Analysis Study of Oriented Area Development Plan in Sukaresmi Area (Case Study: Sukaresmi Bogor, West Java Province)

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ABSTRACT

Several cities in Indonesia have implemented a Transit Oriented Zone system in integrating a sustainable transportation system, the area at the Sukaresmi point has become one of the areas developed with the Transit Oriented Development (TOD) concept in the Presidential Regulation of the Republic of Indonesia Number 55 of 2018 concerning the Plan Main Transportation Jakarta, Bogor, Depok Tangerang and Bekasi in 2018-2029. The development of this area will generate new movements in the surrounding road network. Of course, it will have a negative impact on the surrounding traffic. The negative impacts include an increase in the volume of traffic flow which can cause congestion, pollution, accidents, and other things that cannot be avoided on roads in the area where there is no traffic management arrangement around the area, it is necessary to conduct a study on traffic impact analysis. and analysis of generation and pull, the performance of roads in the operation stage in 2024, the development of the sukaresmi area has a total of 37.316 m2. With traffic engineering to minimize congestion due to area development plans. From the analysis result, the basic building coefficient is 70%, the building floor coefficient is 4.98. In the existing conditions, the highway has a saturation level of > 1. The generation and pull that occurs is 1240 cur/hour. Whereas the operation stage, the road saturation level becomes > 1. Recommendations given are the provision of safe public transportation facilities, realizing the importance of road traffic and road transportation and a study of land ownership around the Sukaresmi-oriented development plan is needed.

Keywords: Transit Oriented Development (TOD); traffic impact analysis; road; transportation; land.

INTRODUCTION

Transit Oriented Development also supports the use of sustainable modes of transportation such as public transportation, walking and cycling, as well as reducing travel distances that will reduce existing traffic congestion. With the development plan in this area, it will generate a new movement generation in the surrounding road network, of course, will have a negative impact on existing traffic, this negative impact can include an increase in the volume of traffic flow that can cause congestion, pollution, accidents, and other things others that cannot be avoided.

Traffic Management and Engineering

Traffic management and engineering is a series of businesses and activities that include planning, procurement, installation, regulation and maintenance of road equipment facilities in the context of realizing, supporting and maintaining traffic security, safety, order and smoothness (Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 96 of 2015)

Trip and Generation

The definition of movement generation according to Ofyar Z Tamin is a modeling stage that estimates the number of movements originating from a zone or land use and the number of movements attracted to a land use or zone. Traffic movement is a land use function that produces traffic movements. This traffic generation includes:

a. Traffic leaving a location and
b. Traffic leading to or arriving at a location.

Traffic Impact Analysis

Traffic impact analysis is a series of study activities regarding the traffic impact of the construction of activity centers, settlements and infrastructure which will cause disturbances in security, safety, order and smoothness of traffic and transportation, the results of which are set forth in the form of documents resulting from traffic impact analysis (Ministerial Regulation Republic of Indonesia Transportation Number PM 75 of 2015)

Transit Oriented Development

According to Peter Calthrope (1993) the definition of Transit Oriented Development (TOD) is a mixed-used building community that encourages people to live and have activities in areas that have public transportation facilities and reduce the habit of people driving private cars. Therefore, Transit Oriented Development must be in the form of mixed land use or mixed-use because the existence of public transportation in mixed use areas will have direct implications for the level of activity in the area.

Pattern of travel of people from one place to another

In road traffic planning, what needs to be considered is the compatibility between planning and supervision in the form of a basic concept. This concept is very dependent on activities that determine the appropriate steps in the behavior of motorized vehicle drivers (Ganda CF et.al, 2019; Karimah H, Akbardin J, 2019; Syaiful S et.al, 2022; Syaiful S et.al, 2022). The driver of this vehicle really depends on the purpose of the trip. This goal adjusts to a clear form in terms of activities as previously planned (Syaiful S, Rusfana H, 2022; Syaiful S, Pratama Y, 2019; Syaiful S, Hariyadi D, 2019; Syaiful S et.al, 2020). A person's journey depends on the strength that is exercised at the time of travel. A well-scheduled trip will create a sense of comfort while traveling. So that the right form can be carried out properly and directed. In accordance with the concept of travel in carrying out each activity (Syaiful S, Fadly A, 2020; Syaiful S et.al, 2021; Syaiful S et.al, 2023). Very diverse travel patterns will create a basic concept in calculating the number of people traveling. The number of trips that must be used by each person in making the trip according to a clear form in a very suitable form. Each travel activity can form a very directed pattern (Syaiful S et.al, 2023).

RESEARCH METHODS

The location of the research was carried out in an area-oriented development plan in the Sukaresmi area in Tanah Sereal District, Bogor City, the traffic assessment analysis was estimated at a radius of 1-2 km from the area based on traffic impact guidelines.
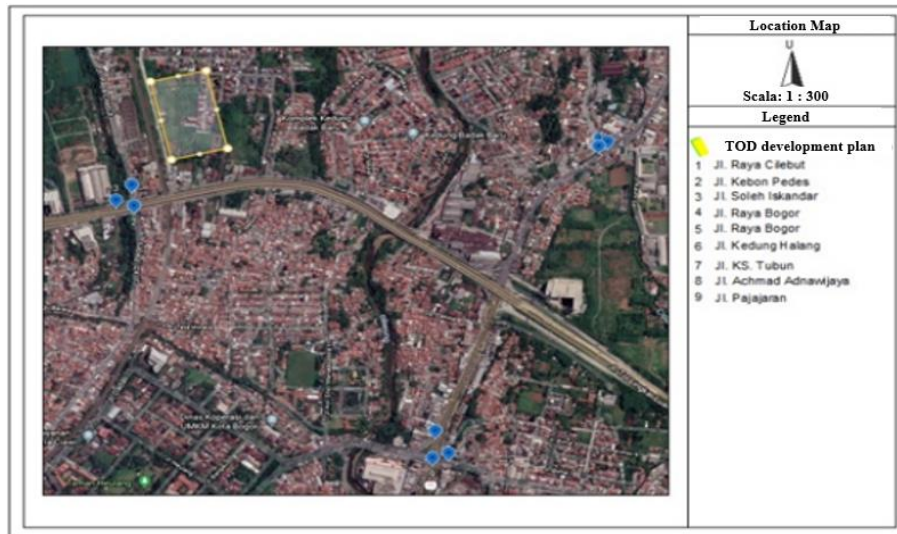
Figure 1. Research Location Source: Google Earth

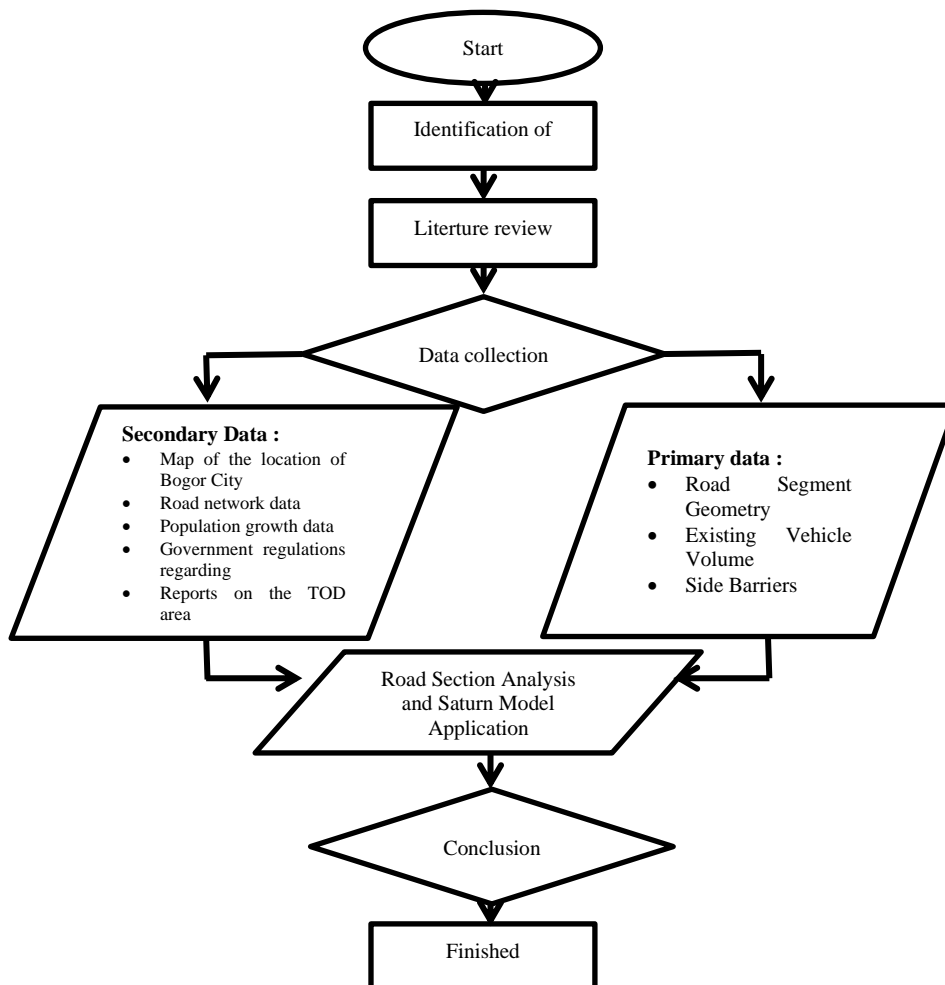The stages of this research are shown in the research flow diagram shown in Figure 2 as follows:

Figure 2. Research Flowchart

RESULTS AND DISCUSSION
Land Use

This area has a land area of about 37,316 m2 and in this area there is also a plan to build a residential area, commercial area, parking building, green open space and roads.

Table 1. Land Use of the Sukaresmi TOD Area

Planning Area Area	Zona	Amenities		Land area (Sqm)
37.316	Residential A	Apartement		7.993
	Residential B	Apartement		5.329
	Commercial A		Hotel	3.108
			Shopping Center	1.332
	Commercial B		Shop house	888
			General Office Building	3.552
	Residential Parking Building			2.351
	Commercial Parking Building			1.567
Sub- Total				**26.121**
RTH				3.732
Road				7.463
Total amount				**37.316**

Source: Analysis results

Basic Building Coefficient (KDB)

The TOD Sukaresmi area includes the Sub-City TOD-City Service Sub-District. The following table shows the results of the analysis of the Basic Building Coefficient (KDB) based on the Regulation of the Minister of Agrarian Affairs and Spatial Planning / Head of the National Land Agency Number 16 No. 17 of 2017.

Table 2. Basic Coefficient of Building (KDB)

Planning Area Area	Zona	Amenities	Building footprint	
			Land area (Sqm)	KDB (%)
37.316	Residential A	Apartement	7.993	21%
	Residential B	Apartement	5.329	14%
	Commercial A	Hotel	3.108	8%
		Shopping Center	1.332	4%
	Commercial B	Shops house	888	2%
		General Office Building	3.552	10%
	Residential Parking Building		2.351	6%
	Commercial Parking Building		1.567	4%
Sub- Total			26.121	70%
RTH			3.732	10%
Road			7.463	20%
Total amount			**37.316**	**100%**

Source: Analysis results

Building Floor Coefficient (KLB)

The following table shows the results of the analysis of the Building Floor Coefficient (KLB) based on the Regulation of the Minister of Agrarian Affairs and Spatial Planning / Head of the National Land Agency Number 16 No. 17 of 2017.

Table 3. Building Floor Coefficient (KLB)

Planning Area Area	Zona	Amenities	Building footprint		Building floors				
			Land area (Sqm)	Number floors	Sub - Total Floor Area (Sqm)	KLB	Nett Saleable Area	Unit / Room	
37.316	Residential A	Apartement	7.993	10	79.931	2,14	59.948	2.398	
	Residential B	Apartement	5.329	10	53.287	1,43	39.965	1.599	
	Commercial A	Hotel	3.108	8	24.867	0,67	18.651	789	
		Shopping Center	1.332	3	3.997	0,11	2.398	160	
	Commercial B	Shops house	888	2	1.776	0,05	1.066	30	
		General Office Building	3.552	4	14.210	0,38	8.526	568	
	Residential Parking Building		2.351	2	4.702	0,13	2.821	-	
	Commercial Parking Building		1.567	2	3.135	0,08	1.881	-	
	Sub- Total		**26.121**			**4,98**			

Source: Analysis results

Geometric Paths

Based on direct observations, measurements, and documentation that have been carried out on traffic infrastructure in the form of geometrical existing roads, the road sections are geometrically shown in Table 4.

Table 4. Geometric road sections

No.	Street name	Street type	Length street	Street function
1	Jalan Raya Bogor	4/2T	14,55	Jalan Arteri Primer
2	Jalan Kedung Halang	4/2T	19,55	Jalan Arteri Primer
3	Jalan Raya Cilebut	2/2TT	5	Jalan Lokal Primer
4	Jalan KH. Soleh Iskandar. 1	4/2T	7	Jalan Kolektor Primer
5	Jalan Kebon Pedes	2/2TT	6	Jalan Kolektor Sekunder
6	Jalan KH. Soleh Iskandar. 2	4/2T	7	Jalan Kolektor Primer
7	Jalan KS Tubun	4/2T	23,5	Jalan Arteri Primer
8	JalanAchmad Adnawijaya	4/2T	16	JalanKolektor Sekunder
9	Jalan Pajajaran	4/2T	21,7	Jalan Arteri Primer

Source: Analysis results

Based on the traffic impact analysis report Transit Oriented Development Sukaresmi PT. BIA, the capacity of roads is shown in Table 5.

Table 5. Capacity of roads

No	Street name	Street	Basic	Width		capacity

		type	capacity (Co)	Factor Lane/Lane	Direction Separation (PA)	Side Barriers Factor (HS)			City size	(C) skr/hour
						Level	Kind of way	numbers		
1	Jl. Raya Bogor	4/2T	6600	1	0,97	high	Kereb	0,89	1	5698
2	Jl. Kedung Halang	4/2T	6600	1,25	0,97	high	Kereb	0,89	1	7122
3	Jl Raya Cilebut	2/2TT	2900	0,56	1,00	low	Kereb	0,9	1	1462
4	Jl. KH. Soleh Iskandar. 1	2/2TT	2900	1	1,00	high	Kereb	0,84	1	2436
5	Jl. Kebon Pedes	2/2TT	2900	0,87	1,00	low	Kereb	0,9	1	2271
6	Jl. KH. Soleh Iskandar. 2	2/2TT	2900	1	1,00	high	Kereb	0,84	1	2436
7	Jl. KS Tubun	6/2T	9900	1,36	0,91	high	Kereb	0,92	1	11272
8	Jl. Achmad Adnawijaya	4/2T	6600	1	1,00	high	Kereb	0,92	1	6072
9	Jalan Pajajaran	4/2T	6600	1,24	0,94	high	Kereb	0,92	1	7078

Source: Analysis results

Recapitulation of the service level of the existing roads

For generation analysis, only 1 data is needed in the form of peak hour traffic, where this data is the largest traffic data per unit time. Therefore, researchers only took 1 data, in the form of peak or greatest hourly traffic per unit time.

Table 6. Recapitulation of vehicle volume

No.	Street name	lane	Busy working		Off work	
			Total Q (skr/hour)	Capacity (C)	Total Q (skr/hour)	capacity (C)
1.	Jl. Raya Cilebut	South - North	761	1462	-	1462
		North - South	860		-	
2	Jl. KH. Soleh Iskandar. 1	West - East	4745	2436	3680	2436
		East -West	5150		3598	
3	Jl. Kebon Pedes	South - North	723	2271	-	2271
		North - South	687		-	
4	Jl. KH. Soleh Iskandar. 2	East -West	3576	2436	-	2436
		West - East	3763		-	
5	Jl. Raya Bogor	East -West	1814	5698	-	5698
		West - East	2117		-	
6	Jl. Kedung Halang	East -West	2737	7122	934	7122
		West - East	2360		1259	
7	Jl. KS Tubun	South - North	3556	11272	2582	11272
		North - South	3879		3686	
8	Jl. Achmad Adnawijaya	East -West	1545	6072	1128	6072
		East -West	1316		968	

9	Jl. Pajajaran	South - North	1962	7078	1651	7078
		North - South	1881		1856	

Source: Analysis results

Table 7. Recapitulation of service levels

No.	Street name	Lane	Busy working		Off work	
			degree of saturation	LOS	Degree of saturation	LOS
1.	Jl Raya Cilebut	South - North	0,52	B	-	-
		North - South	0,59	C	-	-
2	Jl. KH. Soleh Iskandar. 1	West - East	1,95	F	1,51	F
		East - West	2,11	F	1,48	F
3	Jl. Kebon Pedes	South - North	0,21	A	-	-
		North - South	0,20	A	-	-
4	Jl. KH. Soleh Iskandar. 2	East - West	1,47	F	-	-
		West - East	1,54	F	-	-
5	Jl. Raya Bogor	East - West	0,32	A	-	-
		West - East	0,37	B	-	-
6	Jl. Kedung Halang	West - East	0,38	B	0,13	A
		East - West	0,33	A	0,18	A
7	Jl. KS Tubun	South - North	0,32	A	0,23	A
		North - South	0,34	A	0,33	A
8	Jl. Achmad Adnawijaya	East - West	0,25	A	0,19	A
		West - East	0,22	A	0,16	A
9	Jl. Pajajaran	South - North	0,28	A	0,23	A
		North - South	0,27	A	0,26	A

Source: Analysis results

Table 8. Final recapitulation of road service levels

No.	Street name	Lane	Busy working	
			Degree of saturation	LOS
1.	Jl. Raya Cilebut	South - North	0,52	B
		North - South	0,59	C
2	Jl. KH. Soleh Iskandar. 1	West - East	1,95	F
		East - West	2,11	F
3	Jl. Kebon Pedes	South - North	0,21	A
		North - South	0,20	A
4	Jl. KH. Soleh Iskandar. 2	East - West	1,47	F
		West - East	1,54	F
5	Jl. Raya Bogor	East - West	0,32	A
		West - East	0,37	B
6	Jl. Kedung Halang	West - East	0,38	B
		East - West	0,33	A
7	Jl. KS Tubun	South - North	0,32	A
		North - South	0,34	A
8	Jl. Achmad Adnawijaya	East - West	0,25	A
		West - East	0,22	A
9	Jl. Pajajaran	South - North	0,28	A
		North - South	0,27	A

Source: Analysis results

Obtaining Generation and Withdrawal

Table 9. Generation and Attraction of Sukaresmi Transit Oriented Development Area

	Amenities	Area (m2)	Area SF	Unit	Coeffisien ITE	ITE Generation (trip/jam)
	Residential A	7.993	86.037	2.398	0,58	1.391
	Residential B	5.329	57.358	1.599	0,58	927
Commercial A	Hotel	3.108	33.459	789	0,60	473
	Shopping Center	1.332	14.339	160	3,71	593
Commercial B	Ruko	888	9.560	30	3,71	113
	General Office Building	3.552	38.239	426	1,49	635
	Total	**22.203**	**238.991**			**4.132**

Source: Analysis results

Table 10. Generation and Attraction of the Sukaresmi Transit Oriented Development Area

Moda proportion	Assumtion %	Generation + trip	
		ITE (Trip/hour)	ITE (Smp/hour)
		4.132	1.240
Motorcycle	32%	1322	397
Car	60%	2479	744
Operation	8%	331	99
Total	**100%**	**4132**	**1240**

Source: Analysis results

Therefore, the total attraction and generation from the Sukaresmi Transit Oriented Development area is 1240 pcu/hour. This generation and attraction will be charged to the road network in the largest peak traffic flow.

Obtaining the Performance of the Road Section of the Sukaresmi Transit Oriented Development Area operation

Table 11. Recapitulation of LOS comparisons before and after generation and pull loading on roads

No.	Street name	Trip	Capacity	Total Q (skr/hour)	DJ	LOS	Total Q (skr/hour) + Generation	DJ + Generation	LOS + Generation
1.	Jl. Raya Cilebut	S - U	1462	761	0,52	B	1221	0,84	D
		U - S		860	0,59	C	1319	0,90	D
2	Jl. Raya Cilebut	B - T	2436	4745	1,95	F	5204	2,14	F
		T - B		5150	2,11	F	5609	2,30	F
3	Jl. KH. Soleh Iskandar. 1	S - U	2271	723	0,21	A	1183	0,52	B
		U - S		687	0,20	A	1146	0,50	B
4	Jl. Kebon Pedes	T - B	2436	3576	1,47	F	4035	1,66	F
		B - T		3763	1,54	F	4222	1,73	F
5	Jl. KH. Soleh Iskandar. 2	T - B	5698	1814	0,32	A	2273	0,40	B
		B - T		2117	0,37	B	2577	0,45	B
6	Jl. Raya Bogor	B - T	7122	2737	0,38	B	3196	0,45	B
		T - B		2360	0,33	A	2819	0,40	B
7	Jl. Kedung Halang	S - U	11272	3556	0,32	A	4015	0,36	B
		U - S		3879	0,34	A	4338	0,38	B
8	Jl. KS Tubun	T - B	6072	1545	0,25	A	2004	0,33	A
		B - T		1316	0,22	A	1776	0,29	A

9	Jl. Achmad Adnawijaya	S - U	7078	1962	0,28	A	2421	0,34	A
		U - S		1881	0,27	A	2340	0,33	A

Source: Analysis results

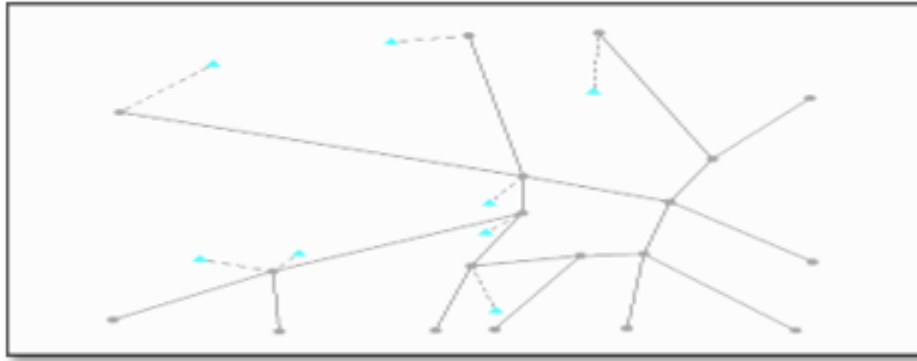**Road Network Modeling**

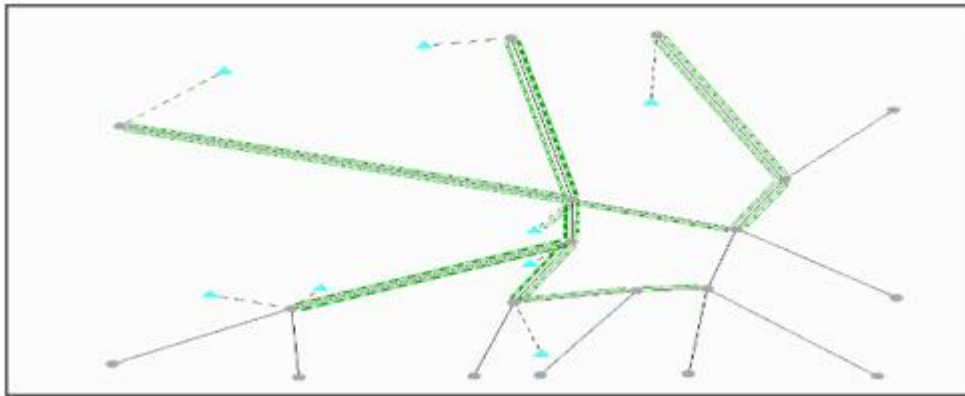**Figure 3.** Road Network Modeling Source: Analysis Results

Road Loading Modeling

Figure 4. Road Load Modeling Source: Analysis Results
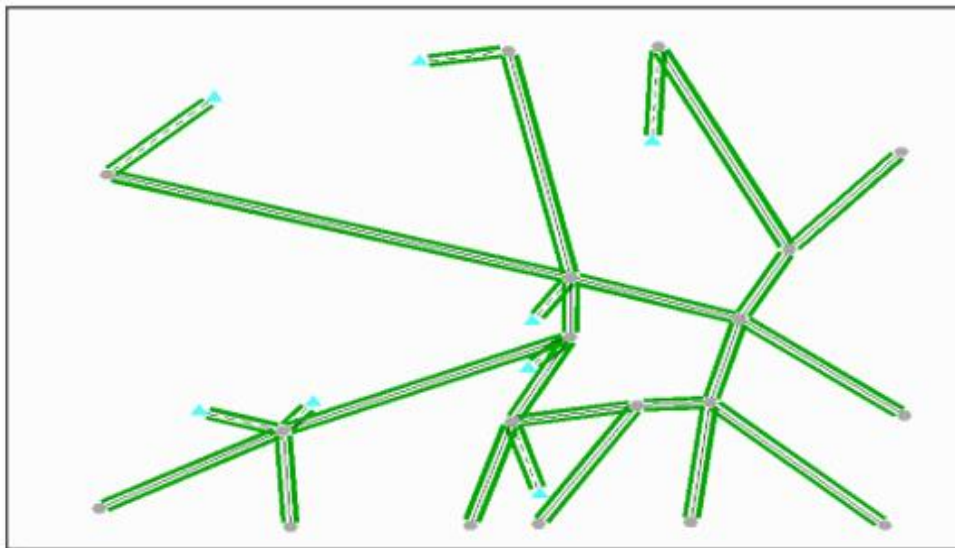
Road Capacity Modeling

Figure 5. Road Capacity Modeling Source: Analysis Results

CONCLUSION

As for the results of the analysis and discussion, the following conclusions can be drawn, the performance of the existing road sections. On Jalan Raya Cilebut, the south to north direction has a total Q of 761, the degree of saturation is 0.52 and the service level is B, while from north to south it has a total Q of 860, the degree of saturation is 0.59 and the level of service is C. KH. Soleh Iskandar. 1 west to east direction has a total Q of 4745 degrees of saturation of 1.59 and a service level of F, while from east to west has a total Q of 5150 degrees of saturation of 2.11 and a level of service F. On Jalan Kebon Pedes, the direction south to north has a total Q of 723, a degree of saturation of 0.21 and a service level of A, while from north to south has a total of Q of 687, a degree of saturation of 0.20 and a level of service A. On Jalan KH. Soleh Iskandar. 2 east to west direction has a total Q of 3576 degrees of saturation of 1.47 and the level of service is F while from west to east has a total Q of 3763 degrees of saturation of 1.54 and the level of service is F. On Jalan Raya Bogor east to west has the total Q is 1814, the degree of saturation is 0.32 and the service level is A, while from west to east it has a total Q of 2117, the degree of saturation is 0.37 and the level of service B. On Jalan Kedung Halang from west to east has a total Q of 2737, the degree of saturation is 0.38 and the service level is B, while from east to west it has a total Q of 2360, the degree of saturation is 0.33 and the service level is A. On Jalan KS Tubun, the south to north direction has a total Q of 3556, the degree of saturation is 0.32 and the service level is A, while from north to south it has a total Q of 3879 degrees of saturation of 0.34 and the level of service is A. On Jalan Achmad Adnawijaya east to west has a total Q of 1545, the degree of saturation is 0.25 and the service level is A, while from west to east it has a total Q of 1316, the degree of saturation is 0.22 and the level of service is A. On the Pajajaran road south to north has a total Q of 1962, the degree of saturation is 0.28 and the level of service is A, while from north to south it has a total Q of 1882, the degree of saturation is 0.27 and the level of service A. The results of the analysis of movement of the Transit Oriented Development Area Sukaresmi amounting to 1240 cur / hour. The performance of roads during the operation stage of the Sukaresmi Transit Oriented Development. On Jalan Raya Cilebut, the south to north direction has a total Q of 1221, the degree of saturation is 0.84 and the service level is D, while from north to south it has a total Q of 1319, the degree of saturation is 0.90 and the level of service is D. KH. Soleh Iskandar. 1 west to east has a total Q of 5204, the degree of saturation is 2.14 and the service level is F, while from east to west it has a total Q of 5609, 2.30 degrees of saturation and service level of F. On Jalan Kebon Pedes, the south to north direction has a total Q of 1183, the degree of

saturation is 0.52 and the service level is B, while from north to south it has a total Q of 1146, the degree of saturation is 0.50 and the level of service is B. KH. Soleh Iskandar. 2 east to west direction has a total Q of 4112, the degree of saturation is 1.69 and the service level is F, while from west to east it has a total Q of 4222, the degree of saturation is 1.73 and the level of service is F. to the west it has a total Q of 2273, the degree of saturation is 0.40 and the level of service is B, while from west to east it has a total Q of 2577, the degree of saturation is 0.45 and the level of service B. On Jalan Kedung Halang, west to east has the total Q is 3196, the degree of saturation is 0.45 and the service level is B, while from east to west it has a total Q of 2819 degrees of saturation of 0.40 and the level of service B. On Jalan KS Tubun, south to north has a total Q of 4015 , the degree of saturation is 0.36 and the service level is B, while from north to south it has a total Q of 4338, the degree of saturation is 0.38 and the level of service is B. On Jalan Achmad Adnawijaya ara h east to west has a total Q of 2004, the degree of saturation is 0.33 and the service level is A, while from west to east it has a total Q of 1776, the degree of saturation is 0.29 and the level of service is A. On Jalan Pajajaran, south to north has a total Q of 2421, the degree of saturation is 0.34 and the service level is A, while from north to south it has a total Q of 2340, the degree of saturation is 0.33 and the service level is A.

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