Prosiding Forum Studi Transportasi antar Perguruan Tinggi
Vol. 10, No. 1, Tahun 2023, p. 473-483

MOVEMENT AND PLACES' ASSESSMENT IN TANJUNG BUNGA, MAKASSAR

Ilham Ari Fauzi A. Uskara
Departemen Teknik Sipil
Universitas Indonesia
Kampus Baru UI Depok
Ilhamuskara@gmail.com

R. Ivan Adwitiya
Departemen Teknik Sipil
Universitas Indonesia
Kampus Baru UI Depok
ivanadwitiya1@gmail.com

Andyka Kusuma[1]
Departemen Teknik Sipil
Universitas Indonesia
Kampus Baru UI Depok
Andyka.k@ui.ac.id

Tri Tjahjono
Departemen Teknik Sipil
Universitas Indonesia
Kampus Baru UI Depok
tri.tjahjono22@gmail.com

Abstract

Authorities are responsible for developing public transport that matches the resident's or user's background within a certain area. There is one strategic area in Makassar, namely, Tanjung Bunga, which has planned to build an integrated living space, where all the amenities and residences are connected by public transport. This research aims to assess the road function using the movement and places approach. This research uses a quantitative method and uses a questionnaire to collect primary data. The questionnaire asks about a household interview survey (HIS) which consists of daily trips within the last 7-days of activities. There are a total of 138.649 trips generated, moving into 8 zones inside Tanjung Bunga area. seeing the place's significance and movement's significance of each zone, there are 2 recommendations proposed, first is to maintain the existing BRT route but the track is differentiated from the carriageway and the second one is to add paratransit service in the secondary route.

Keywords: Household Interview Survey, Cross Classification, Trip Generation, Bus Routing, Movement and places

Abstrak

Pemerintah bertanggung jawab dalam penyediaan fasilitas transportasi umum yang sesuai dengan kebutuhan pengguna layanan pada suatu kawasan tertentu. Terdapat satu bagian wilayah aglomerasi di Makassar yang dinamakan Tanjung Bunga, telah merencanakan untuk membangun kawasan terintegrasi yang dimana seluruh bangunan fasilitas umum akan tersambung dengan transportasi umum. Penelitian ini melakukan analisa penempatan sistem layanan transportasi berdasarkan pendekatan *movement and place.* Penelitian ini menggunakan metode kuantitatif dan kuesioner sebagai alat pengambil data primer. Pada survey ini responden akan ditanyakan mengenai perjalanan dalam 7 hari kebelakang. Ditemukan bahwa terdapat 138.649 perjalanan yang mayoritas terbagi menjadi 8 zona di dalam kawasan tanjung bunga. Berdasarkan penilaian movement and place, ada 2 rekomendasi yang diajukan, pertama bahwa jalur BRT eksisting diharapkan menggunakan lajur khusus yang terpisah dari lalu lintas lain, dan yang kedua bahwa pada jalur sekunder diharapkan dapat ditambah kendaraan paratransit.

Kata Kunci: Survey Rumah Tangga, Cross Classification, Bangkitan perjalanan, Rute Bus, Movement and places

[1] Corresponding Author : andyka.k@ui.ac.id

INTRODUCTION

Background

The government has the authority and owns all types of sources to develop a well public transport to support community activities. it is important to develop policies and streetscape designs that provide pedestrians with safe comfortable walking conditions to major destinations such as public transport, shops, healthy food, parks, and recreation facilities (Thomson et al., 2017). Even though the demand for public transport comes as a derived demand, a lack of transport opportunities is a barrier to accessibility and social inclusion in contemporary society, especially among people living in rural and sparsely populated areas (McDonagh 2006; Farrington 2005). Similarly as stated on the 2030 Sustainable Development Agenda said that any government should aim to achieve transport-related targets, specifically in SDG 11, saying that any city should already provide access to safe, affordable, accessible, and sustainable transport systems for all various backgrounds of citizens, especially those who in vulnerable situations.

The increasing number of populations is in line with the need for public transport facilities. Cities around the world are facing the challenges of population growth and rapid change: to continue to provide the basic services and maintain the infrastructure that allowed us to thrive; to ensure that the city we have inherited and the city we are building will provide future generations with the variety and abundance of opportunities we have today (Planning, 2008). Looking at the increase of population in Indonesia which already reached 3,26 million people on average per year (BPS, Sensus penduduk 2020), the demand will follow the trend and authorities should plan to fulfill those needs by either developing new infrastructure or planning another advanced transport system. In addition, The Transportation Minister Regulation of Republic Indonesia no. 15 the Year 2019 about public transportation enforcement, stated that to develop route network planning, authorities must consider several things, for instance, the demand for transport and land usage.

The Movement and Places Framework establish a holistic approach to implementing a transport system. The principles are to understand how the system is performing from the perspective of different users and ensure that people have input into the designing and decision-making process (Victorian Government, 2019). Thus, by implementing this framework, the 2030 Sustainable Development Agenda can be achieved, highlighting the needs of all authorities, users, and developers.

Public services

There is a metropolitan area in Makassar City and a part of Mamminasata or Makassar - Maros – Sungguminasa – Takalar (Agglomeration area of South Sulawesi) namely Tanjung Bunga Area, aiming to engage an integrated residential and commercial center, developed by PT. Gowa Makassar Tourism Development (PT. GMTD) with total development area is 1000 hectares, plus 600 hectares of reclamation area. It is located in Template District and Marios District with a total population is around 15.000 persons, and it still increases year by year following the continuous development happening there. Starting to construct in 1991, they have built a lot of resident clusters with the amenities such as recreational areas,

hotels, and commercial facilities. Those accommodations and facilities have driven a large number of resident trips that moved around that area and also become an attraction area.

Unfortunately, As regards the amount of possible traffics within Tanjung Bunga Area itself, several transportation problems have occurred. Lack of public transportation undoubtedly creates congestion especially at peak-hour and during holidays. The current public transportation service is very irrelevant to meet the level of service (LoS) of the population dominated by medium to high-class people. There is only one main road in Tanjung Bunga served by one public transport namely BRT Mamminasata, whereas the secondary road or local road has not been served by any mode of public transport, even though there are public places such as the university, school, and public administration.

LITERATURE REVIEW

Demand Modelling (4 steps Model)

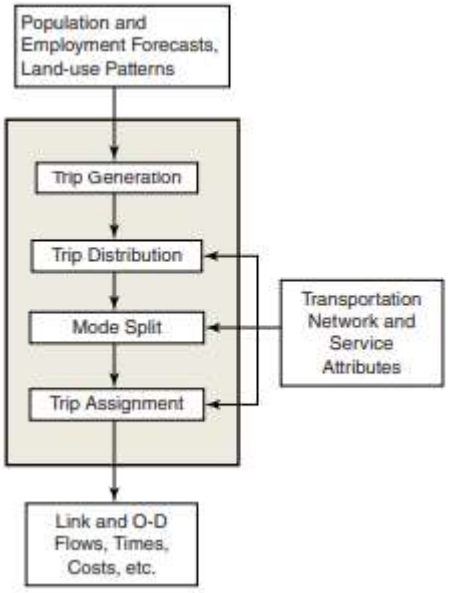

Figure 1. Traditional Travel Demand Modelling

(Mayer, 2016)

Traditional travel demand modeling, named 4 steps model consists of four sequential steps: trip generation, trip distribution, mode choice, and trip assignment. These models answer the question: How many people travel? What are the travel patterns for the study area? What travel modes are used? What trip paths will be followed through the transportation network? (Mayer, 2016). So by following these steps, major questions have been solved.

Figure 1 shows the general framework for a four-step modeling system. Although the four steps have remained the major structural form for modeling since the 1950s or have become the traditional method, the methods have matured through the years. technical staff. It begins with population, employment, and land-use forecasts, which are often provided by agencies, staff within a planning agency, or local authorities.

The concept of 4 steps model will be adjusted to the movement and places approach which the main idea will remain used.

Movement and Places

Movement and Place establish a whole deep understanding throughout the life cycle of a plan or project. It can guide the process of consultation, analysis, decision-making, and evaluation. The concept is flexible, in a way that every authority related to the project has

shared accountability to foster a well-design built environment including effective transport networks. Thus this paper is open for collaboration and co-design by outlining a common language across authorities, developers, and staff.

The Framework organizes transport links by their 'place' and 'movement' roles into the road and street types. A set of priority uses, performance measures, and potential interventions are then developed for each road and street type (Victorian Government, 2019). This framework will result in a deep understanding of each link, as the result of multiple layers of parties. On Vicroads' assessment, it considers the Movement and Place (MxP) based on the significance of the location or in other words the existing condition, while on the World Bank report, the assessment is seeing directly the type of the places, with almost no consideration of the number of trips created by the place. Both assessments are using 3 x 3 matrix of movement and place.

Table 1. Movement score by World Bank Report

Movement Functions	Score		
	3	2	1
Strategic Role	Station in the CBD Areas and/or principal governments buildings	Station in the regional centers and/or regional governments	District hospital, market, and residence
Service Diversity	Support with last mile journey facilities	Limited facilities	Associated with first mile journey
Usage	High	Medium	Low

Table 2. Place score by World Bank Report

Place Classification	Definitions
P1	Highly important areas
P2	Important areas with high density land use
P3	Semi urban areas, less density land-use

METHODOLOGY

Study location

Tanjung Bunga is a part of the Agglomeration area in South Sulawesi namely Makassar - Maros – Sungguminasa – Takalar or Mamminasata and currently become a residence for around 12.000 people. This paper specifies the study area to only the North Zone and South Zone of Tanjung Bunga.

Survey

Based on PERMENHUB RI No. 15 2019, Said that on determining the public transport, the proposer should consider the forecasting number of trip generation and trip attraction created by the users within a zone. Also, it is supported by (White M, 2021), which knows that it is

possible to create an urban design based on citizens' perceptions. Thus, the primary data of this research was developed by resident survey only.

The population is divided using stratified sampling where researchers divide the population of the study area into smaller subgroups or strata, based on shared characteristics. Then randomly select among those groups with the same scale to form the final sample. The shared characteristics can be based on gender, age, sex, education level, or income. Here the author uses the cluster location as the variable/strata that split the population into small groups. There are 5 groups is created, which are High cluster 1, High cluster 2, Medium cluster 1, Medium cluster 2, and Low cluster. Those strata are made from their respective land price or in other words their average household income. Also, there are 2 groups high cluster and a medium cluster, due to simplifying the zoning system later on. The number of samples is divided proportionally with the percentage of their respective population of each stratum. The survey is run door-to-door and online. Both surveys contain similar questions, asking about their trips for the past 7-days.

O-D Matrix

Origin-Destination (O-D) Matrix presents people's movement in a certain zone. The demand for transportation can be presented by the origin-destination matrix (Peterson A, 2007). The Origin-Destination Matrix (O-D Matrix) is created from the trip modeling of the population. First, each cluster and facility are addressed to a zone with a certain coverage area. Then the trips from the survey are plotted to these zones to create the O-D Matrix. Note that the survey trips only represent the respondents, so the following discussion will describe how to convert that trip to a population trip modeling.

ANALYSIS

Trips

The author collect the number of the trip produced by the sample residents. The data is processed using cross classification method, where not only the sample is divided into 5 groups, but also considering their household size and number of Autocar owns. Cross classification model developed by Messrs. H.J Wootton and G.W. Pick, considers the household as the fundamental analysis unit. It estimates the trip generation rate for households, which are put in separate categories and represents the household characteristic. There are 3 main independent parameters, which are income class, car ownership, and household size (Saxena & Subhash, 1989). As mentioned before that the income class comes from the cluster location.

Then the author changed the number of trips from the sample to several trips for the population. It used cross classification method to obtain those trips. The trips are plotted to create a trip generation, showing where the trips started and where they trip going. All the trips are reduced from the 5 cluster area, and it moved within Tanjung Bunga going out. There are a total of 138,649 trips produced in 7 days, or 19.352 trips in a day.

Zoning Model

The trips produced by residents has collected, but before the movement and place assessment, the area of sub-urban must be divided based on the coverage area of the existing public transport station (Integrated Transport Planning Ltd, 2021). Rancangan Induk Transportasi Jabodetabek (RITJ) also stated that should be no more than 500m in distance measured from each house in the zone to the nearest station. The authors create a model where the station's point meets the criteria from RITJ. Also, a model of paratransit is created, which will serve another area that the current BRT cannot access. Each amenity is addressed to a specific zone and the center of it is the station. The effective number of zones is 8 zones, 6 of them served by BRT (Station 1 – Station 6) and the other 2 served by paratransit (station A and Station B). This separation of Tanjung Bunga will create a focused understanding of modeling the trips. The facility and area for each zones' coverage are shown below:

Table 3. Amenities within each zone

Mode of Public Transportation		Residence and Amenities
Primary Route	Secondary route	
Station 1		Center Point of Indonesia, Pantai Losari, Siloam Hospital, Phinisi Mall, The Rinra Mall
Station 2		High Cluster 1, Hotel Gammara
Station 3		High Cluster 1, TSM, Holywings, Office
Station 4		High Cluster 2, Medium Cluster 1, GTC Mall, Pantai Akkarena, Food Court, Town Management
	Station A	Low Cluster, Sekolah Dian Harapan
	Station B	Low Cluster, Poltekpar, Kantor Kelurahan
Station 5		Medium Cluster 1, Medium Cluster 2
Station 6		Medium Cluster 2

Origin and Destination Matrix

The OD matrix is a fundamental consideration in assessing the M x P Matrix. It shows the significance of the zone, whether it has a high trip production or less. To create the O-D Matrix, at station A and station B for instance, it consists of residents' area of the low cluster, thus the total trips from the cluster are plotted to these 2 stations. Similar to the others, every trip from cross-classification ion is plotted to those 8 stations. The matrix is modified to accommodate the trip to the outside of the zone, which passes through the north exit, east exit, and south exit.

Table 4. Origin and Destination Matrix

Destination \ Origin		St. 1	St. 2	St. 3	St. 4	St. A	St. B	St. 5	St. 6
Station 1	Shop / Other	40	16	91	176	404	392	64	176
Station 2	Home	20	-	54	21	0	0	-	-
Station 3	Home	20	-	54	21	0	0	-	-
	Shop	48	38	38	219	251	231	82	345
	Work	-	0	0	0	124	124	0	0
Station 4	Home	177	-	211	91	42	0	-	-
	Shop	0	5	5	6	0	0	0	0
	Work	0	8	8	0	73	73	0	0

Destination	Origin	St. 1	St. 2	St. 3	St. 4	St. A	St. B	St. 5	St. 6
	Other	16	11	66	59	222	222	23	79
Station A	Home	434	-	434	278	12	85	-	-
	School / Work	-	0	0	54	15	15	29	112
Station B	Home	434	-	434	278	12	85	-	-
	School / Work	-	0	0	0	102	102	0	0
Station 5	Home	84	-	95	43	21	0	-	-
Station 6	Home	244	-	453	184	94	0	-	-
North Exit	School / Work	-	129	129	614	1469	1469	286	1525
East Exit	School / Work	-	13	13	88	292	292	51	154
South Exit	Other	-	1	1	18	15	15	6	4

The route will be:

Figure 2. BRT Route

Figure 3. Paratransit Route

Movement and place assessment

Vicroads guidance uses the aspirational state as the first consideration to assess the lane. For place assessment, it used the significance of the amenities or the number of trips generated, while in movement assessment it used the functional lane, travel speed, and pedestrian & cyclist accessibility. There is a change in movement leveling, from M1 to M5, then adjusted to M1 to M3, Similar to the place leveling. The adjustment is applied to simplify the judgment and also to match the assessment with the World Bank report reference which only uses a 1-3 scale.

The aspirational state is made by observing the master plan of Tanjung Bunga Bunga and its ongoing development. Station 1 can become a city hub, while station 4 can become activity streets. Station 2, station 3, station 5, and station 6 is a connector, whilst Stations A and B are local streets.

Table 5. Place Classification from Victoria Road

Route		Aspirational State	n of trips	Place Class	Place Corr
Primary	Secondary				
Station 1		City Hub	1348	P2	P1
Station 2		Connector	221	P3	
Station 3		Connector	1912	P2	P1
Station 4		Activity Streets	2121	P2	
	Station A	Local Streets	2393	P2	
	Station B	Local Streets	2334	P2	
Station 5		Connector	822	P3	
Station 6		Connector	2398	P2	

The place classification of each station has shown the significance of its facilities within the stations. Station 1 which has a recreational area, hospital, and public space, eventually generates 1348 trips, while station 3 with similar functional land use generates 1912 trips. The Category for both of these stations is P2. if the data input also includes the number of visitors from an outsider, as a result, the place classification might increase to become P1.

Table 6. Movement Classification from Victoria Roads

Route		Aspirational State	Lane Function	Travel Speed	M Class	M Corr
Primary	Secondary					
Station 1		City Hubs	Carriageway BRT Pedestrian	Moderate	M2	M1
Station 2		Connectors	Carriageway BRT	Moderate	M2	M1
Station 3		Connectors	Carriageway BRT	Moderate	M2	M1
Station 4		Activity Streets	Carriageway BRT	Moderate	M2	
	Station A	Local Streets	Private car	Low	M3	
	Station B	Local Streets	Private car	Low	M3	
Station 5		Connectors	Carriageway BRT	Moderate	M2	M1
Station 6		Connectors	Carriageway BRT	Moderate	M2	M1

For the existing lane, the primary route provides a lane for general carriageway, bus, and pedestrians station 1 only. Station 1 to station 3 is the main road that has an attractive amenity; thus, the movement classification should get increase.

Table 7. Place Classification from World Bank

Route		Type of Places	Place Class
Primary	Secondary		
Station 1		Central Bussiness District Public Space	P1
Station 2		MICE / Hotel Residence	P2
Station 3		Central Bussiness District	P1

Route		Type of Places	Place Class
Primary	Secondary		
		Office	
		Residence	
		Shopping Area	
		Residence	
Station 4		Public Administration	P1
		Hotel	
		Public Space	
	Station A	Residence	P2
		School	
		Residence	
	Station B	University	P2
		Public Administration	
Station 5		Residence	P3
Station 6		Residence	P3

Table 8. Movement Classification from World Bank

Route		Score			Score Acc	M Class
Primary	Secondary	Role	Diversity	Usage		
Station 1		3	3	2	8	M1
Station 2		1	2	1	4	M3
Station 3		3	2	2	7	M1
Station 4		2	2	2	6	M2
	Station A	2	1	1	4	M3
	Station B	2	1	1	4	M3
Station 5		1	2	2	5	M2
Station 6		1	2	2	5	M2

Stations 1 to station 4 is the P1 category, except for station 2 which only has P2. These 4 stations have a higher score since there is a central business district (CBD) within the area, and a mix of land use, such as residents area, CBD, hotel, and public facilities. Whereas station A and Station B are in the P2 category since there are a school and universities that exist. Station 5 and station 6 includes in the P3 category as they have residents area only. There are no corrections on the place score because the type of places cannot be changed nor removing one of the facilities.

Assessing the movements' classification of each station is easier in the world bank, the score and parameter can be used directly. The main focus of this classification is the existing lane productivity, the service quality of public transport, and the location. Station 1 to station 3 has already met their best model referring to the world bank approach, even though the lane in station 2 should be in the M1 category to increase and maintain the headway of its adjacent station. Station 4, station 5, and station 6 do not have to be changed. But in station A and station B, since there is no public transport serving the areas, so the recommendation will be to add paratransit, which is also appropriate with the current lane width in the secondary route.

CONCLUSIONS

a. The station plotting follows the recommendation of Rancangan Induk Transportasi Jabodetabek (RITJ). The changes in station placement reduce the number of stops, where it was 14 stations in Tanjung Bunga, then it changed to 8 stations.
b. The movement's and place's score by Victoria Roads Guidance is applied Based on the OD-Matrix and existing lane function. In place assessment, there are 8 areas assessed, 5 out of 8 are in the P2 category, and the remaining areas are in the P3 category. While in the movement's assessment, the primary route is in the M2 category and the second route is in the M3 category.
c. There are corrections in movement and places by Vicroads guidance. First, in place classification at stations 1, 3, and 4 the score should be higher because the scoring should not count the resident trips only, but also the outsider whose trips should be included in the OD-matrix. On the other hand, the movements score at stations 1, 2, 3, 5, and 6 can be increased to meet the aspirational state, this can be done by prioritizing the bus route and widening the footpath. In addition to stations A and B, the road should be changed to be private access only for residents, to protect the neighborhood.
d. Cross-reference has been done in the analysis process, using world bank reports, to assess the movement and places score. The result shows a similar value to the score correction in Vicroads' score, making it more accurate.
e. Based on both approaches -Victoria roads and World Bank report- the recommendation for public transport is: keep the bus route as the existing (primary road), but change the station location and specialized the lane; and add a paratransit station in the secondary route, which is at station A and station B.

The authors believe that this research is not perfect, there are a lot of limitations that affect the accuracy of the results. For instance, The Household Interview Survey (HIS) covered only the data of Tanjung Bunga residents which were accepted for internal-internal and internal-external trips. Additional roadside interview surveys to cover external-internal trips can be done to complete the O-D table and increase the accuracy of Movement and Place. Also with the developer's insight might result in a deeper understanding of household trips.

ACKNOWLEDGEMENT

The authors would like to thank "UP2M Teknik Sipil dan Lingkungan Universitas Indonesia" who has provided financial support for this research, also thanks to Dinas Kependudukan dan Catatan Sipil Kota Makassar or Civil Registry Service Office of Makassar and PT. Town Management Division for the support in conducting the research.

REFERENCES

Al-Taei, A. K., dan Taher, A. 2006. Prediction Analysis of Trip Production using Cross-Classification Technique. Al-Rafidain Engineering, Volume 14.

Gray, Y. M. 2013. *Transit Oriented Development in the Chicago Region: Efficient and Resilient Communities for the 21st Century.* Chicago: The Center of Neighborhood Technology.

Integrated Transport Planning Ltd. 2021. *Resilient Urban Mobility Diagnostics and Investment Options for Bandung and Medan.* Birmingham: ITP.

Kutz, M. 2004. *Handbook of Transportation Engineering.* New York, Chicago, San Francisco, Lisbon, London, Madrid, Mexico City, Milan, New Delhi, San Juan, Seoul, Singapore, Sydney, Toronto.: The McGraw-Hill Companies.

Mayer, M. 2016. *Transportation Planning Handbook Fourth Edition.* New Jersey: John Wiley & Sons, Inc.

Naser, I. H. dan Shaia, H. 2020. Estimation Trip Generation for Urban Area of Nasiriyh City. *Journal of Global Scientific Research*, 451 - 460.

Saw, K., Bhima Ji, K. K. dan Joshi, G. J. 2015. Activity Based Spatial and Temporal Trip Generation Computation and Validation: A Quick Analysis Approach. *International Journal of Intelligent Transportation and Urban Planning*, 79-89.

Victorian Government. 2019. *Movement and Place in Victoria.* Victoria: Department of Transport.

White, M., Paay, J., Dia, H. and Yang, T. 2021. Exploring balance between movement and place in designing safe and successful places. New South Wales.