GENERATION AND ATRACTION TRAVEL IN BOGOR DISTRICT

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ABSTRACT

Cibungbulang District has 32.66 km^2 area with 15 villages, Ciampea District has 51.06 km^2 area with 13 villages, Dramaga District has 24.47 km^2 area with 10 villages, and Ranca Bungur District 21.68 km^2 area with 15 villages are conterminal districts to Kota Bogor, and are crossed by the main road that connects between West Java Province and Banten Province. The increase of movement in and out of this area affects the number of movements and also the trip generation and trip attraction caused in the four districts such as education centers, offices, hospitals and recreation places. Conduct a Traffic counting survey on the main road sections that begin to be processed based on MKJI 2017 methode. Also using Trip Generation Manual, describe the number of trip generation and trip attraction to MAT. Then, modeled into SATURN Software. So that, the research results are 9,522 trip/hour trip generation with 382,504 smp/hour trip attraction. And has Level of Service on A-F with B level average. This proves the need for improvement and equitable distribution of infrastructure and facilities, traffic infrastructure. And to realize alternative roads and mass transportation

Key word: trip generation; trip attraction; MAT; transportation.

INTRODUCTION

The current high development, especially in Bogor Regency, has also resulted in the high demand for transportation which is a must to be fulfilled

Cibungbulang Subdistrict, Ciampea Subdistrict, Dramaga Subdistrict, and Ranca Bungur Subdistrict are sub-districts that are directly adjacent to Bogor City, and are crossed by the main road connecting West Java Province with Banten Province. Each district has an area of 32.66 km^2 with a population of 133.845 people/km^2 in Cibungbulang District. 51.06 km^2 with a population of 160.487 people/km^2 in Ciampea District. Meanwhile, 24.47 km2 with a population of 111,119 people/km^2 in Dramaga District and an area of 21.68 km^2 with a population of 54,260 people/km^2 in Ranca Bungur District (Bogor Regency in Figures 2018). In this research area, one of the best universities in Indonesia has also been built, hospitals, markets, to natural and family tourism destinations. Thus, it causes a movement of the awakening and attraction of the journey of people and goods which is expected to cause several problems, especially in the decline in road performance (Badan Pusat Statistik Kabupaten Bogor, 2018); (Badan Pusat Statistik Kabupaten Bogor, 2018a); (Badan Pusat Statistik Kabupaten Bogor, 2018b); (Badan Pusat Statistik Kabupaten Bogor, 2018c); (Badan Pusat Statistik Kabupaten Bogor, 2018d); (Dinas Kabupaten Bogor, 2018); (Direktorat Jenderal Pelayanan Kesehatan, 2018); (Direktorat Jenderal Pendidikan Dasar dn Mennegah, 2015) (IPB University, 2014).

The movement of the awakening

Movement generation is a modeling stage that estimates the amount of movement originating from a zone or land use and the amount of movement attracted to a land use or zone. Traffic movement is a land use function that produces traffic movements (Mecky.R.E.M, Theo.KS, 2011); (Prasetyo.W.H,2018); (Silvia.S., 199); (Suriyadi.RA, Azmeri, 2017); (Tamin, 2000). This traffic generation includes:

1) Traffic leaving a location

2) Traffic to or from a location

The output from the calculation of traffic generation and attraction is the number of vehicles, people, or goods per unit of time, for example vehicles/hour.

A person's journey is influenced by a need, a need is someone's guidance in traveling. People travel either using motorized vehicles or non-motorized vehicles. Using a motorized vehicle affects the importance of traveling. This need will support daily activities, whether traveling or not. So that motorized vehicles are very useful so that they can be categorized as vehicles as a necessity (M.Mubarak, et.al, 2020); (S.Syaiful, A.Fadly, 2020); (Thamrin, Syaiful, 2016).

The distribution of movements

The goal of moving within an area will cause problems, such as congestion, air pollution, noise, delays and so on. One way to be able to find solutions to these problems is to understand the current and future movement patterns. Understanding patterns can be identified by searching data about the origin and destination of movements, the magnitude of the movements, and when the movements occur.

Origin Destination Matrix (MAT)

MAT is a matrix of origin and destination which contains information about the magnitude of movement between zones within a certain area. In this case, the Tid notation states the amount of movement flow (vehicles, passengers, and goods) moving from origin zone i to destination zone d during a certain time interval.

Degre of saturation

The value of the degree of saturation or Volume Capacity Ratio (VCR) for roads is obtained based on the analysis of traffic volume divided by road capacity. To obtain road and intersection capacity, geometric measurements of existing roads and intersections are required. Furthermore, the amount of traffic volume in the coming period will be calculated based on traffic forecasting analysis. The amount of the traffic growth factor is based on the growth rate of vehicles.

Table 1. Vehicle growth rate.

Service level	City Size Factor FVBUK	Scope Limit V/C
A	Free traffic flow conditions with high speed and low traffic volume	0,00 – 0,20
B	The flow is stable, but the operating speed is starting to be limited by traffic conditions	0,20 – 0,44
C	The current is stable, but the speed and motion of the vehicle are controlled	0,45 – 0,74
D	The current is close to stable, the speed can still be controlled, V / C can still be tolerated	0,75 – 0.84
E	Flow unstable speed sometimes stops, demand is close to capacity	0,85 – 1,00
F	Forced flow, low speed, volume over capacity, long queue (jammed)	$\geq 1,00$

(Source: MKJI, 2017)

**Simulation and Assignment of Traffic on Urban Road Network (SATURN)**

SATURN (Simulation and Assignment of Traffic on Urban Road Network) is a computer software developed by the Institute of Transport Studies, University of Leeds.

SATURN can also function as both a loading model and a pure intersection simulation model. SATURN is also equipped with other standard loading models, such as Generalized Cost, All or Nothing, Wardrop Balance, Burrel Multi-Route Loading (SUE), and others. SATURN can also be used to estimate the trip matrix using traffic flow data or update an existing matrix, as part of an external iteration using the output of the last loading in the iteration process.

RESEARCH METHODS
Executing Place
The research locations are located on main roads, education centers, office buildings, recreation and tourism areas, economic and health centers located in the four study areas.
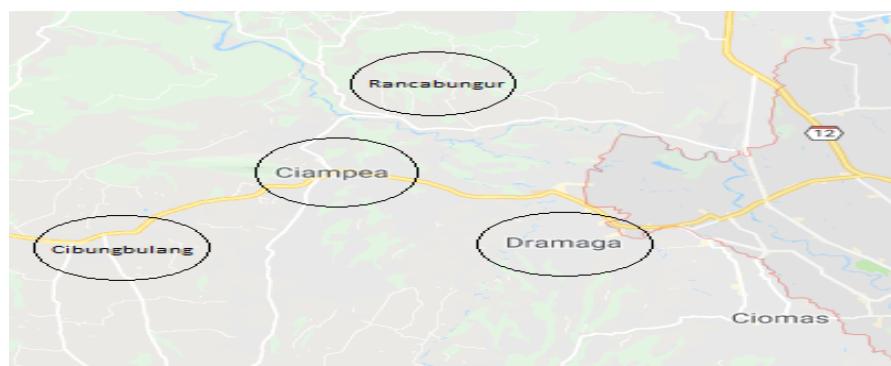
Figure 1. Study area (Google Maps, 2019)

Research time
Time The research was carried out at peak hours based on daily traffic habits through Google Maps.

Materials and tools
1) The materials needed in this study are primary and secondary data obtained from the analysis and related agencies in the form of growth data for Bogor Regency, existing conditions in Bogor Regency, and RTRW Map data for Bogor Regency.
2) The tools needed consist of: Traffic Counting questionnaire form, stationery, counting, a computer for data processing, and a printer, A4 paper as a print out of the planning results.

Procedure
The way this research works is described based on the stages that have been designed in the research flow diagram shown in Figure 2 below.
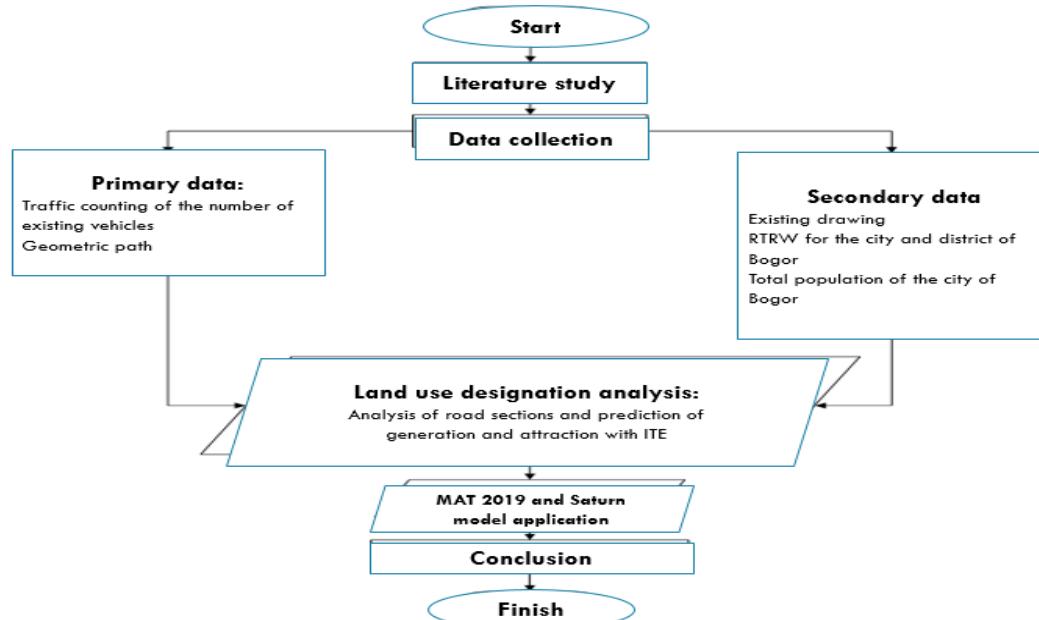
Figure 2. Flow Chart (Analysis results)

RESULTS AND DISCUSSION
Existing Condition of the Study Area
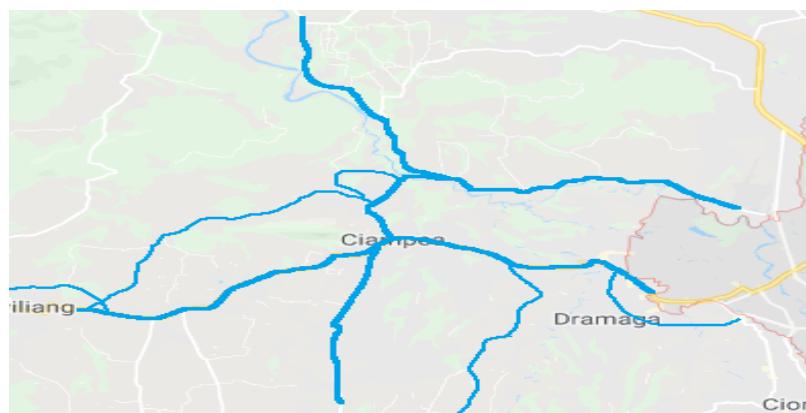
Figure 3. Location of Traffic Counting and Generation Prediction (Google Maps, 2019)

The categories of road functions in the study area based on the 2016 RTRW of Bogor Regency are shown in Table 2.

Table 2. Road Section Identification

No	Road name	Road type	The width of roads	Road function
1	Jl. Leuwiliang Bogor	2/2 TT	7 m	Primary Collector I
2	Jl. Baru Galuga	2/2 TT	8 m	Secondary Artery
3	Jl. Raya Galuga	2/2 TT	6 m	Secondary Collecto I

No	Road name	Road type	The width of roads	Road function
4	Jl. Lapangan Tembak	2/2 TT	5 m	Secondary Collecto I
5	Jl. Leuwiliang Bogor (Ciampea)	2/2 TT	7 m	Primary Collector I
6	Jl. Letnan Sukarna	2/2 TT	6 m	Secondary Collector I
7	Jl. Cikampak-Cicadas	2/2 TT	5 m	Secondary Collector I
8	Jl. Cihideung Ilir	2/2 TT	4 m	Secondary Collector I
9	Jl. Cihideung Udik	2/2 TT	4 m	Secondary Collector I
10	Jl. Purnawarman	2/2 TT	4 m	Secondary Collector I
11	Jl. Lapangan Tembak (Ciampea)	2/2 TT	5 m	Secondary Collector I
12	Jl. Leuwiliang Bogor (Jl. Raya Dramaga)	2/2 TT	7 m	Primary Collector I
13	Jl. Lingkar Laladon	2/2 TT	14 m	Secondary Artery
14	Jl. H. Miing	2/2 TT	8 m	Secondary Collector I
15	Jl. Raya Cagak	2/2 TT	6 m	Secondary Collector I
16	Jl. Raya Rancabungur	2/2 TT	7 m	Secondary Collector I
17	Jl. Letkol Atang Sanjaya	2/2 TT	5 m	Secondary Collector I
18	Jl. Mekarsari	2/2 TT	5 m	Secondary Collector I

Source: Analysis Results

Vehicle surveys are carried out on road sections based on the 2016 RTRW of Bogor Regency which are then adjusted based on times of daily congestion on the Google Maps application. Which then counts the total volume and the total flow of the vehicle is calculated.

Table 3. Vehicle Volume Flow with Urban Road Classification in Dramaga District

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total Q Skr/hour
17:00-18:00	Jl. Leuwiliang-Bogor (Jl. Raya Dramaga)	B	1164	32	3	612	1811	1352.7
		T	2080	26	2	560	2668	1841.8

(Source: Analysis Results)

Flow of volume Jl. Laladon Circle to the west and east.

Table 4. Vehicle Volume Flow with Urban Outer Road Classification in

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total Q Skr/hour
15:00-16:00	Jl. Lingkar Laladon	B	492	4	0	104	600	404
		T	576	2	0	76	654	424

(Source: Analysis Results)

Flow of volume Jl. Leuwiliang Bogor (Ciampea) west and east.

Table 5. Vehicle Volume Flow with Urban Road Classification in Ciampea District

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total Q Skr/hour
07:00-08:00	Jl. Leuwiliang – Bogor (Ciampea	B	1728	12	0	472	2212	1523.2
		T	2948	8	8	560	3524	2348.8

(Source: Analysis Results)

Traffic volume in Ciampea Subdistrict, west and east, north and south.

Table 6. Vehicle Volume Flows with the Classification of Urban Outer Roads in Ciampea District

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total Q Skr/hour
08:00-09:00	Jl. Letnan Sukarna	U	1164	0	0	248	1412	946.4
		S	764	0	0	236	1000	694.4
10:00-11:00	Jl. Cihidueng Ilir	U	384	0	0	72	456	302.4
		S	448	0	0	64	512	332.8
11:00-12:00	Jl. Cihidueung Udik	U	244	0	0	12	256	158.4
		S	216	0	0	16	232	145.6
10:00-11:00	Jl. Lapangan Tembak (Ciampea)	U	492	0	0	48	540	343.2
		S	420	0	0	92	512	344
09:00-10:00	Jl. Purnawarman	B	328	0	0	112	440	308.8
		T	308	0	0	120	428	304.8
17:00-18:00	Jl. Cikampak – Cicadas	S	376	7	1	88	472	323.3
		U	332	2	1	44	379	246.9

(Source: Analysis Results)

Flow of volume Jl. Leuwiliang - Bogor (Cibungbulang) west and east.

Table 7. Vehicle Volume Flow with Urban Road Classification in Cibungbulang District

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total O Skr/hour
11:00 - 12:00	Jl. Leuwiliang – Bogor (Cibungbulang)	B	1520	0	4	460	1984	1377.2
		T	1360	4	4	400	1768	1226

(Source: Analysis Results)

Vehicle volume flow in Cibungbulang subdistrict to the west and east, north and south.

Table 8. Flow of Vehicle Volume with the Classification of Urban Outer Roads in Cibungbulang District

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total O Skr/hour
10:00-11:00	Jl. Baru Galuga	B	476	0	4	208	688	498.8
		T	416	2	0	216	634	468
15:00-16:00	Jl. Raya Galuga	U	368	0	0	80	466	311.6
		S	88	0	0	112	200	164.8
09:00-10:00	Jl. Lapangan Tembak (Cibungbulang)	B	332	0	0	100	432	299.2
		T	288	0	0	56	284	192.8

(Source: Analysis Results)

The flow of vehicle volume in Rancabungur District is west and east, north and south.

Table 9. Vehicle Volume Flow with Urban Outer Road Classification in Ranca Bungur District

Period	Road	Direction	SM	KBM	BB	KR	Volume	Total O Skr/hour
12:00-13:00	Jl. Raya Cagak	B	692	0	0	232	924	647.2
		T	880	0	0	216	1096	744
17:00-18:00	Jl. Raya Rancabungur	U	348	0	0	112	460	320.8
		S	380	0	0	108	488	336
16:00-17:00	Jl. Letkol Atang Sanjaya	B	1096	0	0	216	1312	873.6
		T	920	0	0	260	1180	812
10:00-11:00	Jl. Mekarsari	U	308	0	0	160	468	344.8
		S	244	0	0	76	320	222.4
09:00-10:00	Jl. H. Miing	U	360	0	0	92	452	308
		S	256	0	0	112	368	265.6

(Source: Analysis Results)

Road Speed and Capacity Calculation
The calculation of road speed and capacity in the study location is calculated based on the results of a road clarification survey which is then processed and adjusted based on the 2017 MKJI.

Speed Calculation
Vb = (Vbd + Vbl). Fvbhs. Fvbuk (1)

Table 10. Average Speed of Urban Road Classification Section

No	Road	VBD	VBL	FVBHS	FVBUK	VB Skr/hour
1	Jl. Raya Bogor - Leuwiliang (Cibubulang)	42	0	0.93	1.03	40.23
2	Jl. Raya Bogor - Leuwiliang (Ciampea)	42	0	0.93	1.03	40.23
3	Jl. Raya Bogor - Leuwiliang (Dramaga)	42	3	0.93	1.03	43.11

(Source: Analysis Results)

Vb = (Vbd + Fvb-W). Fvb-Hs.Fvb-Fj (2)

Table 11. Average Speed of Outer-Urban Road Classification Section

No	Road	VBD	VBL	FVBHS	FVB-FJ	VB km/hour
1	Jl. Raya Galuga	68	-3	0.96	0.98	61.15
2	Jl. Baru Galuga	68	-3	1	1	65
3	Jl. Lapangan Tembak	65	-3	1	1	62
4	Jl. Raya Cikampak- Cicadas	65	-11	0.91	0.98	48.16
5	Jl. Cihideung Ilir	65	-11	0.91	0.94	46.19
6	Jl. Cihideung Udik	61	-9	0.96	0.94	46.92
7	Jl. Raya Pasar Ciampea	68	-11	0.85	0.91	44.09
8	Jl. Purnawarman	61	-9	0.96	0.94	46.92
9	Jl. Lap. Tembak	61	-9	1	0.94	48.88
10	Jl. Lingkar Laladon	68	0	0.96	0.93	60.71
11	Jl. Raya Cagak	68	-3	0.91	0.93	55.01
12	Jl. Raya Rancabungur	61	0	0.96	0.93	54.46
13	Jl. Letkol Atang Sanjaya	68	-11	0.91	0.93	48.24
14	Jl. Mekarsari	65	-11	1	0.94	50.76
15	Jl. H. Miing	65	-3	1	0.94	58.28

(Source: Analysis Results)

The calculation of road capacity based on MKJI 2017 is stated in the following table:

C = C0 X Fclj X Fcpa X Fchs X Fcuk (3)

Table 12. Urban Road Capacity

No	Road	Co	FCLj	FCPA	FCHS	FCUK	C
1	Jl. Raya Bogor - Leuwiliang (Cibubulang)	2900	1	1	1.04	0.92	2774.72
2	Jl. Raya Bogor - Leuwiliang (Ciampea)	2900	1	1	1.04	0.92	2774.72
3	Jl. Raya Bogor - Leuwiliang (Dramaga)	2900	1.14	1	0.92	1.04	3163.18

(Source: Analysis Results)

C = C0 X Fclj X Fcpa X Fchs (4)

Table 13. Capacity of Outer Urban Roads

No	Road	Co	FCLi	FCPA	FCHS	C
1	Jl. Raya Galuga	3100	0.91	1	0.88	2482.48
2	Jl. Baru Galuga	3100	1.08	1	0.93	3113.64
3	Jl. Lapangan Tembak	3100	0.69	1	0.93	1989.27
4	Jl. Raya Cikampak- Cicadas	3100	0.69	1	0.84	1796.76
5	Jl. Cihideung Ilir	3100	0.69	1	0.84	1796.76
6	Jl. Cihideung Udik	3000	0.69	1	0.88	1821.6
7	Jl. Raya Pasar Ciampea	3100	0.91	1	0.8	2256.80
8	Jl. Purnawarman	3000	0.69	1	0.88	1821.60
9	Jl. Lap. Tembak	3100	0.69	1	0.93	1989.27
10	Jl Lingkar Laladon	3100	1	1	0.96	2976.00
11	Jl. Raya Cagak	3100	0.91	1	0.84	2369.64
12	Jl. Raya Rancabungur	3100	1	1	0.88	2728.00
13	Jl. Letkol Atang Sanjaya	3100	0.69	1	0.88	1882.32
14	Jl. Mekarsari	3100	0.69	1	0.93	1989.27
15	Jl. H. Miing	3100	0.91	1	0.93	2623.53

(Source: Analysis Results)

Existing Service Level
Existing Service Level (Level of Service, LoS) of roads in the Study Area in 2019

Table 14. Existing Service Levels of Study Areas in 2019

Roads	Type	The width of the road	skr/hour	c	VCR	LOS
JL. Leuwiliang Bogor (Cibungbulang)	2/2 TT	7 m	2603	2775	0.9	E
Jl. Baru Galuga	2/2 TT	8 m	967	3114	0.3	B
Jl. Raya galuga	2/2 TT	6 m	476	2482	0.2	A
Jl. Lap. Tembak	2/2 TT	5 m	492	1989	0.2	A
JL. Leuwiliang Bogor (Ciampea)	2/2 TT	7 m	3872	2775	1.4	F
Jl. Letnan Sukarna	2/2 TT	6 m	2492	2257	1.1	F
Jl. Cihidueng Ilir	2/2 TT	4 m	635	1797	0.4	B
Jl. Cihidueung Udik	2/2 TT	4 m	304	1822	0.2	A
Jl. Lap. Tembak (Ciampea)	2/2 TT	5 m	870	1989	0.4	B
Jl. Purnawarman	2/2 TT	4 m	741	1822	0.4	B
Jl. Cikampak-Cicadas	2/2 TT	5 m	712	1797	0.4	B
Jl. Raya Dramaga	2/2 TT	8 m	3195	3163	1.0	E
Jl. lingkar Laladon	2/2 TT	7 m	828	2728	0.3	B
Jl. Raya Cagak	2/2 TT	6 m	1706	2454	0.7	C
Jl. Raya Rancabungur	2/2 TT	7 m	802	2728	0.3	B
Jl. Letkol ATS	2/2 TT	5 m	1212	1882	0.6	C
Jl. Mekarsari	2/2 TT	5 m	678	1989	0.3	B
Jl. H. Miing	2/2 TT	6 m	697	2624	0.3	B

(Source: Analysis Results)

Prediction of Generation and Withdrawal Calculations in the Study Area
In the calculation of the generation, an assumption is made of the number of units and the area for each generation, including: schools, offices, apartments, hotels, hospitals to recreation areas in the study area. Furthermore, to get the total number of pcu / hour pulls, the assumption is that the proportion of vehicles is uniform with the traffic counting data which is changed based on the

vehicle coefficient on the MKJI. Estimation of generation and attraction using the Trip Generation ManualITE (Institute Transportation Engineers).

Table 15. Calculation of Generation and Withdrawal in Cibungbulang District

Description/ITE Code	Description/ITE Code	Units	Larges Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
SMA Taman Islam (Senior High School)	INSTITUTIONAL	KSF^2	3815	0.97	39.83
Pasar Saptu (Wholesale Market)	RETAIL	KSF^2	2750	0.88	26.05
Kantor Desa Situ Udik (Government Office)	OFFICE	KSF^2	370	1.21	4.82
SMPS Aulia (Junior High School)	INSTITUTIONAL	KSF^2	700	1.19	8.97
SMA Aulia (Senior High School)	INSTITUTIONAL	KSF^2	700	0.97	7.31
SMPS Mulia (Junior High School)	INSTITUTIONAL	KSF^2	32000	1.19	409.90
SMK Cahaya (Senior High School)	INSTITUTIONAL	KSF^2	5000	0.97	52.21
Taman Air, Gunung Handeleum (Athletic Club)	RECREATIONAL	KSF^2	10394	5.96	666.83
Kantor Desa Situ Ilir (Government Office)	OFFICE	KSF^2	350	1.21	4.56
SMP Ash-Sholihin (Junior High School)	INSTITUTIONAL	KSF^2	2047	1.19	26.22
SMPS Tahfizh Al-Basyir (Junior High School)	INSTITUTIONAL	KSF^2	1000	1.19	12.81
Kantor Desa Cibatok 2 (Government Office)	OFFICE	KSF^2	480	1.21	6.25
SMP Taruna Bhakti (Junior High School)	INSTITUTIONAL	KSF^2	3000	1.19	38.43
Kantor Desa Ciaruteun Udik (Government	OFFICE	KSF^2	295	1.21	3.84

Description/ITE Code	Description/ITE Code	Units	Larges Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
Office) SMAN 1 Cibungbulang (Senior High School)	INSTITUTIONAL	KSF^2	10000	0.97	104.41
SMK Bumi Sejahtera	INSTITUTIONAL	KSF^2	3565	0.97	37.22
Kantor Desa Cibatok 1 (Gouverment Office)	OFFICE	KSF^2	350	1.21	4.56
Kantor Desa Sukamaju (Government Office)	OFFICE	KSF^2	400	1.21	5.21
Pt. Puspa Damayanti (Utilities)	INDUSTRIAL	KSF^2	5880	0.76	48.10
Kantor Desa Cemplang (Government Office)	OFFICE	KSF^2	680	1.21	8.86
Pt. M&S Aparel (General Light Industrial)	INDUSTRIAL	KSF^2	33430	0.97	349
SMK Teknomedika 2 (Senior High School)	INSTITUTIONAL	KSF^2	1935	0.97	20.20
Kantor Desa Galuga (Government Office)	OFFICE	KSF^2	350	1.21	4.56
SMP PGRI Cibungbulang (Junior High School)	INSTITUTIONAL	KSF^2	1500	1.19	19.21
SMK Pertiwi Cibungbulang Bogor (Senior High School)	INSTITUTIONAL	KSF^2	8500	0.97	88.75
Kantor Desa Dukuh (Govermment Office)	OFFICE	KSF^2	350	1.21	4.56
SMPN 1 Cibungbulang (Junior High School)	INSTITUTIONAL	KSF^2	5768	1.19	73.89
SMPS Al Badariah (Junior	INSTITUTIONAL	KSF^2	2657	1.19	34.03

Description/ITE Code	Description/ITE Code	Units	Larges Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
High School) Kantor Kecamatan Cibungbulang (Government Office)	OFFICE	KSF^2	2170	1.21	28.26
Kantor Desa Cimanggu 2 (Goverment Office)	OFFICE	KSF^2	350	1.21	4.56
SMP Bumi Sejahtera (Junior High School)	INSTITUTIONAL	KSF^2	2400	1.19	30.74
SMA Bumi Sejahtera (Senior High School)	INSTITUTIONAL	KSF^2	2000	0.97	20.88
SMPS Islam Nurul Ihsan (Junior High School)	INSTITUTIONAL	KSF^2	3669	1.19	47.00
Lembah Pelangi (Regional Park)	RECREATIONAL	Acres	12.6	0.20	2.52
Kantor Desa Cimanggu 1 (Government Office)	OFFICE	KSF^2	400	1.21	5.21
SMPN 2 Cibungbulang (Junior High School)	INSTITUTIONAL	KSF^2	10300	1.19	131.94
SMK Matusha Dwi Elang (Senior High School)	INSTITUTIONAL	KSF^2	4369	0.97	45.62
SMK Pandu Bogor (Senior High School)	INSTITUTIONAL	KSF^2	17876	0.97	186.65
Kantor Desa Girimulya (Government Office)	OFFICE	KSF^2	350	1.21	4.56
Kantor Desa Leuweung Kolot (Government Office)	OFFICE	KSF^2	350	1.21	4.56
Kantor Desa Ciaruteun Ilir (Government Office)	OFFICE	KSF^2	700	1.21	9.12
Prasati Batu Tulis Ciaruteun	INSTITUTIONAL	KSF^2	2000	0.18	3.9

Description/ITE Code	Description/ITE Code	Units	Larges Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
(Museum) Prasasti Tapak Gajah (Museum)	INSTITUTIONAL	KSF^2	2040	0.18	3.95
Prasasti Muara Pasir (Museum)	INSTITUTIONAL	KSF^2	3400	0.18	6.59
SMPN 3 Cibungbulang (Junior High School)	INSTITUTIONAL	KSF^2	9994	1.19	128.02
Kantor Desa Cijujung (Governnment Office)	OFFICE	KSF^2	350	1.21	4.56
	Total				2770

(Source: Analysis Results)

The results of the analysis of the generation and pull calculations in Ciampea District are presented in the following table:

Table 16. Calculation of Generation and Withdrawal in Ciampea District

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
Pasar Selasa (Wholesale Market)	RETAIL	KSF^2	2420	0.88	22.92
Kantor Desa Ciampea Udik (Government Office)	OFFICE	KSF^2	700	1.21	9.12
SMP Madani (Junior High School)	INSTITUTIONAL	KSF^2	5000	1.19	64.05
SMK Madani (Senior High School)	INSTITUTIONAL	KSF^2	2000	0.97	20.88
Cakrawala Nuansa Nirwana (Athletic Club)	RECREATIONAL	KSF^2	16200	5.96	1039.31
Kantor Desa Cinangka (Government Office)	OFFICE	KSF^2	450	1.21	5.86
SMK Miftaahush Shuduur (Senior High School)	INSTITUTIONAL	KSF^2	20250	0.97	211.44
Kantor Desa Cibuntu	OFFICE	KSF^2	730	1.21	9.51

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
(Government Office) SMP Bumi Sejahtera Ciampea (Junior High School)	INSTITUTIONAL	KSF^2	3000	1.19	38.43
Kantor Desa Cicadas (Government Office)	OFFICE	KSF^2	810	1.21	10.55
Kp. Wisata Rumah Joglo (Horse Race Track)	RECREATIONAL	Acres	8.35	4.3	35.91
Kantor Desa Tegal Waru (Government Office)	OFFICE	KSF^2	260	1.21	3.39
Kantor Desa Bojong Jengkol (Gouverment Office)	OFFICE	KSF^2	630	1.21	8.21
PT. G&S (General Light Industrial)	INDUSTRIAL	KSF^2	11200	0.97	116.94
SMA Hanura (Senior High School)	INSTITUTIONAL	KSF^2	700	0.97	7.31
Kp. Wisata Cinangneng (Country Park)	RECREATIONAL	Acres	37.06	0.09	3.34
Kantor Desa Cihideung Udik (Government Office)	OFFICE	KSF^2	350	1.21	4.56
SMK Global Buana (Senior High School)	INSTITUTIONAL	KSF^2	13400	0.97	139.91
SMPS Darussolihin (Junior High School)	INSTITUTIONAL	KSF^2	1650	1.19	21.14
SMK Agri Insani (Senior High School)	INSTITUTIONAL	KSF^2	5035	0.97	52.57
SMK Farmasi Galenium (Senior High School)	INSTITUTIONAL	KSF^2	500	0.97	5.22
SMK Geo Informatika	INSTITUTIONAL	KSF^2	1824	0.97	19.04

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
(Senior High School) Dramaga Tower (Apartment)	LODGING	Units	2355	0.62	1460.1
Kantor Desa Cihideung Ilir (Government Office)	OFFICE	KSF^2	600	1.21	7.81
Kantor Desa Cibanteng (Government Office)	OFFICE	KSF^2	400	1.21	5.21
SMP Pelita Ciampea (Junior High School)	INSTITUTIONAL	KSF^2	9450	1.19	121.05
SMP Pgri Ciampea (Junior High School)	INSTITUTIONAL	KSF^2	1225	1.19	15.69
SMK Komputer Indonesia (Senior High School)	INSTITUTIONAL	KSF^2	650	0.97	6.79
SMK Pelita Ciampea (Senior High School)	INSTITUTIONAL	KSF^2	15600	0.97	162.88
SMK Pelita Ciampea 2 (Senior High School)	INSTITUTIONAL	KSF^2	5000	0.97	52.21
Kantor Kecamatan Ciampea (Government Office)	OFFICE	KSF^2	2450	1.21	31.91
Kantor Desa Bojongrangkas (Government Office)	OFFICE	KSF^2	450	1.21	5.86
SMA Negeri 1 Ciampea (Senior High School)	INSTITUTIONAL	KSF2	6099	0.97	63.68
Kantor Desa Cibadak (Government Office)	OFFICE	KSF2	300	1.21	3.91
Kantor Desa Benteng (Goverment Office)	OFFICE	KSF^2	350	1.21	4.56
SMK Bakti (Senior High	INSTITUTIONAL	KSF^2	1200	0.97	12.53

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
School) Yayasan Darulfalah (Senior High School)	INSTITUTIONAL	KSF^2	33000	0.97	344.56
SMPN 1 Ciampea (Junior High School)	INSTITUTIONAL	KSF^2	3308	1.19	42.37
Pasar Ciampea Indah (Wholesale Market)	RETAIL	KSF^2	29320	0.88	277.74
Pasar Lama Ciampea (Wholesale Market)	RETAIL	KSF^2	17000	0.88	161.03
Kantor Desa Ciampea (Goernment Office)	OFFICE	KSF^2	500	1.21	6.51
Total					4636

(Source: Analysis Results)

The results of the analysis of the generation and pull calculations in Dramaga District are presented in the following table:

Table 17. Calculation of Generation and Withdrawal in Dramaga District

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit of measure	Coefisien ITE	ITE Generation (trip/hour)
Kantor Desa Purwasari (Government Office)	OFFICE	KSF^2	1030	1.21	13.42
MTS Darul Fallah (Junior High School)	INSTITUTIONAL	KSF^2	2500	1.19	32.024
SMP Pgri Petir (Junior High School)	INSTITUTIONAL	KSF^2	1082	1.19	13.86
Kantor Desa Petir (Government Office)	OFFICE	KSF^2	1450	1.21	18.89
Kantor Desa Suka Damai (Government Office)	OFFICE	KSF^2	900	1.21	11.72
SMP Taman	INSTITUTIONAL	KSF^2	1000	1.19	12.81

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit of measure	Coefisien ITE	ITE Generation (trip/hour)
Manggah Dua (Junior High School) Kantor Desa Suka Wening (Government Office)	OFFICE	KSF^2	610	1.21	7.95
SMP Yafahi (Junior High School)	INSTITUTIONAL	KSF^2	1900	1.19	24.34
SMK Yafahi (Senior High School)	INSTITUTIONAL	KSF^2	1900	0.97	19.84
Kantor Desa Neglasari (Government Office)	OFFICE	KSF^2	550	1.21	7.16
SMK Globin (Senior High School)	INSTITUTIONAL	KSF^2	2400	0.97	25.06
Pasar Dramaga (Wholesale Market)	RETAIL	KSF^2	2760	0.88	26.14
Kantor Desa Sinarsari (Government Office)	OFFICE	KSF^2	400	1.21	5.21
Kantor Desa Ciherang (Government Office)	OFFICE	KSF^2	1050	1.21	13.68
SMPN 2 Dramaga (Junior High School)	INSTITUTIONAL	KSF^2	11000	1.19	140.90
SMA Negeri 1 Dramaga (Senior High School)	INSTITUTIONAL	KSF^2	14010	0.97	146.28
Rs. Karya Bhakti Pratiwi (Hospital)	INSTITUTIONAL	KSF^2	7455	0.93	74.63
Kantor Kecamatan Dramaga (Government Office)	OFFICE	KSF^2	2800	1.21	36.47
Mc Donald (Fast Food Restaurant Woth Drive Through Window)	SERVICES	KSF^2	450	33.84	163.92
Kantor Desa	OFFICE	KSF^2	1150	1.21	14.98

Description/ITE Code	Description/ITE Code	Units	Large Sqm/Unit of measure	Coefisien ITE	ITE Generation (trip/hour)
Dramaga (Gouverment Office) SMP Negeri 1 Dramaga (Junior High School)	INSTITUTIONAL	KSF^2	6740	1.19	86.34
SMA Kornita (Senior High School)	INSTITUTIONAL	KSF^2	5900	0.97	61.60
SMK Adi Sanggoro (Senior High School)	INSTITUTIONAL	KSF^2	7000	0.97	73.09
Universitas IPB (College)	INSTITUTIONAL	KSF^2	2670000	2.54	8.00
Hotel Duta Berlian (Hotel)	LODGING	ROOMS	90	0.6	54.00
Kantor Desa Babakan (Government Office)	OFFICE	KSF^2	1115	1.21	14.52
SMPIT Nurul Fajar (Junior High School)	INSTITUTIONAL	KSF^2	700	1.19	8.97
Kantor Desa Cikarawang (Government Office)	OFFICE	KSF^2	1180	1.21	15.37
Total					1131

(Source: Analysis Results)

The results of the analysis of the generation and pull calculations in Rancabungur District are presented in the following table:

Table18. Calculation of Generation and Withdrawal in Rancabungur District

Descriptio/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
Kantor Desa Mekarsari (Government Office)	OFFICE	KSF^2	740	1.21	9.64
Ponpes Rafah (School)	INSTITUTIONAL	KSF^2	14000	1.19	179.33
SMPN 1 Rancabungur (Junior High School)	INSTITUTIONAL	KSF^2	10000	1.19	128.09

Descriptio/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
SMP Purnawarman (Junior High School)	INSTITUTIONAL	KSF^2	3000	1.19	38.43
SMK Pembina Bangsa (Senior High School)	INSTITUTIONAL	KSF^2	30000	0.97	313.24
Kecamatan Rancabungur (Government Office)	OFFICE	KSF^2	1100	1.21	14.33
Kantor Desa Rancabungur (Government Office)	OFFICE	KSF^2	370	1.21	4.82
SMAN 1 Rancabungur (Senior High School)	INSTITUTIONAL	KSF^2	5390	0.97	56.28
Kantor Desa Pasir Gaok (Government Office)	OFFICE	KSF^2	300	1.21	3.91
Kantor Desa Bantar Jaya (Government Office)	OFFICE	KSF^2	870	1.21	11.33
SMK Makarya Bogor (Senior High School)	INSTITUTIONAL	KSF^2	2130	0.97	22.24
SMK Pelayaran Makarya 1 Bogor (Senior High School)	INSTITUTIONAL	KSF^2	2470	0.97	25.79
Kantor Desa Bantarsari (Government Office)	OFFICE	KSF^2	550	1.21	7.16
Kantor Desa Candali (Government Office)	OFFICE	KSF^2	415	1.21	5.41

Descriptio/ITE Code	Description/ITE Code	Units	Large Sqm/Unit Of measure	Coefisien ITE	ITE Generation (trip/hour)
SMPS Cimulang (Junior High School)	INSTITUTIONAL	KSF^2	2000	1.19	25.62
SMK Al Furqon (Senior High School)	INSTITUTIONAL	KSF^2	10200	0.97	106.50
SMK Makarya 2 Bogor (Senior High School)	INSTITUTIONAL	KSF^2	2470	0.97	25.79
Kantor Desa Cimulang (Government Office)	OFFICE	KSF^2	520	1.21	6.77
		Total			985

(Source: Analysis Results)

Study Zone Conditions and MAT 2019
Forty five zones in the four study sub-districts were observed based on the administrative division of the kelurahan.

Table 19. Calculation of Generation and Withdrawal in Rancabungur District

Zona	Kelurahan	Sub-District
1	Situ Udik	
2	Situ Ilir	
3	Cibatok 2	
4	Ciaruten Udik	
5	Cibatok 1	
6	Sukamaju	
7	Cemplang	
8	Galuga	Cibungbulang
9	Dukuh	
10	Cimanggu 2	
11	Cimanggu 1	
12	Girimulya	
13	Leuweung Kolot	
14	Ciaruten Ilir	
15	Cijujung	
16	Ciampea Udik	
17	Cinangka	
18	Cibuntu	
19	Cicadas	
20	Tegal Waru	
21	Bojong Jengkol	Ciampea
22	Cihideung Udik	
23	Cihideung Ilir	
24	Cibanteng	
25	Bojong Rangkas	

Zona	Kelurahan	Sub-District
26	Cibadak	
27	Benteng	
28	Ciampea	
29	Purwasari	
30	Petir	
31	Sukadamai	
32	Sukawening	
33	Neglasari	Dramaga
34	Sinarsari	
35	Ciherang	
36	Dramaga	
37	Babakan	
38	Cikarawang	
39	Mekarsari	
40	Rancabungur	
41	Pasir Gaok	
42	Bantarjaya	Ranca Bungur
43	Bantarsari	
44	Candali	
45	Cimulang	

Source: Survey Results

The results of the existing 2019 Origin Destination Matrix for the 4 sub-district study areas are shown in the following table:

Table 20. MAT Existing Study Area 2019

(Source: Analysis Results)

Road Network Modeling in the 4 sub-district study locations is shown in the following Figure:
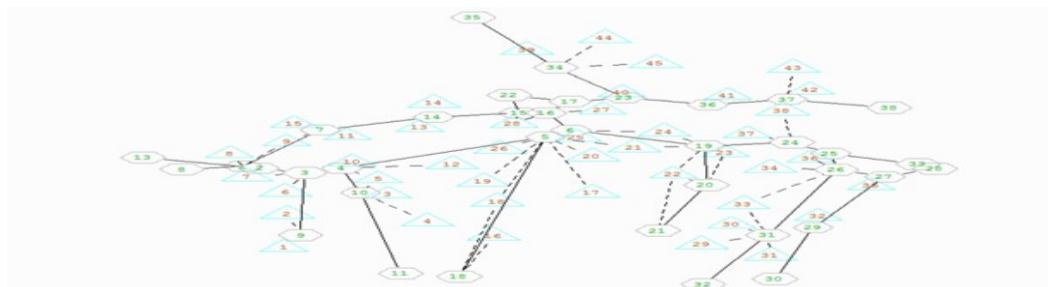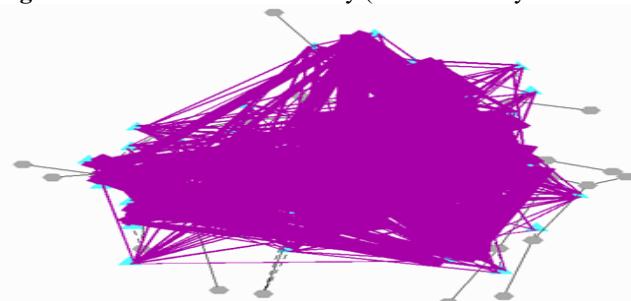

Figure 4. Road Network for the Study Location (Source: Analysis Results)

The following is a picture of the road loading (VCR Variable Intensity) of the study location
.
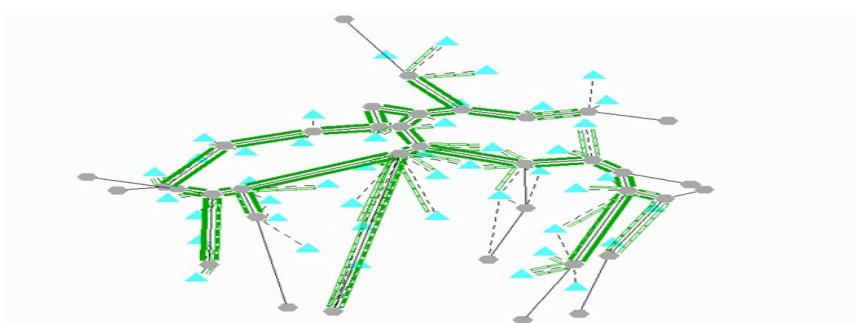
Figure 5. VCR Variable Intensity (Source: Analysis Results)

Figure 6. The Pattern of Generation and Withdrawal of the Existing 2019 Study Sites (Source: Analysis Results)

The origin-destination matrix is charged to the road network and calibrated to obtain rsq for the design of the transportation modeling equation in the four study districts, namely Y = 2310.06 + 273.16 (X) which is presented in the following figure:
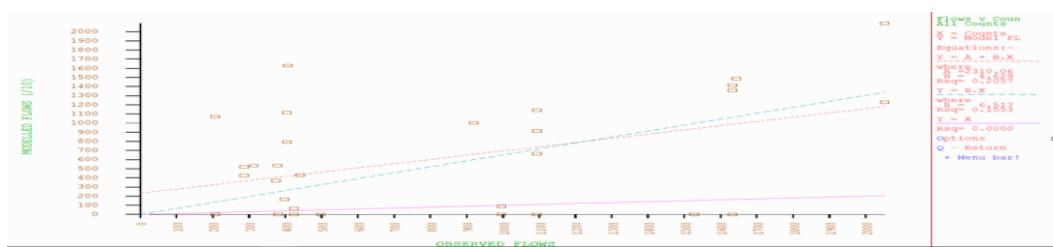
Figure 7. Calibration Results of the 2019 Study Location Network (Source: Analysis Results)

CONCLUSION

Based on the results and discussion that have been described, the following conclusions can be drawn, the existing condition of the road network in the study area shows that the LoS is in the range A to F. service for vulnerable E and F, while other roads in the study area have an average service level value for vulnerable B. This occurs as a result of greater movement in the main road corridor. The number of awakening and withdrawals in the education area, hospital, offices and trade/shopping areas in Cibungbulang District, Ciampea District, Drama District and Rancabungur District is 9,522 trips/hour with an attraction of 382,504 pcu/hour. The design of the transportation modeling equation in the four study districts, namely Y = 2310.06 + 273.16 (X).

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