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# The Effect of Using the Activities of the Alfamidi Warehousing Center and Alfamidi Supermarket Dc. Karanja Lembah on the Performance of the Karanja Lembah Road Section in Palu City

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***Abstract***
*Conditions on the Karanja Lembah roads with the existence of the largest Alfamidi Warehousing Center in Palu City adjacent to Alfamidi Dc Karanja Lembah Supermarket experience congestion that can reduce traffic performance making it difficult to streamline time in transportation. The purpose of this study is to determine the performance of the Karanja Lembah Road section due to the activities of the Alfamidi Warehousing center and Alfamidi Supermarket, in addition to determining the origin zone of the rise and pull of consumer movements towards the Alfamidi Dc Karanja Lembah Supermarket. In this study, the data obtained from surveys conducted on the Karanja Lembah roads, warehousing area and at Alfamidi Supermarket Dc Karanja Lembah for 9 hours starting from 08:00 a.m – 05:00 p.m include traffic surveys, side obstacles, vehicles operating in the warehousing area, and customers shopping at Alfamidi Supermarket to provide questionnaires. The analysis in this study used the calculation method IHCM 1997, namely urban roads. Based on the results of the analysis conducted at the time of this study, it was obtained (DS) due to the activity of the Alfamidi warehousing center and Alfamidi Supermarket was 0.65 with the service level (LOS) categorized as C in the sense that it was still within stable limits. The origin zone of arrival to Alfamidi Supermarket is dominated by people from Sigi Regency.*

***Keywords: traffic flow, road performance, warehousing alfamidi and alfamidi supermarket, IHCM 1997***

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## I. INTRODUCTION

Transportation is currently growing rapidly so that it can cause congestion for road users, this also reduces comfort and road capacity decreases. Conditions like this are found on the Karanja Lembah roads with the existence of the largest Alfamidi Warehousing Center in Palu City adjacent to the Alfamidi supermarket DC. Karanja Lembah. This makes Karanja Lembah road which is the main road with a fairly dense traffic volume often disrupted traffic flow, especially in the activity area of the Alfamidi warehousing center and Alfamidi DC.Karanja Lembah supermarket. The purpose of this study is to determine how the performance on the Karanja Lembah Road section due to the activities of the Alfamidi Warehousing Center, and Alfamidi Supermarket on the Karanja Lembah roads, and from where the origin zone of the rise and attraction of visitors to the Alfamidi Supermarket DC. Karanja Lembah.

## RESEARCH LOCATIONS

The location of this research will be carried out on Karanja Lembah roads in Palu city, Central Sulawesi Province. The area where the research was carried out is the main road that is directly connected to the road to the capital city of Sigi regency in Biromaru and is also connected to the road to Kelapa Gading Regency and Bumi Pertiwi Indah Regency. The research locations is show.


**Figure 1 : Research Location**
**Source:** *Google.com*

### 1.1.3 Data Retrieval

Some of the activities carried out in this data collection include:

1. Geometric road survey, the survey carried out is to make direct measurements of the existing dimensions of the road including road type, road shoulder, sidewalk, traffic lane, segment length, road drainage and road slope, the results of these measurements are depicted in the form of sketches.
2. Traffic volume survey (Vehicle/Hour), this survey was conducted to determine the amount of traffic flow and the performance of the road section carried out at the observation point, while this survey was carried out at the optimal time of the operation of gas stations on Karanja Lembah Road. Each of these survey points was conducted at 08:00 a.m – 05:00 p.m . To conduct this survey, 2 surveyors are needed who are placed on the Karanja Lembah Road.
3. Side obstacle survey, this survey was conducted to determine the class of side obstacles on the Karanja Lembah Road section, while this survey was conducted on Tuesday at 08:00 a.m – 05:00 p.m. To conduct this survey, 2 surveyors are needed and placed on a designated road section, which is in a radius of 50 m from the location of warehousing and Alfamidi Supermarkets
4. Conduct a survey at the entrance of the warehouse to find out the fluctuations of vehicles in and out of the Alfamidi warehousing.
5. Conducted a questionnaire survey that was distributed to Alfamidi supermarket customers who came to shop to find out the origin zone of travel generation.

## 2.1 Library Review

### 2.1.1 Road Network System

According to Law Number 2 of 2022, the road network system is a single road section that connects and binds activity centers/growth centers, and transportation nodes with areas under the influence of their services in a hierarchical relationship.

### *2.1.2 Level of Service*

According to [1] explained that there are two important characteristics in the assessment of traffic services of a road section, namely capacity and the relationship between speed and volume passing through the road section. In the concept of traffic it is stated that the average speed of space is more suitable for analyzing traffic flow. Service level is a function of speed/travel time and the ratio between volume to capacity.

### 2.1.3 Urban Road Performance

According to [2] the performance of a road section is the ability of a road section to run based on its function without any obstacles in serving the traffic flow that occurs on the road section. The indicator of measuring the performance of the road section in question is the ratio of volume per capacity (*VC Ratio*), speed and traffic density.

### 2.14. Free Current Speed

According to [3] (FV) is defined as the speed at the zero current level, that is, the speed that the driver will choose if driving a motor vehicle without being affected by other motor vehicles on the road. The speed (Vehicle/Hour) of a vehicle that is not affected by other vehicles (i.e. the speed at which the rider experiences a comfortable ride in geometric conditions, environments and existing traffic arrangements, on segments of the road where there are no other vehicles). The equation for determining the speed of free current has the following general form:

$$FV = (FV_O \text{ x } FV_W) \text{ x } FFV_{SF} \text{ x } FFV_{CS} \quad (1)$$

### 2.1.4 Road Section Capacity

Capacity is defined as the maximum current through a point on the road that can be sustained per unit hour under certain conditions. For two-lane two-way roads, capacity is determined for two-way flow, but for roads with many lanes, the current is separated per direction and capacity is determined per lane [1]. The basic equation for determining capacity is as follows:

$$C = C_o \text{ x } FC_W \text{ x } FC_{SP} \text{ x } FC_{SF} \text{ x } FC_{CS} \quad (2)$$

### 2.1.5 Degree of Saturation

According to [3] degree of saturation (DS) is defined as the ratio to capacity, used as the main factor in determining the level of performance of intersections and road segments. The DS value indicates whether or not the road segment has capacity problems.

$$DS = \frac{Q}{C}$$

### 2.1.5 Desire Line

To facilitate the reading of the pattern of pulling and rising vehicles / people to Alfamidi Dc. Karanja Lembah supermarkets, a *desire line* was made. The reading of the number of movement patterns is distinguished by the thickness of the line on the desire line. The thicker the line, the greater the movement, the value of movement is represented in the legend of the available image which has been scalized according to the thickness and amount of movement. This survey was conducted by providing a questionnaire sheet to Alfamidi Supermarket customers who want to shop, in the format of a questionnaire they can fill in several questions asked including their domicile so that from the address of origin the customer journey can be described through this desireline to see customer travel patterns, following the survey results on Tuesday, July 11, 2023 at 08:00 a.m – 05:00 p.m

### 3.1 Method

To complete this study, several stages that will be carried out include:

ii. Taking geometric measurements of Karanja Lembah Road Collecting data on traffic surveys, side obstacles, and arrivals at survey locations

iii Calculating the traffic volume of Karanja Lembah Road

iv Calculating the side obstacles that occur on the Karanja Lembah Road

v Calculate the speed of free flow, road capacity, and degree of saturation of road sections with conditions

the activity of the Alfamidi warehousing center and supermarket

vi Calculate the speed of free flow, road capacity, and degree of saturation of each road section without the activity of the Alfamidi warehousing center and supermarket

vii Know the travel pattern of the destination zone of customers Alfamidi Supermarket Dc Karanja Lembah

### 3.1.1 Results and Discussion

The highest traffic volume occurs during peak hours of 04:00 a.m – 05:00 p.m with a total of 966 PCU / hour. This is because the Karanja Lembah road section is the main choice for the community to meet their needs because it is directly connected to the road to Sigi Biromaru Regency, resulting in this road section being quite congested, this is due to different community activities, some work in companies, children go to school, office workers, traders and others who are domiciled from Sigi Biromaru Regency who work in Palu City and vice versa who is domiciled in Palu City who wor**Table**ks in Sigi Biromaru Regency.

**Table 1: Karanja Lembah Road Peak Traffic Volume (PCU/hour)**

| Day | Hour (WITA) | Street Name | MC | LV | HV | Total (v/h) |
|---|---|---|---|---|---|---|
| | | | 0,5 | 1 | 1,3 | |
| Tuesday | 04:00 - 05:00 | Karanja Lembah Road | 453 | 430 | 83 | 966 |

The calculation of free flow speed and road capacity on Karanja Lembah Road sections is calculated based on the Indonesian Road Capacity Manual (IHCM 1997) for urban roads. The following to see the survey data and fluctuations in the volume of vehicles on the Karanja Lembah roads can be seen in the picture below.

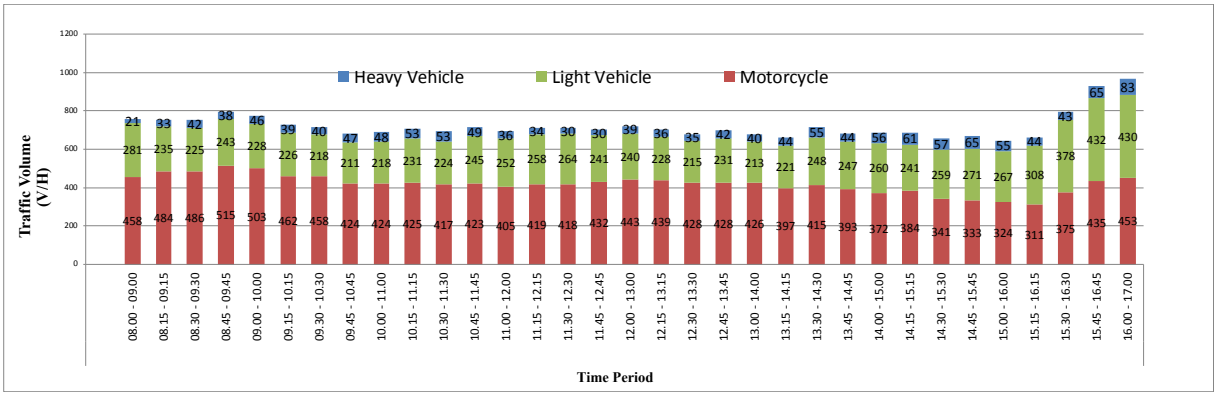



**Figure 2 : Traffic Volume Fluctuations of Karanja Lembah Road (PCU/hour)**

From the picture above, it is clear that the volume of vehicles on the Karanja Lembah roads from 08:00 a.m – 05:00 p.m has a variety of different numbers of vehicles, where it is clear that the highest number of vehicle volumes is the MC which dominates every hour, but for the highest peak hours in vehicle volume on the Karanja Lembah roads section occurs at 04:00 p.m – 05:00 p.m.

### 3.1.2 Side Barriers

The data taken in the side obstacle survey on Tuesday, July 11, 2023, are vehicles that stop and park on the shoulder of Karanja Lembah roads, who park at Alfamidi Supermarket, pedestrians (who parallel and cross the road), vehicles in and out of the warehousing area, vehicles entering and exiting the road and slow vehicles at the survey location. In this survey, samples were taken at peak hours, namely at 04:00 p.m – 05:00 p.m.

**Table 2 : Side Resistance Data Before and After Processing**

| Data Before Processing Side Barries | | | | | | | |
|---|---|---|---|---|---|---|---|
| Day | Hour (P.m) | Street Name | Walker Foot | Parking/ Stop | Out/ Enter | Move Slow | Total |
| Tuesday | 04:00 - 05:00 | Karanja Lembah | 8 | 19 | 28 | 30 | 85 |
| **Data After Processing Side Barries** | | | | | | | |
| Day | Hour (p.m) | Street Name | Walker Foot | Parking/ Stop | Out/ Enter | Move Slow | Total |
| | | | 0,5 | 1 | 0,7 | 0,4 | |
| Tuesday | 04:00 - 05:00 | Karanja Lembah | 4 | 19 | 19,6 | 12 | 54,6 |

from survey data conducted on Karanja Lembah Road at peak hours, the results are multiplied by each factor of side obstacle weight (parking vehicles = 1, slow vehicles = 0.4 pedestrians = 0.5 and exit/entry vehicles = 0.7), the highest value of side obstacles on the Karanja Lembah Road section on Tuesday at 04:00 p.m – 05:00 p.m obtained the number of pedestrians 4 PCU / hour, parking at Alfamidi Supermarket 19 PCU / hour, vehicles in and out / 19.6 PCU / hour and slow-moving 12 PCU / hour with a total side obstacle value of 54.6 PCU / hour

from the total value of the side obstacle survey, the Karanja Lembah road is categorized as VL (*Very Low*) class. To see in graphic form can be seen in the picture below:

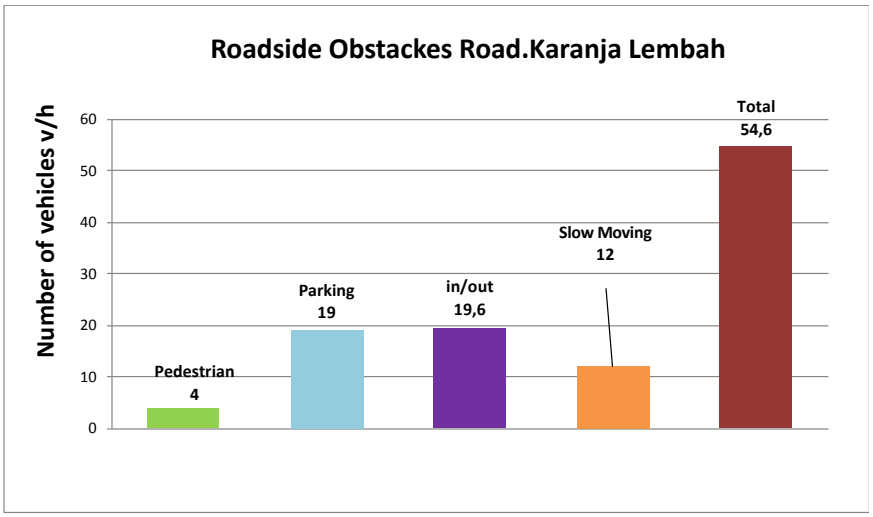



**Figure 3 :** Karanja Lembah Road Side Barriers

Based on figure IV.5, the number of side obstacles that occur on the Karanja Lembah Road section at peak hours of 04:00 p.m – 05:00 p.m is 54.6 from this result shows that the Karanja Lembah roads has very low side obstacles (VL), especially right at the Alfamidi supermarket location so that it can create a fairly high slowdown in vehicles behind vehicles that want to park in the Alfamidi area. This can reduce the performance of the Karanja Lembah roads section due to side obstacles that occur in the central area of warehousing and supermarkets Alfamidi Dc. Karanja Lembah.

### 3.1.3 Free Current Speed

Karanja Lembah Road is a type of 2-lane-2-way undivided road (2/2 UD), with lane widths of ± 8 meters and 5 meters respectively. The calculation of free flow speed is calculated based on the Indonesian Road Capacity Manual (*IHCM 1997*) for urban roads. The basic free flow speed and adjustment factor of each road are taken from IHCM 1997, therefore the calculation of the free current speed on the Karanja Lembah Road section.

Calculation of free flow speed in the absence of Karanja Lembah road activity

Base free current *speed*,$FV_o$ : 42 Vehicle/Hour
Track width adjustment factor, $FV_w$ : -9.5 Vehicle/Hour
Side Resistance, $FFV_{SF}$ : 1.01
City size adjustment factor, $FFV_{CS}$ : 0.93

$FV = (FV_O + FV_W) \times FFV_{SF} \times FFV_{CS}$
$= ((42 + (-9,5)) \times 1,01 \times 0,93$
FV = 30 V/jam

**Table 3 : Free Flow Speed of Karanja Lembah Road**

| Street Name | FVo (Vehicle/Hour) | FVw (Vehicle/Hour) | FFVsf | FFVcs | FV (Vehicle/Hour) |
|---|---|---|---|---|---|
| Karanja Lembah Road | 42 | -9.5 | 01.01 | 0,06458 | 30 |

Based on the table above, it can be seen that the speed of free flow on the Karanja Lembah Road due to side obstacles is 30 Vehicle/Hour and 42 Vehicle/Hour so that the traffic flow that occurs on the Karanja Lembah Road section is close to unstable. Of course, the speed of free flow which is below the standard that should be a problem in the performance of the Karanja Lembah roads section of Palu City.

### 3.1.4 Vehicle Speed

Based on the results of a vehicle speed survey at peak hours conducted on Jalan Karanja Lembah on Tuesday at 04:00 p.m – 05:00 p.m, it was found that the speed of each vehicle passing at a certain distance has a different speed. At the time of data processing, the results of the vehicle speed survey were taken at peak hours with the number of each sample taken as much as 5% of the total number of motorcycles and private cars, while for pickup vehicles, angkot, trucks and buses as much as 10% of the total number of vehicles.

**Table 4 : Vehicle Speed at peak hours of Karanja Lembah Road**

| Day/p.m | Vehicle Type | Average Vehicle Travel Time | Mileage (m) | Vehicle | |
|---|---|---|---|---|---|
| | | | | m/sec | v/h |
| Tuesday (04.00-05:00) | Motor | 9,13 | 50 | 5,48 | 19,72 |
| | Private Car | 11,96 | 50 | 4,18 | 15,05 |
| | City Transport | 0 | 50 | 0,00 | 0 |
| | Pick Up | 9,15 | 50 | 5,46 | 19,67 |
| | Truck | 10,49 | 50 | 4,77 | 17,16 |
| | Bus | 9,45 | 50 | 5,29 | 19,05 |

Based on the table above, it can be seen that the speed of motorcycles, pickups, and buses within 50m is approximately the same, which is in the range of 19 Vehicle/Hour, while for private cars and trucks have a lower speed compared to other vehicles with their respective speeds for private cars of 15.05 Vehicle/Hour and for trucks of 19.82 Vehicle/Hour. However, for Angkot vehicles during peak hours, no one crosses the Karanja Lembah road, so the speed data for Angkot is 0 (zero) or none.

### 3.1.5 Capacity

Karanja Lembah Road sections are 2-lane-2-way undivided (2/2 UD) road types, with lane widths of ± 8 meters and 5 meters respectively. This capacity calculation is calculated based on the Indonesian Road Capacity Manual (IHCM 1997) for urban roads. The basic density and adjustment factor of each road are taken from IHCM 1997 and for Karanja Lembah road on Tuesday at 04:00 p.m – 05:00 p.m with a value of 54.6 (VL) therefore the results of the calculation of capacity on the Karanja Lembah Road section can be seen in the calculation and the following table:

Base capacity : 2900 PCU/hour
Line width adjustment factor, $FC_W$ : 0,56 V/jam
Directional separator adjustment factor, $FC_{SP}$ : 1.00
Side Obstacles, $FC_{SF}$ : 1.01
City size adjustment factor, $FC_{CS}$ : 0.90
$C = Co \times FC_W \times FC_{SP} \times FC_{SF} \times FC_{CS}$
$C = 2900 \times 0.56 \times 1.00 \times 1.01 \times 0.90$
$C = 1476$ PCU/Hour

**Table 5 : Karanja Lembah Road Capacity**

| Hour (a.m) | Street Name | Co | FCw | FCsp | FCsf | FCcs | C |
|---|---|---|---|---|---|---|---|
| | | (V/h) | (V/h) | | | (V/h) | (PCU/h) |
| 08.45 - 09.45 | Karanja Lembah Road | 2900 | 0,56 | 1,00 | 1,00 | 0,90 | 1476 |

From the results of the calculation above, the capacity of the karanja Lembah road section is 1476 PCU/ hour.

### 3.1.6. Degree of Saturation

The degree of saturation is a comparison between traffic volume and road capacity. From the previous processed data, the volume and capacity of each road section have been obtained, namely Jalan Karanja Lembah for traffic volume taken on the same day and the same time period as the peak hour, which is Tuesday at 04:00 p.m – 05:00 p.m then to find out the degree of saturation using the Indonesian Road Capacity Manual (IHCM 1997) can be seen in the calculation and Table IV.5:

Calculation of the degree of saturation in the absence of activity of the karanja Lembah road

Q (traffic volume) = 966 PCU/hour
C (road capacity) = 1476 PCU/hour
DS = Q/C
DS = 966/1476
DS = 0,65

**Table 6 :** Saturation Degrees of Karanja Lembah Road

| Hour (a.m - p.m) | Street Name | Q (PCU/Hour) | C (PCU/Hour) | DS (Q/C) | Service Level (LOS) |
|---|---|---|---|---|---|
| 08.00 - 05.00 | Karaja lembah Road | 966 | 1476 | 0,65 | C |

Based on the results of the calculation of the degree of saturation above, the result of the saturation degree value of the Karanja Lembah Road section is 0.65. From these results, it can be seen that the Karanja Lembah Road section has a saturation value that is quite close to the maximum limit determined by IHCM 1997 (DS < 0.75), which means that the performance of the road section is still a stable limit and based on its service level (LOS) is categorized as C.

### 3.1.7. Warehousing Area

On Jalan Karanja Lembah there is the only largest Alfamidi Supermarket warehouse center in Palu City that serves all Alfamidi Supermarkets in Palu City, where this warehousing has operating hours from 08:00 a.m – 05:00 p.m so that with this warehousing activity vehicles operating in and out of the warehousing area can interfere with the performance of the Karanja Lembah road section in this case we can see the results of surveys that have been carried out on operating vehicles working hours. This warehousing can be said to operate very actively because it is not uncommon for drivers to return to warehousing beyond the operational hours limit to meet other alfamidi needs so that this warehousing can affect the performance of the Karanja Lembah roads section.

**Table 7 : Entry/Exit Vehicles operating in warehousing (Vehincle/Hour)**

| No | Time | Car | | Total (Vehincle /hour) |
|---|---|---|---|---|
| | | Perating in warehouse | | |
| | | Enter | Out | |
| 1 | 08:00 (a.m) - 09:00 (a.m) | **2** | 0 | 2 |
| 2 | 09:00 (a.m) - 10:00 (a.m) | 0 | 0 | 0 |
| 3 | 10:00 (a.m) - 11:00 (a.m) | 2 | 1 | 3 |
| 4 | 11:00 (a.m) - 12:00 (a.m) | 3 | 4 | 7 |
| 5 | 12:00 (p.m) - 01:00 (p.m) | 0 | 2 | 2 |
| 6 | 01:00 (p.m) - 02:00 (p.m) | 2 | 0 | 2 |
| 7 | 02:00 (p.m) - 03:00 (p.m) | 0 | **0** | 0 |
| 8 | 03:00 (p.m) - 04:00 (p.m) | 0 | 0 | 0 |
| 9 | 04:00 (p.m) - 05:00 (p.m) | 0 | 0 | 0 |
| TOTAL | | | | **16** |

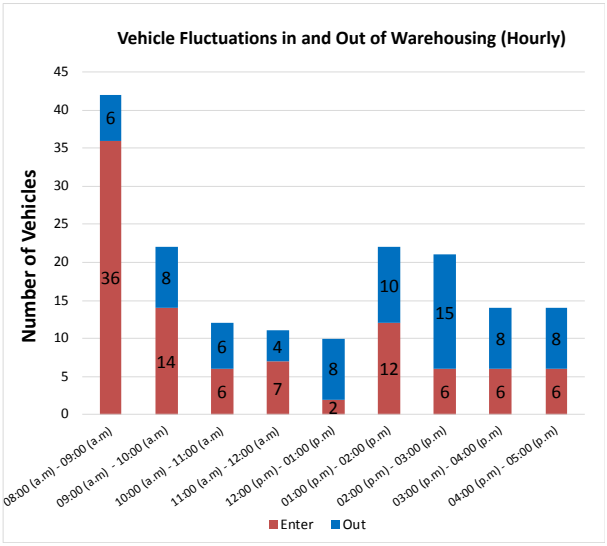



**Figure 4 : Vehicle Fluctuations Warehousing In/Out (Hourly)**

From Table 7 and Figure 4 we can see the fluctuations of vehicles operating in the warehousing center are quite active both incoming and outgoing vehicles where from the results of this survey it is found that the highest peak hours of car arrivals occur at 08:00 a.m – 09:00 a.m with a total of 36 units of incoming vehicles, while the highest peak hours for outgoing vehicles occur at 02:00 p.m -03:00 p.m with a total of 15 units of vehicles leaving the warehousing area. Thus, the number of vehicles operating can certainly cause a slowdown on the Karanja Lembah roads precisely in front of the warehousing center when there are vehicles operating in and out of the warehouse to operate during working hours.

3.15.1 **Parked**

Alfamidi DC Karanja Lembah Palu City provides a large enough parking area that can accommodate two-wheeled and four-wheeled vehicles. In this survey conducted at the peak hour of the processed data, namely at 04:00 p.m -05:00 p.m The data taken in the parking survey on Tuesday at peak hours are vehicles parked in front of Alfamidi both two-wheeled and four-wheeled. The following is the data from the parking survey in the Alfamidi Dc Karanja Lembah Supermarket area:

**Table 8 : Vehicle Parking at Alfamidi Supermarkets**

| Day | Hour (p.m) | Motor | Car | Total |
|---|---|---|---|---|
| Tuesday | 04:00 - 05:00 | 14 | 12 | 26 |

From the results of the survey conducted, it was found that the number of two-wheeled vehicles amounted to 14 units while four-wheeled vehicles as many as 12 units if added up in PCU/ hour got 26 units, from these results we can know that in peak hours two-wheeled vehicles stop more to shop at Alfamidi supermarkets compared to four-wheeled vehicles. To see in graphic form can be seen in the picture below:

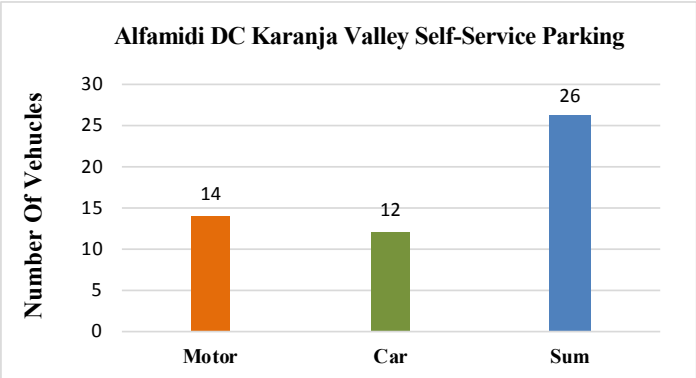
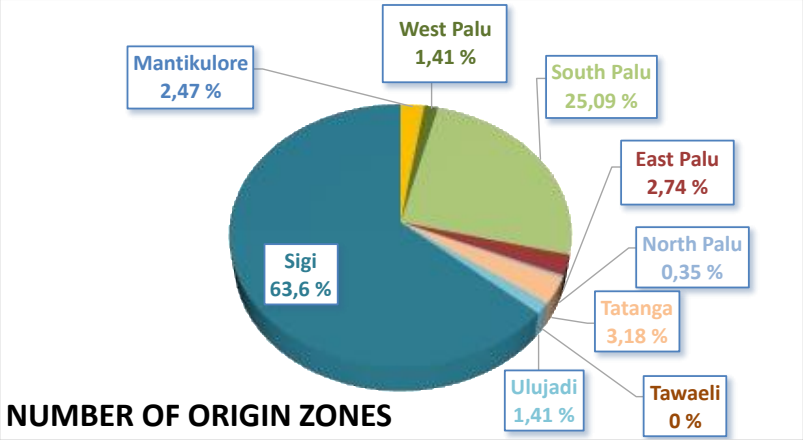



**Figure 5 :** Alfamidi DC Karanja Lembah Self-Service Parking

From the picture above we can see a comparison of the two types of vehicles, from the graph above states that two-wheeled vehicles are higher than four-wheeled vehicles. From the results of this survey we can find out that the parking lot provided by supermarkets is able to accommodate vehicles that stop to shop so as to reduce congestion and vehicle slowdown when there are people who want to singga to shop. In this case, a parking survey has been carried out at peak hours on the results of traffic surveys that have been carried out previously so that we can see the results of this survey how long *the duration of customer* parking when shopping at Alfamidi Supermarket.

3.1.9 Desire Line

To facilitate the reading of the pattern of pulling and rising vehicles/people to Alfamidi Dc. Karanja Lembah supermarkets, a *desire line* was made. The reading of the number of movement patterns is distinguished by the thickness of the line on the desire line. The thicker the line, the greater the movement, the value of movement is represented in the legend of the available image which has been scalized according to the thickness and amount of movement. This survey was conducted by providing a questionnaire sheet to Alfamidi Supermarket customers who want to shop, in the format of a questionnaire they can fill in several questions asked including their domicile so that from the address of origin the customer journey can be described through this desireline to see customer travel patterns, following the survey results on Tuesday, July 11, 2023 at 08:00 a.m – 05:00 p.m. Here we can see the number of arrival origin zones.




**Picture 6 :** Number of arrivals from each sub-district

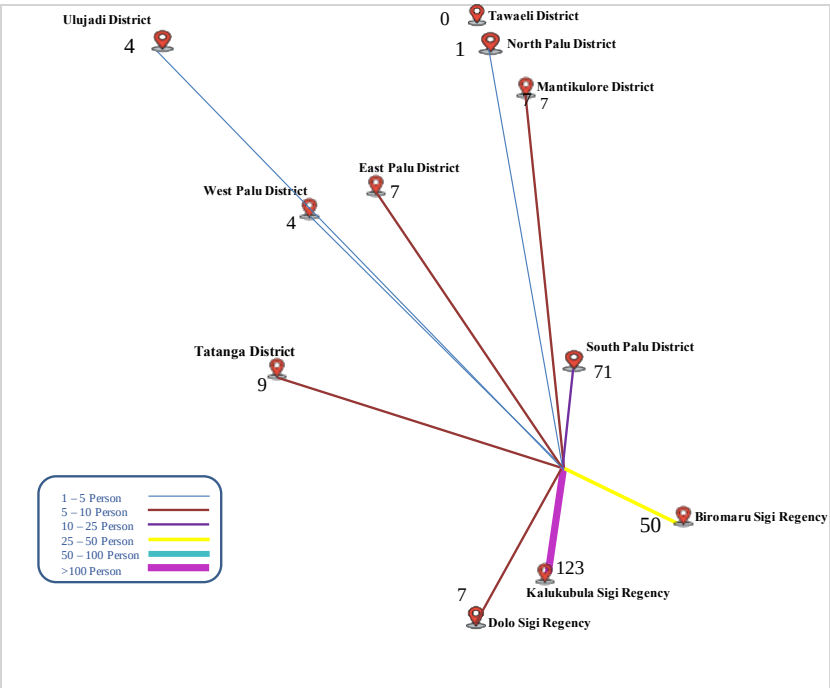



**Figure 7 :** Desire Line Origin Zone *of Customer* Journey

From figure 8 and figure 9 above, we can see the origin zone of *customer* travel based on sub-district, from the results of this survey is illustrated through the thickness of the line drawn from the origin of the sub-district to Alfamidi Supermarket so that it is clear from which sub-district dominates the journey to Alfamidi Dc.Karanja Lembah Supermarket. From this result, it is also clear that the highest number of visitors came from Sigi Biromaru Regency with 180 people, while the highest arrival from within the city of Palu came from South Palu district with 71 people. The sub-district that did not visit Alfamidi Supermarket at all when we surveyed was Tawaeli sub-district.

## IV. CONCLUSION

From the results of the analysis and discussion that has been carried out by the researcher, it can be concluded as follows

1. The saturation degree value (DS) on the Karanja Lembah Road section is 0.65 with the level of road service (LOS) categorized as C (still Stable limit) with the average speed of vehicles passing for motorcycles, pickups, approximately the same in the range of 19 Vehicle/Hour, for private cars and trucks have a lower speed compared to other vehicles with their respective speeds for private cars of 15.05 Vehicle/Hour and for trucks of 15.05 Vehicle/Hour and for trucks of 19 Vehicle/Hour 16.65 Vehicle/Hour. However, for Angkot vehicles during peak hours, no one crosses the Karanja Lembah roads, so the speed data for Angkot is 0 (zero) or none
2. The highest origin zone of visitors to Alfamidi DC Karanja Lembah is from Sigi Biromaru Regency with a total of 180 people, while the highest visitors from Palu City are from South Palu District with a total of 71 people.

## BIBLIOGRAPHY

[1]. Tamin, O. Z. (2000). Perencanaan dan pemodelan transportasi: Penerbit ITBUli, H. (1999). *Analisis Ability to Pay dan Willingnes to pay* Tarif Angkutan Kota (Studi Kasus: Kotamadya Medan). Tesis Magister, Pasca Sarjana, Institut Teknologi Bandung.
[2]. Morlok Edward, K. (1991). Pengantar Teknik dan Perencanaan Transportasi. Jurnal Erlangga,Jakarta.
[3]. Direktorat Jenderal Bina Marga (1997) Manual Kapasitas Jalan Indonesia. Jakarta.