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ANALYSIS OF PUBLIC TRANSPORT DEVELOPMENT IN METROPOLITAN CITY BASED ON ORIGIN-DESTINATION (CASE STUDY: METRO CAPSUL BANDUNG)

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ABSTRACT

Development of new mode of metro kapsul as mass transportation mode in Bandung with corridor plan from Station Hall to Tegallega and return to Station Hall with plan of 19 stop station which can give contribution to congestion problem and lack of public transportation service in Bandung city. This study aims to analyze the potential of demand with the data of origin - destination of the respondent in the corridor plan of the metro capsule in order to give a description of the movement in the origin-destination matrix, in analysis for potential demand used the modal movement assumption of private vehicles, public transport and pedestrian, The location of priority shelter at the beginning of development by using multicriteria analysis while for operational analysis is calculated some variables of capsule metro operating system (headways, frequencies, etc). The result of origin-destination matrix analysis is getting potential demand of metro capsule during weekdays on-peak of 3529 pass/hour, off-peak of 2116 pass/hour. The result of location priority stop location will get 6 (six) stop location recommended in “Stasiun Bandung, Pasar Baru, Pasar Anyar, Taman Tegallega, ITC Kebon Kelapa and Alun-Alun Bandung”. From the operational results of metro capsule, obtained frequency of 20 Unit/jam, headways 3 minutes, the number of vehicles required 8 vehicles, on weekdays and weekends when on-peak and off-peak.

Keywords : *metro capsule, origin-destination matrix, the potential demand, stop priority, operational analysis.*

I. INTRODUCTION

Public transportation problems that occur in the Bandung City cause an increasing number of people who switch to private vehicles because they use less public transportation. The low city transportation services that have to be waited for a long time, the habit of waiting for passengers to linger at the base makes the effect give up for public transport users who have access to use private vehicles. Simply increasing population and tourist growth causes the need for public transportation to increase, so various discourses will improve public transportation in the city of Bandung being developed. The Ministry of Transportation and Government of Bandung City has a discourse to build and develop metro capsules as a mass transportation mode in the city of Bandung that can contribute to the complexity of congestion and improve public transportation services in the city of Bandung which provides improved private vehicles that cause congestion in the city of Bandung. As planned the mode will be built in 2018 with a corridor plan from Bandung Station, Pasar Baru Bandung or Otto Iskandar Dinata street, Tegallega Field, Bandung Great Mosque (Bandung City Square) which has a distance of 6 Km. At the bus stop or station planning stage of the metro capsule, the city government established 19 bus stops with a distance between 300 bus stops that was done to provide services and facilities that were well reached by the community (Bandung City Government, 2016). For the construction of metro capsules in 2017, the attention of the Ministry and the City of Bandung will support 6 priority stops. Furthermore, all bus stops will be built. While the location of the 6 stations has not been determined (finance.detik.com, 2017). The purpose of this study is to analyze the potential demand with the origin - destination matrix in the corridor of the metro capsule plan in order to provide an assessment or assessment of the operational mode of the metro capsule mode and the determination of 6 priority bus stop locations at the start of development.

II. LITERATURE REVIEW

Metro capsule is a term for this mode which has a capsule shape. The mode of transportation consists of only one car (carriage). Metro capsule is a mode of transportation developed by PT Teknik Rekayasa Kereta Kapsul (TREKKA). Metro capsules have technology with an automatic steering system that runs on elevated special tracks

using rubber wheels, where the technology is the same as some modes in several countries commonly called Rubber-Tired Automated Guided Transit (AGT) which was drafted in 1974 in Dallas-Fort Worts, for mass public transportation going to the airport (Vuchic, 2005). Automated guided transit (AGT) is basically developed as a means of providing mass public transportation that aims to serve some of the burden of traffic and daily travel that can not be accommodated by buses or trams, but the operation is smaller than LRT (Light Rapid Transit) and MRT (Mass Rapid Transit). AGT has better service and operations than city buses and trams. Automated guided transit technology is a fully automatic transit system, without the driver, and with a grade-separated transit system where the vehicle automatically runs on a lane that has been designed (guideway) (Vuchic, 2005). Rubber Tired AGT is a form of mass public transportation that combines road and rail technology, it is seen in a system that like a train only uses rubber tires as its wheels.

III. METHODOLOGY

3.1. SURVEY DESIGN

A. Survey Method with Direct Method (Home Interview)

The direct method is the approach carried out by means of data collection and field surveys. The direct method with home interviews is an effective method to get information from a travel diary in the study area, destination origin matrix, and information on the characteristics of the respondents. This method is very dependent on the availability of surveyors and field situation conditions.

B. Factors in Origin-Destination

- 1) The time the activity starts
Waktu dimulainya kegiatan adalah waktu yang dipilih oleh responden untuk melakukan kegiatannya dalam satu hari dimana responden diberikan pertanyaan terhadap kapan saat melakukan kegiatan pertama, dan dilanjutkan ke pertanyaan kapan melakukan kegiatan selanjutnya dalam satu hari.
- 2) Type of activity
This type of activity is a choice of the type of activities carried out by respondents in one day, where the usual activities carried out are rest, study, work, sports, and others.
- 3) Location of Activity

Location of activity is a place or location that is used as a destination in carrying out its activities, where the location is usually very dependent on the type of activity of the respondent.

4) Change of Location

Location transfer is the method used for the respondent to move the location from the initial location starting to move to the destination with the modal questions used to make the transfer and the costs incurred by the respondent.

C. Factors in Origin-Destination

1) Resident Responden

Resident respondents are permanent travelers, or live in the study area. In other words, the resident respondent is someone who has an activity or activities always and often are in the study area.

2) Non-Resident Respondent

Non-Resident Respondent is someone who does shopping, eating, traveling and other activities in the study area and not someone who lives or lives in the study area. In other words non-residents can be referred to as tourists from outside the study area who carry out some of their activities in the study area.

3) Identification of Respondents in the Field

In identifying resident and non-resident respondents, a different type of survey is conducted, i.e. Resident group respondents conducted a home interview survey. Non-resident groups were interviewed at the location of the tourist movement centers in the study area. In analyzing the data of respondents' movements, only the movements in the study area (internal to internal movements) are carried out.

3.2. SURVEY DESIGN

A. MAT Formulation Stage

The approach that can be taken to compile the MAT in the trip series method is first to describe the trip series on the map of the analysis area as in Figure 1, then determine the possible trips that may move on the route of the public transport route, then analyze the movement to be from the origin zone to the destination zone on the route's path. Illustration of origin-destination matrix analysis can be seen in **figure 3.1**.

B. Study Area

The study area (data collection area) is carried out in the corridor of the public transport plan using the "metro capsule" mode in the area of Bandung which is in the 4 administrative areas of the Bandung City, namely Andir sub-district, Astana Anyar sub-district, Regol sub-district, and Sumur Bandung sub-district. Metro capsule plan route will pass Stasiun Bandung - Jalan Kebon Jati - Jalan Otto Iskandar Dinata - Jalan BKR - Jalan Moch. Toha - Jalan Dewi Sartika - Jalan dalem Kawung - Jalan Otto Iskandar Dinata - Jalan Stasiun Timur. The internal zone is planned based on the radius of distance between the center zones of 300 meters. The zone boundary analyzed in this study is the area around the center of the zone with the boundary of the kelurahan.

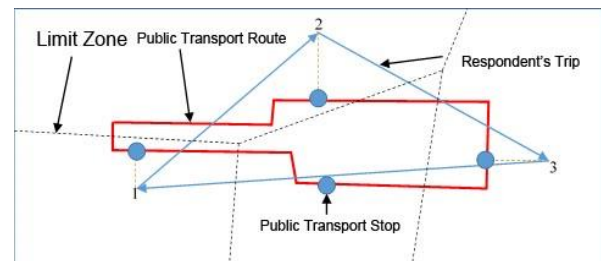


Figure 3.1 Illustration of Origin-Destination Matrix Analysis (MAT)

C. Concept of Movement Analysis in the Study Area

The pattern of each individual's journey certainly has diversity and has more than one trip in each day, it is influenced by the needs of each individual that produces more than one movement. In describing the uniqueness of each individual's movements, the Origin-Destination method will provide a better MAT picture and reflect the habits of the movement.

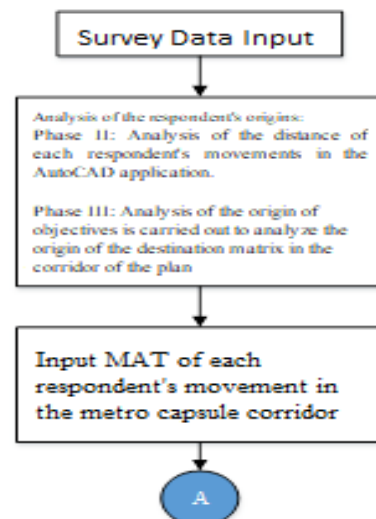


Figure 3.2 Regional Movement Analysis Method Part I

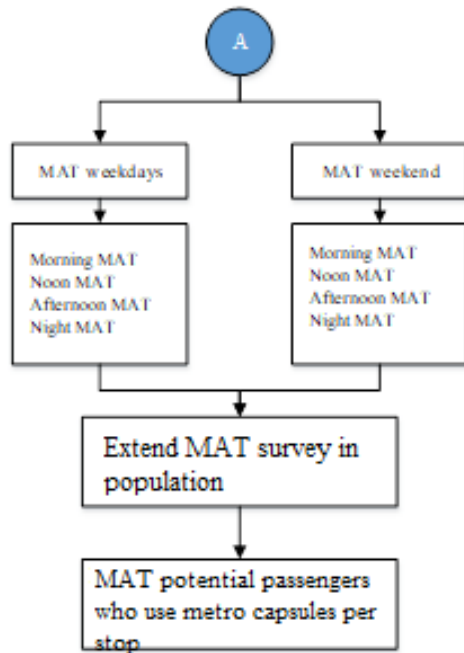


Figure 3.3 Regional Movement Analysis Method Part2

In the flowchart above, it is explained how the process of regional movement analysis method, from the stage of survey data input to get the results of the MAT potential metro passenger capsules per minute. The more detailed explanation is as follows:

- 1) Input survey data.
At this stage the results of the survey data are combined to create input data.
- 2) Input the location coordinates of each respondent's trip into the AutoCAD application.
This process inputs data from the results of the analysis of the previous coordinate points on an existing base map.
- 3) The check and analysis phase of the origin of the respondent's objectives is carried out through data analysis as follows:
 - Phase II: Analysis of the distance of each respondent's movements in the AutoCAD application.
 - Phase III: Analysis of the origin of objectives is carried out to analyze the origin of the destination matrix in the corridor of the plan.
- 4) Extend MAT survey results on population.
In this stage a calculation will be made of the results of the MAT survey carried out by multiplying the escalation of the population. The population analyzed is according to the following definitions:
 - Resident populations with populations that have been obtained at the beginning and also analyzed

populations that have the potential of not moving or only moving within the zone (intrazona movement) and populations that do not travel individually or individually by using assumptions from the age of the population. So we get the age variable as follows:

- Age 0 to 8 years.
This assumption is based on the age of 8 years in Indonesia is equivalent to children with the level of education in grade 2, so that habits in Indonesia at the next age when traveling will be escorted by adults or in traveling only in one region. At the age of 0-4 years at 6% while at 5-8 years at 6%.
- Over 65 years.
This assumption is based on the age above 65 years has the potential to move on its own, but seeing the habits in the community at the next age in driving will use the services of the driver. At the age of > 65 years it is 8%.

From the data above, there are 19% of the population who do not move or only move within the zone (intrazona movement) and population who do not travel individually.

Non-resident population, which is the average tourist visiting the study area. The total population of non-residents is as follows:

- In the region (Republika.com, 2015) Pasar Baru Kota Bandung is as many as 35,000 visitors.
- The capacity of the Bandung Grand Mosque (id.wikipedia.com, 2012) is able to accommodate around 13,000 people, so it can be assumed there are about 2.5 times that capacity of 32,500 people per day.
- As for Bandung Station 8,000 per day (serbabandung.com, 2016) and Taman Tegallega assuming there are as many as 12,000 people per day.

The population for non-resident respondents is 97,500 people per day assuming weekends and weekdays have the same population.

With the data above, calculations can be done to extend the data using the following equation:

$$E_{pop} = \frac{Pop \times Pop_{Idle}}{n} \dots\dots\dots\{1\}$$

Where:

- E_{pop} : The multiplier factor (extend) of the population in the study area
- Pop : Total population in the study area (people)
- Pop_{Idle} : Percentage of population that is not moving or only moving within a zone or intrazona (%)
- n : Number of samples

The MAT value is calculated by multiplying the survey MAT value by the multiplier factor of the population extends in the study area with the following equation:

$$MAT_{pop} = E_{population} \times MAT_{survey} \dots\dots\dots\{2\}$$

The results of the above calculation are then performed on the calculation of extended data from the sample to the population with the multiplier factor above multiplied by the data from the MAT survey.

D. Potential Passenger MAT

In analyzing the potential of metro capsule passengers in this study by assuming modal shifts in respondents using private vehicle modes, public transport users and potential demand from pedestrians to metro capsules.

- Potential Metro Capsule Demand From Private Vehicle Users.
The basis of the assumption of modal shift from private vehicles to metro capsules is from research conducted by Faruq (2014), stating that the result of the probability of choosing TMB is 40% compared to private vehicles which are 60%. The assumption used in this study is the height change of private vehicle mode to metro capsules is 40%.
- Potential Metro Capsules Demand From Pedestrians.
The basis of the assumption of the potential demand from pedestrians to the metro capsules of the percentage or proportion of pedestrians obtained by pedestrians who move in the study area at 12% resident and for non-residents 10%. Assuming the potential demand of pedestrians who will use metro capsules is 100% or all pedestrians will move to use metro capsules.

- Potential Metro Capsule Demand From Public Transport
The basis of the assumption of the potential demand from public transportation to metro capsules of the percentage or proportion of pedestrians illustrating that pedestrians moving in the study area are 16% for non-residents and 20% for non-residents. Assuming the potential demand of public transportation that will use metro capsules is 100% or all pedestrians will move to use metro capsules.
- Total Potential Metro Capsule Demand
From the calculation of potential demand above, namely demand from private vehicles, demand from public transport users and demand from pedestrians. Adding the two MATs together will get the results of the total metro capsule passenger demand will get the total MAT metro caps potential demand.

IV. RESULT AND DISCUSSION

4.1. ANALYSIS OF STOP LOCATION DETERMINATION IN THE BEGINNING OF DEVELOPMENT

In Vuchic (2005), to determine the location of a bus stop, 4 (four) factors that can be taken into consideration are:

- Coverage Area
Coverage area can be said to be an area where people are still comfortable enough to walk (walking distance) to public transportation stops. According to Vuchic (2005), the distance between stations in Paris, the Philippines, and Hamburg Germany has a radius of coverage area of 700-1200 m, it is on a short corridor, while trains on the inter-city lane are 1200-1700 m. According to Director General of Land Transportation (2002), stated that the distance of pedestrians in the city center is 300-500 m; for suburbs 500-1000 m.
- Strategic City Areas
Placing stations in locations or regions that have strategic areas will certainly provide an increase in the potential of passengers, this happens because in the strategic area of the city is an area that has an important influence on the growth of several urban areas so that it has a very high level of movement.
- Movement patterns in the corridor plan.
The level of movement in the corridor of the plan and certain zones which can be

formulated in the form of origin-destination matrix. The pattern of movement in the corridor of the plan can give an idea of the potential movement at the location of the bus stop to be operated.

- Integration of Public Transport Or Feeder routes
Integration of public transport routes or feeders analyzed aims to make the bus stop a collection system to improve the accessibility of public transport services better.

A. The Concept of Locational Analysis

In the analysis of determining the location of bus stops at the beginning of the construction, several stages of analysis will be carried out:

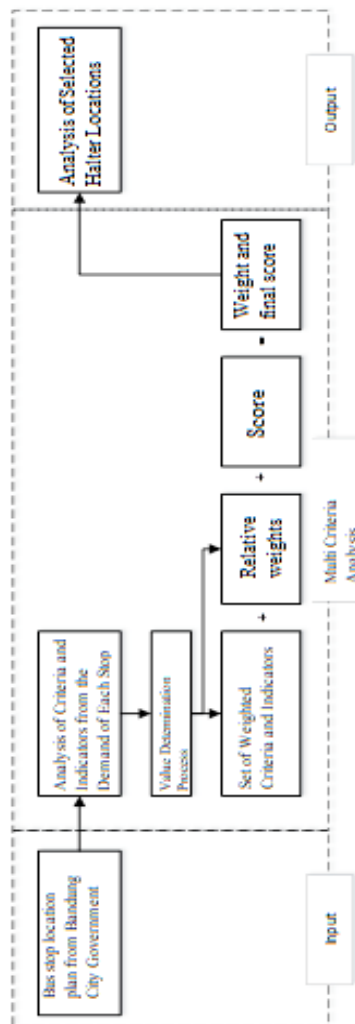


Figure 4.1 Analysis Method for Determining the Location of the Beginning of a Bus Stop

1) Stage I Input

In this stage the data from the initial plan of the metro stop capsule was taken, totaling 19

stops. Government policy towards the establishment of the first stop is as many as 6 stops to be built.

2) Stage II Multi Criteria Analysis

In this analysis the process is divided into as follows:

- Analysis of criteria and indicators of potential demand for each bus stop.
Criteria
The criteria in this study are based on the potential for movement of each bus stop, integration with public transportation, activity centers in the study area.
Indicator
The indicators in this study are based on the amount of passenger demand, or the level of activity of people in each of the multi criteria criteria.
- The value placement process
Value determination is a technique in which the placement of values for each decision element will be analyzed, or the percentage value, between 0 to 100.
- Calculation of relative weights
At this stage of the analysis the calculation of the relative weight or importance of each decision element is based on the synthesis of several analyzes of the study area in the field. The weights used in this study are as follows:

Table 4.1 Assumption of Weight of Each Criteria

No.	Criteria	Weight
1	Potential for Movement	30 %
2	Public Transportation System Integration	20 %
3	Existence of Activity Centers	50 %
Jumlah		100%

• Score

A scoring system that can reflect the condition of the corridor of the plan being assessed is key to the evaluation system. Below this is a dynamic and informative scoring system:

Table 4.2 Basis for Scoring Analysis

Skor	Potential of Movement (People/4hour)	Public Transportation System Integration (Route)	Existence of Activity Centers (Region)
1	< 250	< 2	< 1
2	250 – 500	2 – 4	1 - 2
3	750 – 1000	4 – 6	2 – 3
4	1000 – 1250	6 – 8	3 – 4
5	> 1250	> 8	4 – 5

- Weight and final score
At this stage a multiplication is performed between the weights of each criterion and the score given for each criterion.

Based on the analysis of the three bus stop selection criteria above, a multi-criteria analysis process can be carried out where with a description of the placement of values, calculation of relative weights, and scores. The results of the multi-criteria analysis can be seen in **table 4.3**.

Table 4.3 Results of Analysis on the Selection of Stop Selection Multi Criteria

Halte	Asal	Skor	Bobot	Hasil	Tujuan	Skor	Bobot	Hasil	Integrasi Dengan Angkutan Umum				Kewasan Hasil strategies				Bobot	Hasil	Total Hasil	
									a	b	c	d=0.7c	e	f	g	h=1.5g				i
Halte 1	1729	3		0.3	1647	3		0.9	10	5		1.0	3	2		0.4	5	5	3	5.70
Halte 2	0	1		0.3	0	1		0.3	10	5		1.0	3	2		0.4	3	3	2	3.50
Halte 3	458	1		0.3	458	1		0.3	3	2		0.4	3	3		0.6	5	5	3	4.10
Halte 4	366	1		0.3	1098	2		0.6	7	4		0.8	4	3		0.6	3	3	2	3.80
Halte 5	3661	5		1.5	366	1		0.3	7	4		0.8	4	3		0.6	1	1	1	3.70
Halte 6	1830	3		0.9	92	1		0.3	6	4		0.8	4	3		0.6	2	2	1	3.60
Halte 7	2837	5		1.5	824	1		0.3	6	4		0.8	4	3		0.6	5	5	3	5.70
Halte 8	0	1		0.3	2033	4		1.2	4	3		0.6	4	3		0.6	3	3	2	4.20
Halte 9	2837	5		1.5	549	1		0.3	4	3		0.6	4	3		0.6	2	2	1	4.00
Halte 10	1464	2		0.6	3661	5		1.5	6	4		0.8	5	4		0.8	5	5	3	6.20
Halte 11	366	1		0.3	183	1		0.3	6	4		0.8	5	4		0.8	4	4	2	4.20
Halte 12	3752	5		1.5	92	1		0.3	4	3		0.6	1	1		0.2	3	3	2	4.10
Halte 13	0	1		0.3	0	1		0.3	4	3		0.6	1	1		0.2	4	4	2	3.40
Halte 14	0	1		0.3	92	1		0.3	4	3		0.6	1	1		0.2	5	5	3	3.90
Halte 15	1007	2		0.6	1191	2		0.6	4	3		0.6	1	1		0.2	4	4	2	4.01
Halte 16	183	1		0.3	824	1		0.3	6	4		0.8	3	2		0.4	4	4	2	3.80
Halte 17	0	1		0.3	1830	3		0.9	6	4		0.8	3	2		0.4	5	5	3	4.90
Halte 18	549	1		0.3	732	1		0.3	3	3		0.6	2	1		0.2	4	4	2	3.40
Halte 19	0	1		0.3	5400	5		1.5	9	5		1.0	1	1		0.2	4	4	2	5.00

B. Selected Stop

- The 1st stop is at stop 1 (Stasiun Bandung),
- The 2nd stop is stop 3 (Pasar Baru Bandung),
- The 3rd stop is at hate 7 (Pasar Anyar),
- The 4th stop is at stop 10 (Taman Tegallega),
- The 5th stop is at stop 15 (ITC Kebon Kelapa), and
- The 6th stop is stop 17 (Pendopo and Alun-Alun Kota Bandung)

4.2. OPERATIONAL ANALYSIS OF METRO CAPSULE

A. Concept of Metro Capsule Operational Analysis

In the analysis of the metro operational plan with capsules as follows:

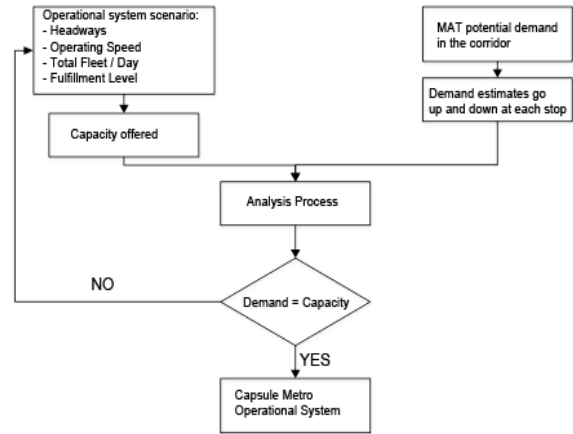


Figure 4.2 Metro Capsule Operational Analysis Method

The chart above explains how the metro capsule operational analysis method, which in the initial stage is to assume the operational system so that it will get the value of the offered track capacity. Whereas in the analysis of metro demand capsules per initial priority, an analysis of passenger fluctuations was estimated at each stop. After getting data of cross-capacity and fluctuating capacity at each stop, a check between capacity and demand is served, with three alternative headways of 5 minutes, 4 minutes and 3 minutes. A clearer explanation of the potential passengers with the operational system is as follows:

1) Analysis of the potential of metro capsule passengers at each stop early in the development.

At this stage the calculation or the sum of potential passengers will be carried out at the recommended stop at the beginning of the planning with the coverage area so that several stops that enter the coverage area will be served by the stop, so as an assumption the potential passengers from the stop will become the potential at the stop.

Operational analysis is based on 6 priority shelters planned and analyzed in the previous chapter, at each stop it is assumed to have a 300 meter coverage area so that it can cover the shelters from the surroundings that will be planned next. Some bus stops are included in the coverage area:

- Within the coverage area at Stop 1 it covers stop 1, stop 2, and stop 19.
- Within the coverage area at Stop 2 covers stop 3, stop 4, stop 5 and stop 18.
- In the coverage area at Stop 3 it covers stop 6, stop 7 stop 8.
- Within the coverage area at Stop 4 it covers stop 10 and stop 11.
- In the coverage area at Stop 5 it covers stop 14 and stop 15.
- Within the coverage area at Stop 6 it covers stop 16 and stop 17.

By flicking movement between zones within the bus stop coverage area, input can be made in the 6 to 6 origin-destination matrix. Once the destination origin matrix is obtained from the metro capsule potential demand, a calculation of the potential of the metro capsule passenger ups and downs can be performed. By adding up the number of resident and non-resident movements during weekdays from the origin and destination of resident and non-resident where each weekend and weekdays are present and the potential of the movement will be divided by 4 because of the 4 time variables (morning, afternoon, evening, night) has 4 hours.

2) Analysis of metro capsule operational plans

In this stage, the input used to analyze the operating mode of metro capsule mode is two time periods, namely on peak hour and off peak hour. Where on peak hour is the time period when peak hour means on peak hour is the time when the maximum potential demand. Whereas off peak hour time is when the potential demand is average. The division of 2 time periods from the 4 time periods in the analysis of the origin destination matrix is based on the side of government stakeholders which aims to provide a balance between the viewpoints of users of transportation services with the operator side and public transportation that is effective and efficient. From the point of view of users of transportation services, a review of services is orderly and orderly. Whereas from the operator's side, the aim is to provide capacity, orderly and orderly public transportation services, and can operate profitably. Based on this, using the two time periods will be far more efficient in terms of service, while in terms of operation will be more effective.

3) Operational Research Data Input

Based on table V.6 Potential of Respondents to Decrease Per Stop, it can be calculated operational

services of the metro capsules per known time, and per halten, so that by using the equation in Chapter II, the variables / characteristics of the known metro capsules are:

- The length of the metro capsule route route is 6 km.
- Metro capsule capacity is 50 passengers/capsules.
- Passenger Potential Increases Maximum On Weekdays, namely:
 - The maximum potential passenger ride on on-peak is 3529 passengers/hour.
 - The maximum potential for passengers to ride off-peak is 2116 passengers/hour.
- Maximum passenger potential rises On Weekend, namely:
 - The maximum potential passenger ride on on-peak is 2032 passengers/hour.
 - The maximum passenger potential for off-peak riding is 1422 passengers/hour.

In the assumption of metro capsule operations, a standard of mass transit SPM (PM 10 of 2012) is used. The operational standards are as follows:

- Metro capsule operational speed of the plan is 40 km / hour.
- The standard headways of mass public transportation are 5 - 15 minutes. So in the initial stages of operational planning is 5 minutes.
- Maximum Fulfillment Rate of occupancy from mass public transport is 100%.

4) Line Capacity

Mode capacity is the availability of space for passengers in a series of modes, then by calculating line capacity or metro capsule cross mode capacity. the capacity of the mode is calculated using the following equation (Vuchic, 2005):

$$C = \frac{60 \times n \times C_v}{h} \dots\dots\dots\{3\}$$

$$C = \frac{60 \times 1 \times 50}{5} = 600 \text{ pnp/hour}$$

5) Analysis of Passenger Potential and Capsule Metro Line Capacity

Passenger Potential and Lane Capacity can be a clue to find out how many fleets are needed and operate. Table 6 presents an analysis of the potential for ups and downs of passengers during weekdays and weekends. In the 'up' and 'down' passengers at the bus stop have zero values. This happens because the data obtained in the field are

incomplete and the assumptions taken. By calculating and comparing the potential up and down data and lane capacity offered, we will get the results as in table 6. From the above calculation it can be concluded that the Headways recommendation to be used in this study is during weekdays which is 3 minutes on peak and 3 minutes on off-peak. Headways on weekends are 3 minutes on peak and 3 minutes off peak.

Table 4.4 Analysis Results Rise Down Passengers on Weekdays

Periode Waktu	Halte	Naik	Turun	Alternatif 1 (headways 5 menit)		Alternatif 2 (headways 4 menit)		Alternatif 3 (headways 3 menit)	
				Line Capacity (ruang/jam)	Penumpang Tidak Terangkut	Line Capacity (ruang/jam)	Penumpang Tidak Terangkut	Line Capacity (ruang/jam)	Penumpang Tidak Terangkut
On-Peak	Halte 1	1036	1289	600	436	750	286	1000	36
	Halte 2	1174	1082						
	Halte 3	1052	351						
	Halte 4	678	976						
	Halte 5	374	206						
	Halte 6	145	557						
Off-Peak	Halte 1	1524	122	600	924	750	774	1000	524
	Halte 2	358	755						
	Halte 3	229	160						
	Halte 4	701	236						
	Halte 5	457	137						
	Halte 6	137	1996						
Siang	Halte 1	892	2103	600	292	750	142	1000	112
	Halte 2	1112	648						
	Halte 3	351	847						
	Halte 4	732	1273						
	Halte 5	160	564						
	Halte 6	2552	366						
Malam	Halte 1	69	23	600	1952	750	1802	1000	1552
	Halte 2	145	46						
	Halte 3	23	46						
	Halte 4	145	122						
	Halte 5	0	145						
	Halte 6	0	0						

6) Frequency

Calculation of headways is the difference in time of departure between two transport vehicle services at a certain point, or the difference in time of arrival between a vehicle and the next vehicle, usually at a bus stop (minutes).

7) Fleet Needs

The calculation of the number of fleets in operation is the number of vehicles needed to serve a

particular track. So by using the equation above you will get the results of metro capsule operations as in table 7 below:

Table 4.5 Analysis Results Rise Down Passengers on Weekdays

Tahap	Variabel	Symbol	Satuan	Weekdays		Weekend	
				On-Peak	Off-Peak	On-Peak	Off-Peak
I	Panjang Trayek	L	km	6	6	6	6
	Kapasitas Kendaraan	C	sps/veh	50	50	50	50
	Kecepatan	V	km/jam	40	40	40	40
	Headways	h	min/kend	3	3	3	3
II	Frekuensi	f	kend/jam	20	20	20	20
	Line Capacity	Cv	pnp/jam	1000	1000	1000	1000
	Jumlah Kendaraan operasi	Ntu	kendaraan	6	6	6	6
	Jumlah Kendaraan yang dibutuhkan		kendaraan	8	8	8	8

V. CONCLUSION AND RECOMENDATION

V.1. CONCLUSION

Based on the data analysis and discussion carried out in the previous chapters, the following conclusions can be obtained:

➤ Based on Origin Destination Analysis, there is a potential demand for the number of passengers to be served by Metro Capsule. Potential passengers ride a maximum on Weekdays, namely:

- The maximum passenger potential for on-peak riding is 3529 passengers / hour. (Pendopo and Alun-Alun Kota Bandung).
- The maximum passenger potential for off-peak riding is 2116 passengers / hour. (Bandung Station)

Passenger potential to rise to the maximum during the Weekend, namely:

- The maximum passenger potential for on-peak riding is 2032 passengers / hour. (Bandung Station)
- The maximum passenger potential for off-peak riding is 1422 passengers / hour. (Tegallega Park)

➤ Metro capsule stop recommendations at the beginning of operation there are 6 stops as follows:

- The 1st stop is at stop 1 (Bandung Station),
- The second stop is stop 3 (Pasar Baru Bandung),
- The 3rd stop is at hate 7 (Pasar Anyar),
- The 4th stop is at stop 10 (Taman Tegallega),
- The 5th stop is at stop 15 (ITC Kebon Kelapa), and
- The 6th stop is stop 17 (Pendopo and Alun-Alun Kota Bandung)

➤ The operational recommendations of metro capsules are as follows:

Headways that will be used in this study are during weekdays which are 3 minutes on peak and 3 minutes on off peak. Headways on weekends are 3 minutes on peak and 3 minutes off peak.

Frequency during weekdays on on-peak is 20 vehicles / hour, and off-peak is 20 vehicles / hour. When weekend on-peak that is equal to 20 ken / hour, and off-peak that is equal to 20 vehicles / hour. The number of vehicles operating on capsule metro on weekdays is 6 vehicles while the off-peak time on weekdays is 6 vehicles, while the number of vehicles operating on capsules metro on weekends is 6 vehicles while on off peak during weekends is 6 vehicles. 6 vehicles. The number of transport vehicles needed is 8 vehicles.

V.2. REKOMENDATION

This research can be developed for further study by considering the following matters:

- Demand for metro capsules can be developed by paying attention to the character in more activity centers scattered along the corridor plan for metro capsules and the influence of external movement to and from the study area.
- Combined modes (share-mode) between mk, private vehicles, existing public transport along the corridor plan of the metro capsule can be developed using modal selection models.

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