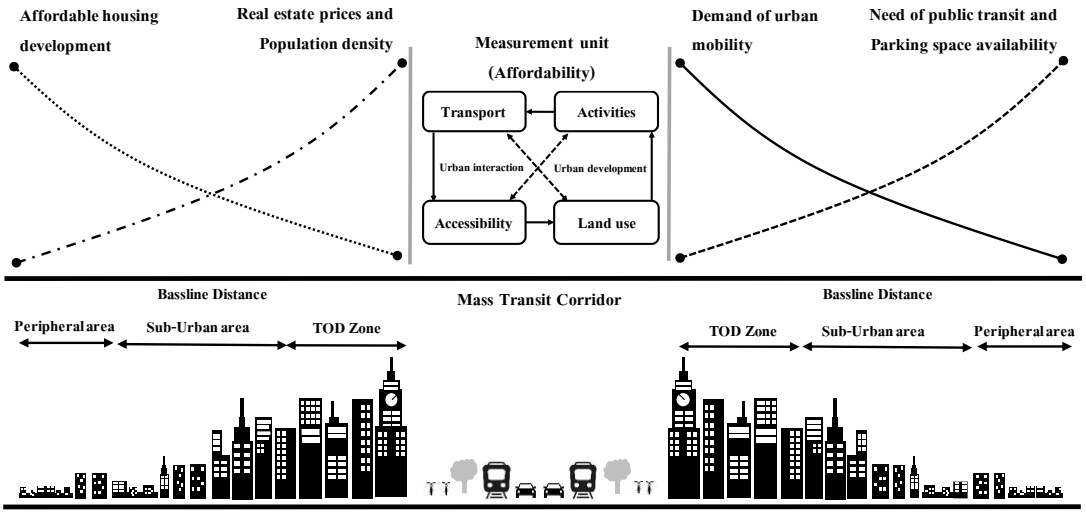

Figure 1: Urban development, urban interaction and urban financing transit-oriented development [9-12]

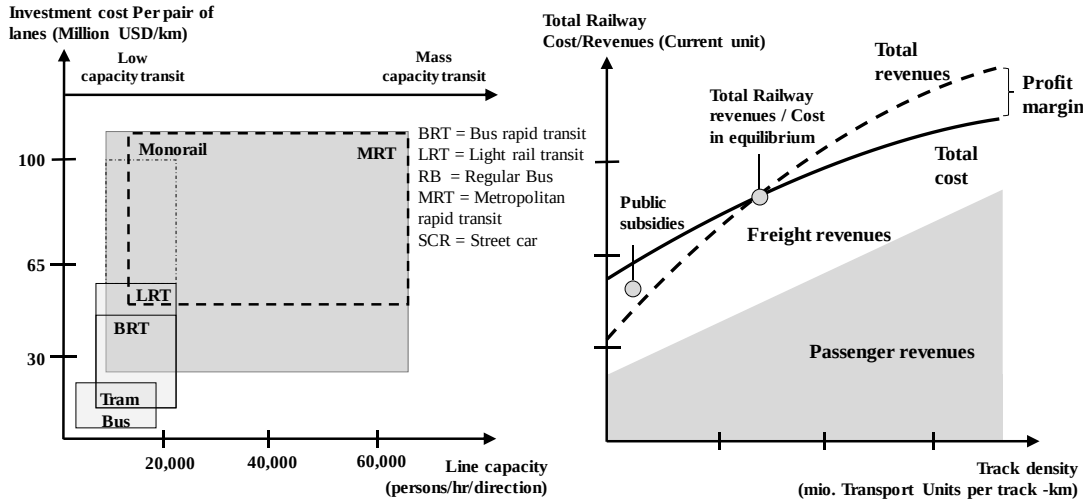

Figure 2: Simplified representation of costs/revenues of a railway system and bus rapid transit (BRT): An efficient and competitive, mode of transport [13-19]

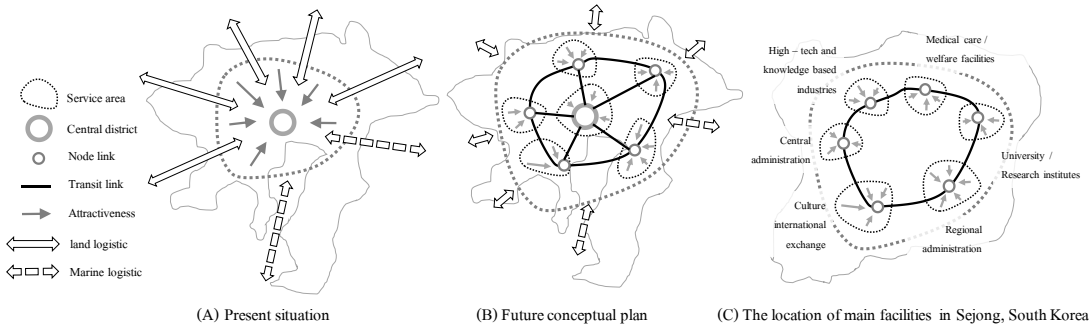

Figure 3: Restructure plan for the capital region (A) Current (B) The polycentric model: the urban village version [20] and the location of main facility in Sejong, South Korea [21]

2 Methods

The accessibility categorizations apparently distinguished the four basic perspectives [22] and at the planning stage, it has been widely used as a tool to solve both transport and land-use problems and to evaluate several alternative transportation systems (often focusing on people's basic accessibility in physical, economical, or social aspects [23]. Previously, various types of measurements [24] commonly presenting the accessibility concepts has been a path of transportation between mobility and associability and the effective measurement defined the general concept of graph theory and spatial separation as a weighted average computation of travelling time for all the zones of consideration where d_{ij} was the distance between i and j, and b was the general parameter as seem in Equation (1). Practically, the public transport mobility represented to adopted the accessibility concept in different levels of transportation modes as the consumer demand [25] perceived by job employment revealed the interpretation of human activities, notion definition, and equality [26]. The research also indicated trip activities by building the areas for different uses.

Unimodal transportation was indicating performance capability separately. Multimodal transportation is referred to the combination of different transportation [27] including both static and dynamic simulations to carriage the passengers from a place where the network was connected to the designated areas. The research composes 3 scale consideration from city scale, building scale and space objective scale, respectively. As seem in Figure 4.

$$Ai = \sum_{n=0}^{\infty} \frac{d_{ij}}{b_n} = \frac{(\text{Zone x Weight average})}{\text{sample size (n)}} \quad (1)$$

The research scope design and accessibility approach schematic flow diagram presents as seem in Figure 5. The whole project considerate that evolve the accessibility index [29-31] investigate by GIS approach. The 6 obviously techniques development are adopted actively for the notion of public transport accessibility index (PTAI). The demand and supply consumer mobility was consolidated based urban geography that clearly perception.

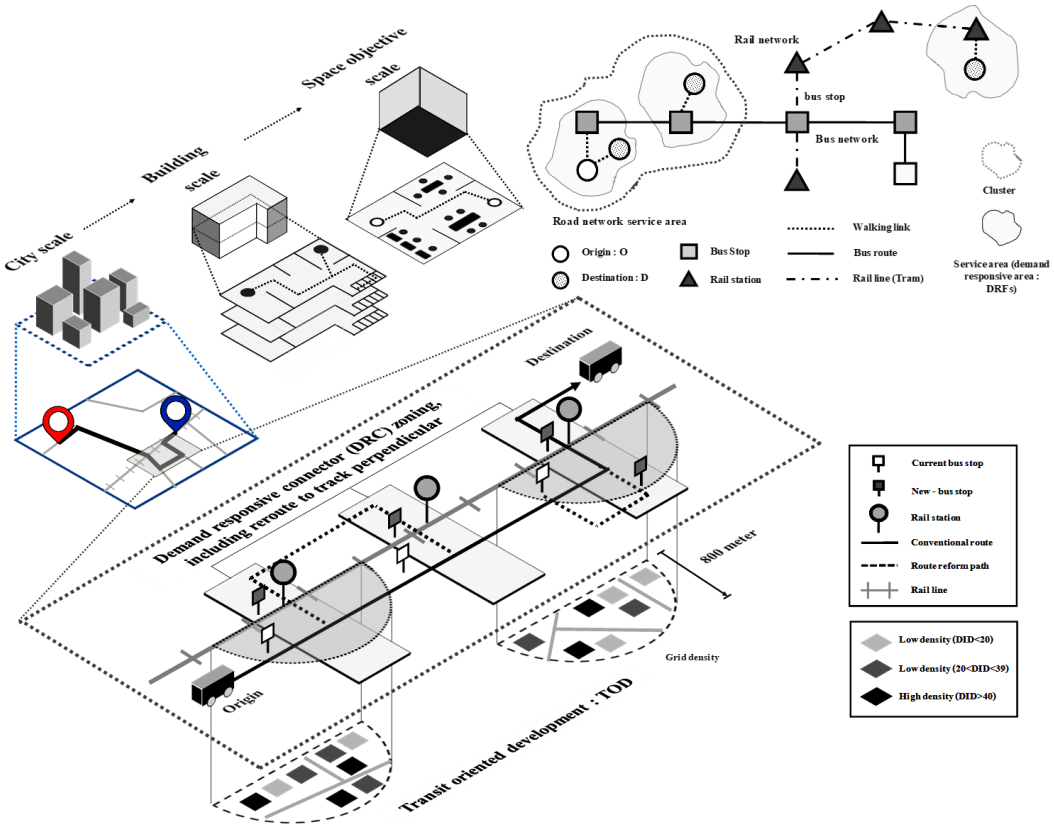

Figure 4: Urban scale configuration. Multimodal transportation, bus route reform concept followed by demand responsive connector (DRC) and transit oriented development: TOD [28] schematic chart.

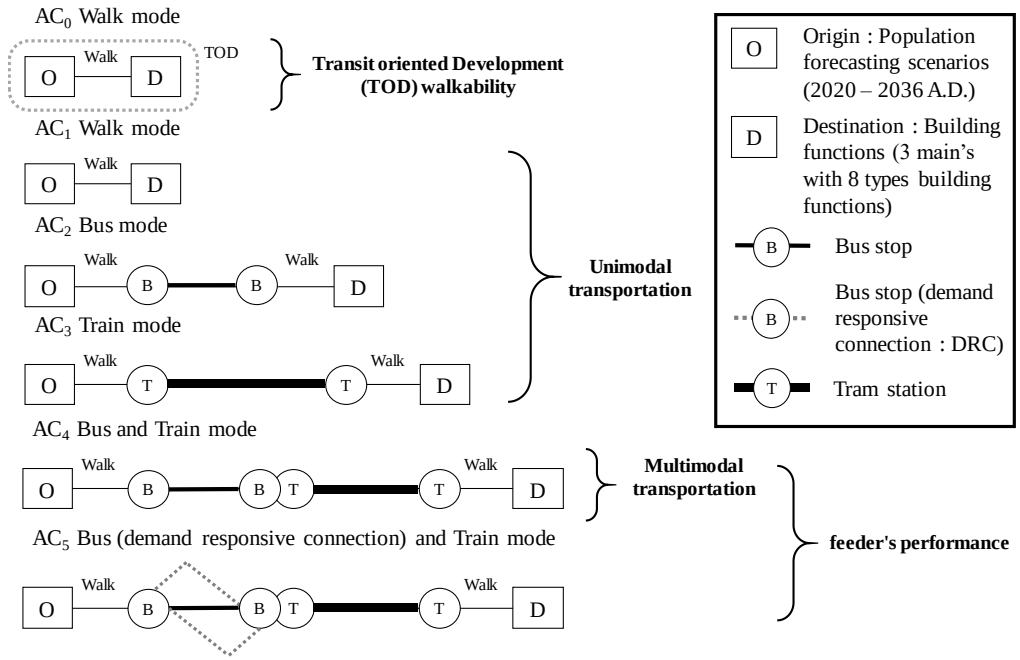

Figure 5: Research scope design and accessibility approach schematic flow diagram.

In Thailand, there were 6 city of TRAM investment plan [32-33], KhonKaen represent the scenario covered 2021 – 2036 A.D. Nowadays, the bus routes have 19 route within 314 bus stop in 12 sub prefecture. The 5 routes TRAM project are plan completed in 2036 A.D. (93 stations within 73.13 km). As seem in Figure 6.

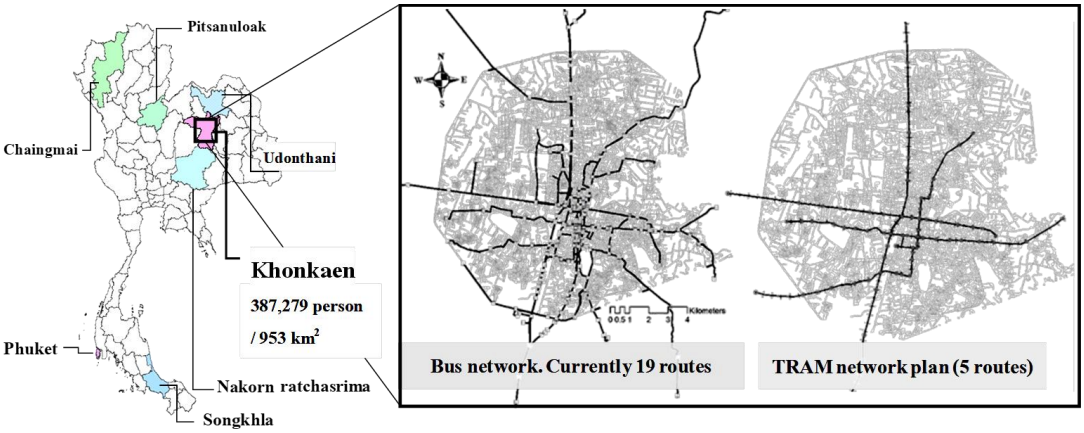

Figure 6: The public transport network, KhonKaen, Thailand case

3 Results

According to the abovementioned, the data analysis presented assessment model of urban transferability based on the population's accessibility index in which 8 building unit's types (commercial, industry, infrastructure, education, religious, public service, infirmary, and recreational units) within 3 building functions (mixed use, commercial and public facility). The trips for urban mobility comparatively discussed within 3 transportation's modes including walk, bus and urban rail (TRAM) modes (train network modelling practically analysed the data in 3 different timeframes including 2021, 2026, and 2036 A.D) based on population ages in 2 groups 1. 10-64 years and over 65 years (person unit) with their accessibility by unimodal transportation as illustrated in Figure 7. According to the bus network computation, The tendency of urban density explicit the public transport relative that growth with bus public transportation line. In 2036 A.D. analysis case, the multimodal transportation model offers an overview of urban interaction and urban development as seem in Figure 8. The development plan of rail transportation as a principal system in conjunction with feeders by the bus network. The multimodal transportation model which were considering between conventional bus route network and route reform by demand responsive connection (DRC) concept [34-35] are comparative performance that revealed the characteristics of public buses feeder linked to TRAM network [36-37]. The demand consumer explicates the importance of responsive stations area (800-meter buffer range). The research adopted the GRG nonlinear optimization techniques [38] by using the grid control density (DID) principal [39] to compose the constraint and effective of walkability and number of population are the objective function in the 3 cases (suburban neighbourhood: SU, urban core: UC, and transit core: TC) of TRAM station's TOD plan [40-44]. The resulted visualizes the possibility of shading improvement location that shown specific effectively location as seem in Figure 9.

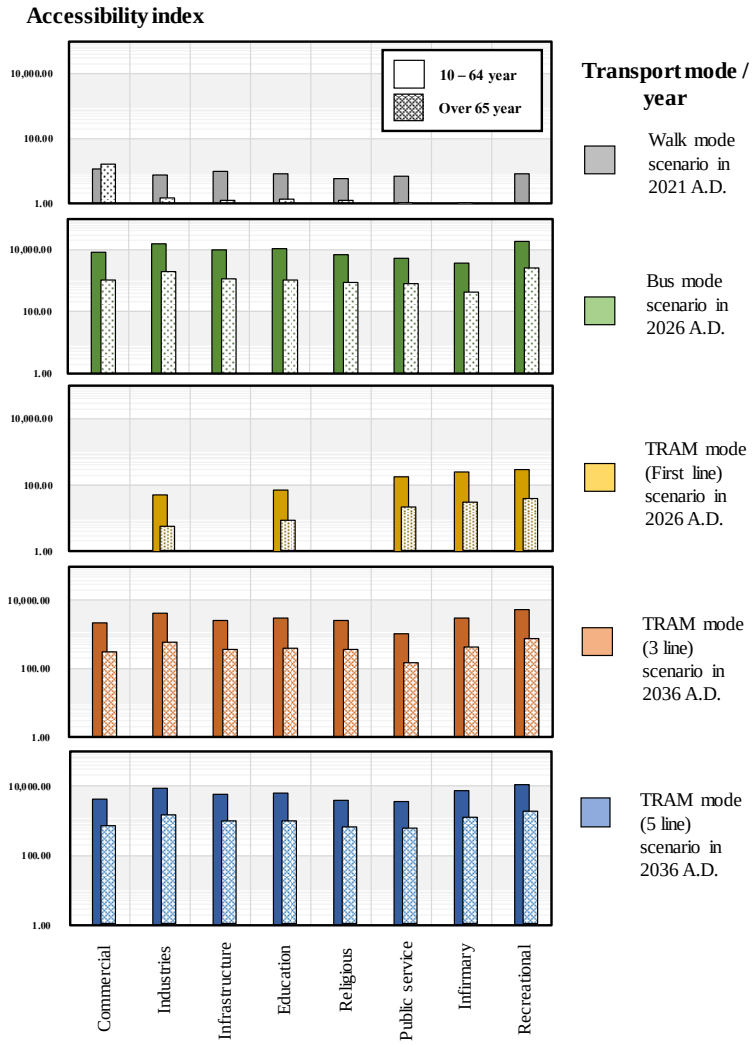

Figure 7: Unimodal transportation with accessibility index (90 minutes' use) comparison of different public transport modes and types of building; the sample groups with 2 different age ranges of 10 to 64 (left) and over 65 (right).

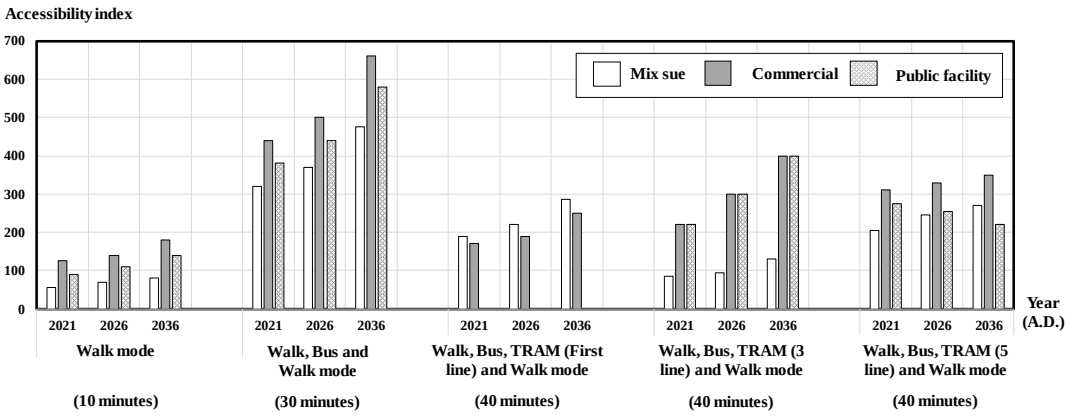

Figure 8: The 5 multimodal transportation mode in different trips propose with accessibility index.

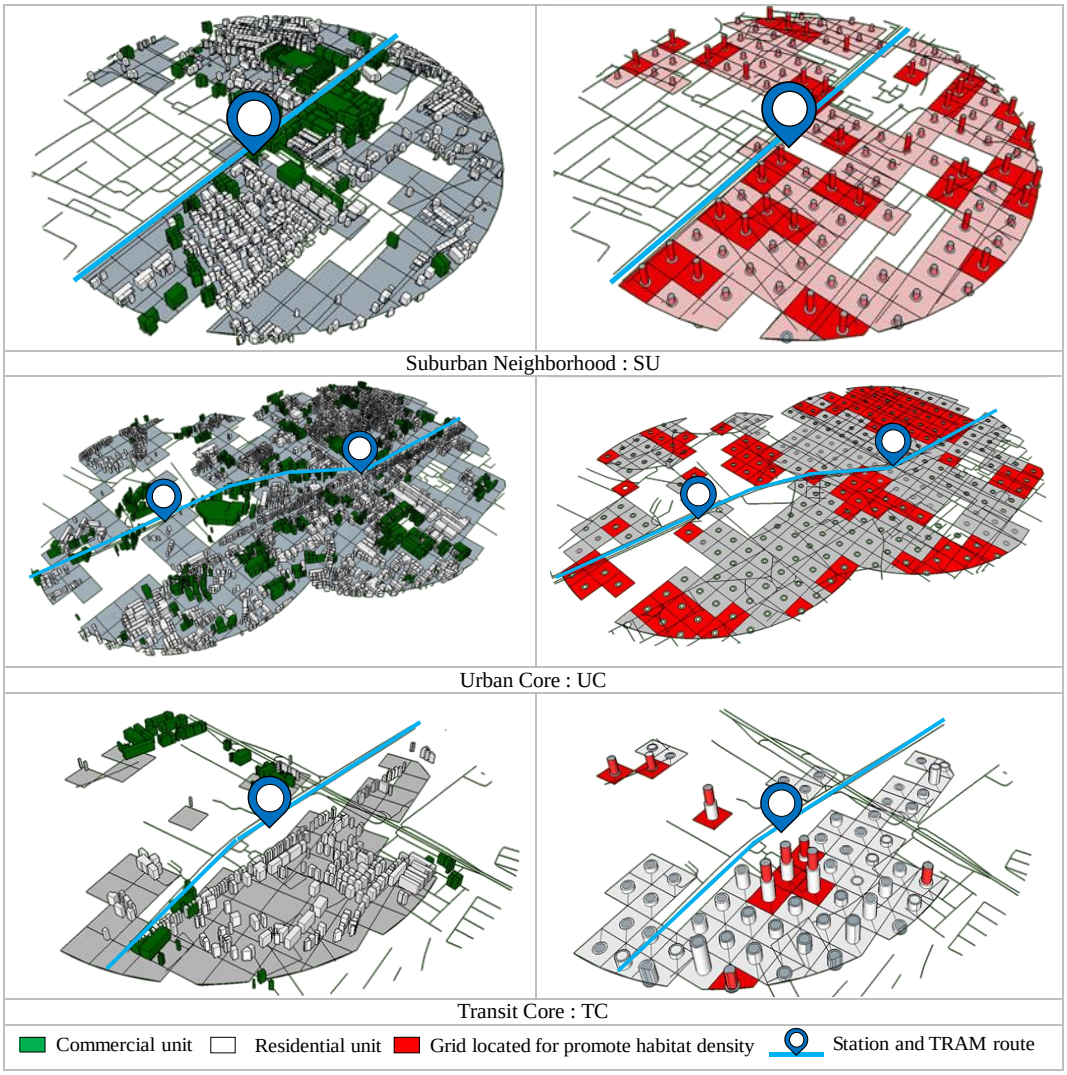

Figure 9: The 3 transit oriented development (TOD) cases, effective grid locations based walkability optimization model.

4 Conclusions and Contributions

The research investigated present the model for universal usefully cases. The research is strongly present the relative parameters development comprising between urban intensity levelling scale, accessibility index and mode of transport as seen in Figure 10. The multimodal transportation presents a well-studied model of traveling. The TRAM project position's to be the primary mode of transit with the bus system functioning as a feeder, and the zoning compaction concept was applied as a transit oriented development: TOD and locality (district zone), respectively.

Urban rail infrastructure was essential for spatial interaction understanding the relationship between urban perception and public infrastructure that leading to be guide and shape policies during the land use and infrastructural policy such as; the management of a city planning overview, high–density zone policy, and transit-oriented development (TOD) etc. The research model clearly represented the urban

perception mobility model based on the urban rail transportation investment plan (TRAM project) which were obviously efficient approach for city-level cooperate in both the public and private sectors.

The analysis case discloses the mechanics of public transportation, particularly bus network transformation in relation to in line of urban economic, where the main street runs parallel. The study found that a bus route reform policy that preserves the route proposal on the train station attractiveness is achievable. Although, the transit oriented development: TOD concept was an options to intended the urban densely but the effective urban mobility doesn't have been performed without the beginning of the urban form and plan. The findings suggest that existing legislation in those locations may be changed, both structurally and in terms of the rules that govern the organizations. The expressly define of urbanism's effective linkages and rerouting opportunities as the regional centre, urban centre, transit town centre, urban neighbourhood, transit neighbourhood, special use, employment district, and mixed use centroid were all involved in the urban creative methods. The model developed are elaborating on the relationship of the city, as seem from the local scale (TOD) to city scale (urban shape) that effectively arranging base on public transport mobility. Finally, the result was an ideal concept that complemented the city plan's urban guidance and measurement for the urban rail public transportation project.

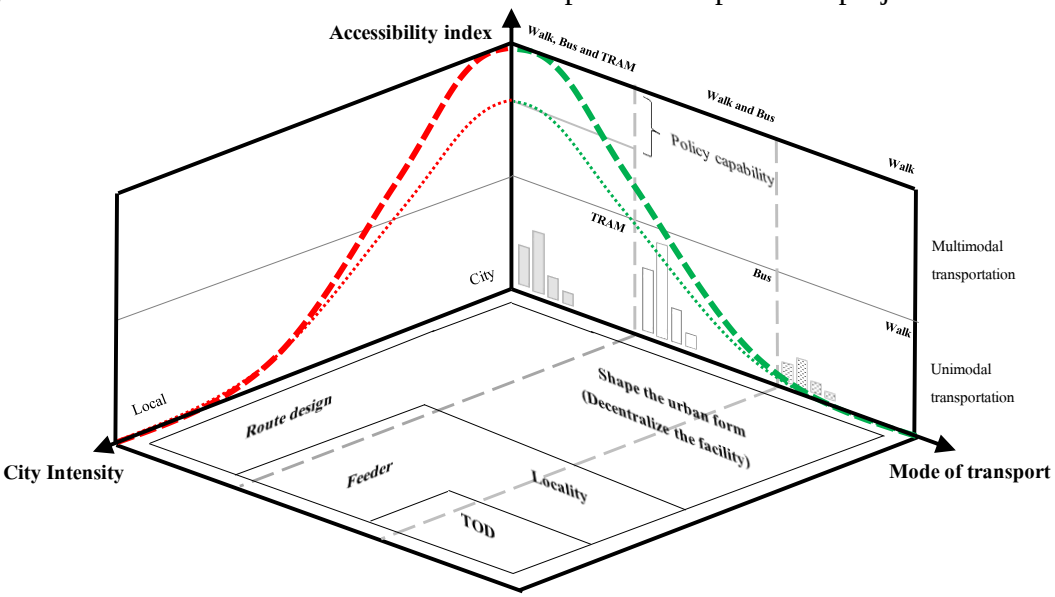

Figure 10: The principal of accessibility index, mode of transportation (urban mobility) and city intensity

Acknowledgements

I would like to express my sincere thanks to my thesis advisor Associate Professor Dr. Takuro Inohae for invaluable help and constant encouragement. This work was supported by Government Science and Technology Scholarship Program from the Ministry of Higher Education, Science, Research and Innovation, Thailand. This research was a partial fulfilments of Ph.D. degree, Department of Civil Engineering and Architecture, Saga University, Japan. All authors have provided consent.

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