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Design of Traffic Lights at the Unsignalized Intersection of Narogong Highway-Pangkalan 5 Road Km. 13.5 Bekasi City, West Java

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ABSTRACT

The intersection of Narogong Highway-Pangkalan road 5, Bantargebang , Bekasi city, is a four-arm intersection that connects Bekasi City with Bogor Regency and is the access to the Bantargebang TPA. The irregular and narrow traffic conditions at the intersection cause frequent traffic jams and are prone to accidents. Therefore, it is necessary to analyze the need for traffic light at the intersection so that a solution can be found in overcoming the problem of congestion and can help smooth the intersection. This analysis is based on the MKJI method (Indonesian Road Capacity Manual) 1997. The results of the analysis show that the intersection of Narogong Highway - Pangkalan road 5, Bekasi City is not able to serve the traffic flow to the maximum, this can be shown by the result of the calculation that has been carried out, so an analysis is needed to improve the performance of the intersection, from the existing calculations alternatives, selected 3 phase alternative with geometric widening, from this solution a cycle time of 80 seconds was obtained with a degree of saturation (DS) = 0.690 to 0.839, and a maximum queue length of 104 meters. The intersection of Jalan Raya Narogong - Jalan Pangkalan 5, Bantargebang , Bekasi City, is intersection four the arm that connects Bekasi City with regency Bogor as well as is access going to to Bantargebang landfill . Condition Then cross that doesn't regular and narrow at intersections the cause often happen congestion and danger happen accident . Therefore _ that is necessary Analysis Need for Traffic Lights at intersections so that obtained solution in overcome problem traffic jams and can help smoothness at intersections . Analysis This based on MKJI method (Indonesian Road Capacity Manual) 1997. Analysis results is known that , the intersection of Jalan Raya Narogong - Jalan Pangkalan 5 Bekasi City is not capable serve current Then cross with maximum , p This can showed with results calculations that have been made done , so required analysis For increase performance intersection , from alternative existing calculations , selected _ 3 phase alternative with widening geometric , from solution This obtained time cycle by 80 seconds with mark degrees saturation (DS) = 0.690 to 0.839, and long queue maximum 104 meters

INTRODUCTION

Every big city faces serious traffic problems, especially at road junctions such as traffic jams and delays on road lanes. (Kumalawati et al., 2022; Listiana & Sudibyo, 2019; Prakoso et al., 2019; Safri et al., 2021; *Study Analysis of Vehicle Volume at Signalized Intersections at the Alun Alun Intersection in Kediri City* , nd; Wibisono, 2019) . With its development Bekasi city , then current transportation is also improving congested especially at intersections . Congestion Then cross the happen Because segment road the Already No capable Again accommodate / pass through current vehicle . Therefore _ That required the right solutions For overcome problem (Budiman & Intari, 2016; Sriharyani & Hadijah, 2016; Yayang Nurkafi et al., 2019) .

Jalan Raya Narogong and Jalan Pangkalan5 are an intersection four where are two roads joinor intersect . Lots of it vehicle light and vehicle the weight that crosses intersection can give rise to problems at certain times such as delays in the morning, afternoon , evening and night day (M. Anggraini et al., 2021; RA Anggraini et al., 2022; Hasibuan & Muchammad Zaenal Muttaqin, 2021; Los, nd; Wirianata et al., 2020) **.** This intersection is often problematic because there are no traffic lights at the intersection, so the resulting vehicle density is quite high, resulting in driver chaos and traffic jams at the intersection. (Azima & Yermadona, 2022; Kartika et al., 2016) **.** Arrangement Then cross at the intended intersection For arrange movement vehicles for each group movement vehicle to get move in a way alternate so that don't disturb each other between existing current _ (Hutabarat et al., 2020; Kurniati et al., 2020) .

Objective from study This is plan a long time ago traffic at the intersection of Jalan Raya Narogong and Jalan Base 5. Benefits from research carried out is for competent parties in particular government as proposal or suggestions to overcome problems at the intersection those , share existing society _ around intersection the in order to drive with safe , comfortable and smooth , for student as material guide To use next research (Directorate General of Highways, 1997; Hasbi, 2019)

METHOD

Analysis used _ For calculation intersection No signal use Indonesian Road Capacity Manual method 1997 (MKJI 1997). Performance measurement follows can estimated For geometry , environmentand Then cross with the method described in method This are :

1. Capacity

Capacity is amount maximum current traffic can maintained at a part road conditions certain and stated in vehicle / watch or junior high school / hour. Total intersection capacity can expressed as results multiplication between capacity base Codanfactors F adjustment [21] calculation intersection capacity according to MKJI 1997

C= Co x Fw x FM x FCS x FRSU x FLT x FRT x FMI

With :

C = Capacity (pcu / hour)

Co = Capacity basic (junior high school / hour)

Fw = Factor correct wide enter

FM = Factor correct road median type

FCS = Factor correct size city

FRSU = Factor adjustment vehicle No motorized , obstacles side and type environment road .

FLT = Factor adjustment turn left

FRT = Factor adjustment turn right

FMI = Factor adjustment ratio minor current

Table 1. Variable - Variable Input Capacity Model

Variable Type	Variable description and input name		Model factor's
Geometry	Intersection type	IT	
	The average width is close	WI	Fw
	Main road median type	m	F_M
Environment	City size class	CS	F_{CS}
	Road environment type,	RE	
	Side obstacles	SF	
	Ratio of non-motorized vehicles	PUM	F_{RSU}
Traffic	Left-turn ratio	PLT	F_{LT}
	Right-turn ratio	P_{RT}	F_{RT}
	Minor road flow ratio	Q_{MI}/Q_{TOT}	Fx ;

2. Degrees Saturation

Degrees saturation (DS) is defined as ratio current Then cross to capacity, used as the main factor in determination level performance intersections and segments road .[21]. Degree value saturation show is segment road to have problem capacity or no.Degrees saturation For all over intersection , (DS), is calculated as following :

DS = QTOT / C

With :

DS = Degrees Saturation

C = Capacity (pcu / hour)

QTOT = Quantity Total flow at the Intersection (pcu /hour)

3. Delay

Delays at intersections is the total time the average resistance experienced by the vehicle when pass something intersection . Obstacle the appear If vehicle stop Because happen queue at the intersection . Delay at intersection can happen for two reasons that is Traffic Delays (DT) due to interaction traffic with another movement in intersections , and delays Geometric (DG) consequences disturbed or No disturbed deceleration and acceleration vehicle .

Delay in the past cross road shared become a number of points assessment , as following :

a) Intersection Traffic Delays

Intersection Traffic Delays is Average delay entering vehicle _ intersection . Intersection Traffic Delays This determined based on value degrees boredom.

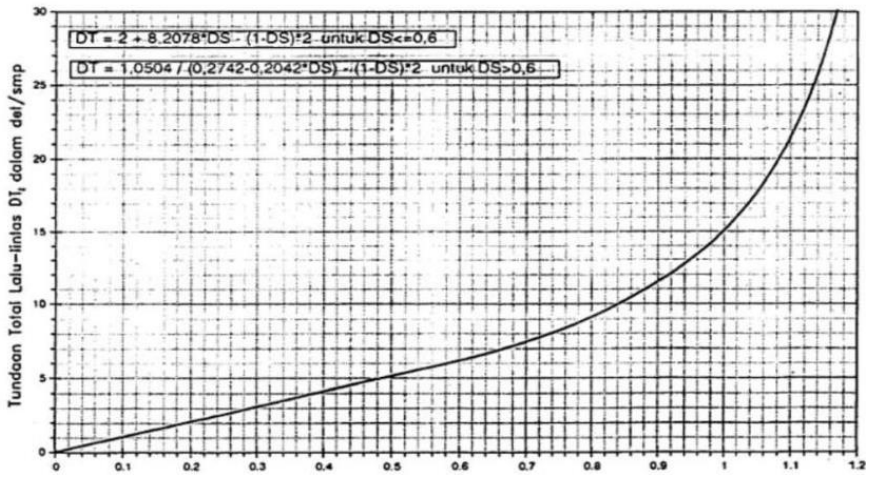


Figure 1. Intersection Traffic Delays to Degrees Saturation

(Source: MKJI 1997)

b) Main Road Traffic Delays (DTMA)

The Main Traffic Delays are Average delay _ entering vehicle _ intersection from road main . These Major Traffic Delays determined based on mark between Major Traffic Delays with degrees boredom .

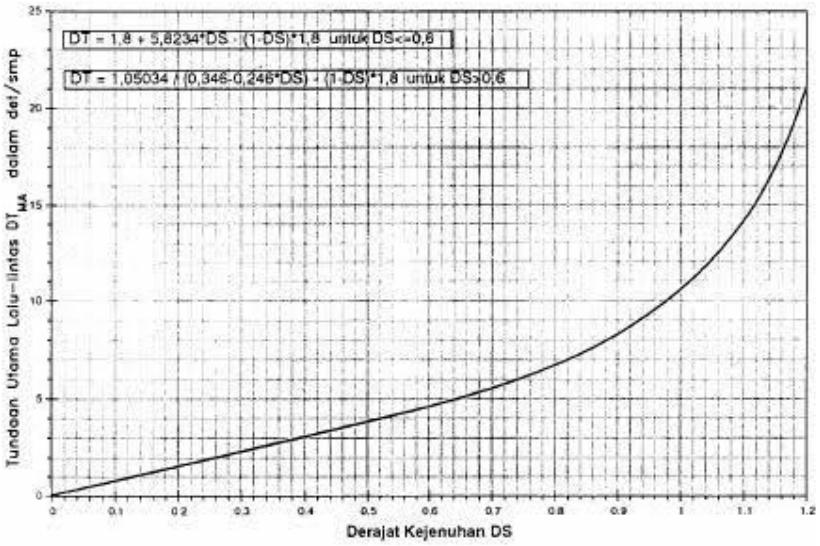


Figure 2. Main Traffic Delays Against Degrees Saturation

(Source: MKJI 1997)

c) Minor Road Traffic Delays (DTMI)

These Minor Traffic Delays determined based on mark between Intersection Traffic Delays with Main Road Traffic Delays. With Formula As Following :

DTMI = (QTOT x DT1 - QMA x DTMA) / QMI

With :

QTOT = Total Current (pcu / hour)

DT1= Intersection Traffic Delay

QMA = Major Road Flow

DTMA= Main Road Traffic Delay

QMI = Minor Road Current

d) Delay Geometric Intersection (DG)

Delay Geometric Intersection is Delay Geometric entering vehicle _ intersection . Delay Geometric Intersection calculated use formula as following :

For DS < 1.0:

DG = (1 - DS) x (Pr x 6 + (1 - Pr) x 3) + DS x 4

For DS ≥ 1.0,

DS = 4

With :

DG= Delay Geometric Intersection

DS= Degrees Saturation

Pr = Ratio Total Turn

e) Delay Intersection (D)

Delay Intersection can calculated use formula as following :

D = DG + DT1

With :

D= Delay Intersection

DG= Delay Geometric Intersection

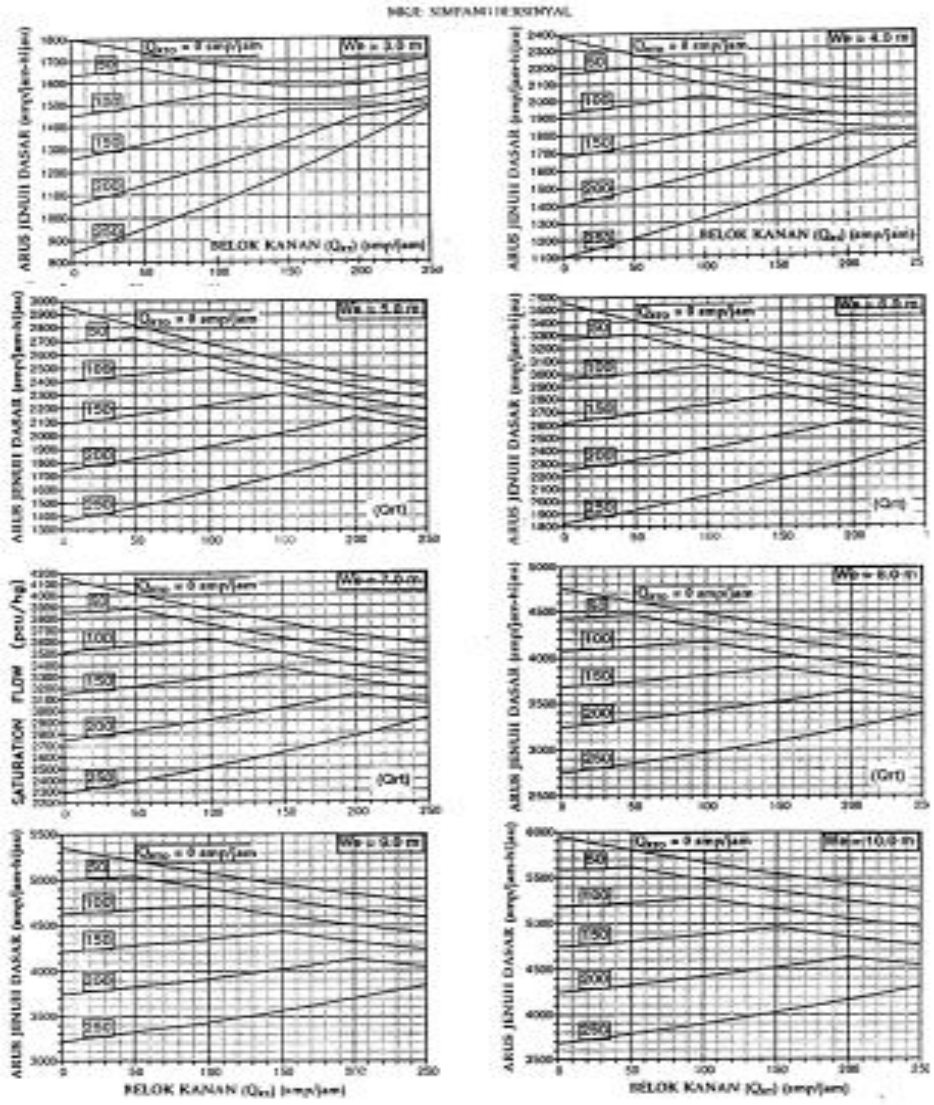
DT1= Intersection Traffic Delay

4. Current Fed up

Current saturation (S) is results from current fed up basis (So) and factors adjustment (F) at the intersection

a) For count current fed up base at the intersection
b) Count current fed up base at the intersection challenged

Table 2. Basic Saturation Currents for Countered Type Approaches



Formulation For count is with ,

So = 600 x We

Where :

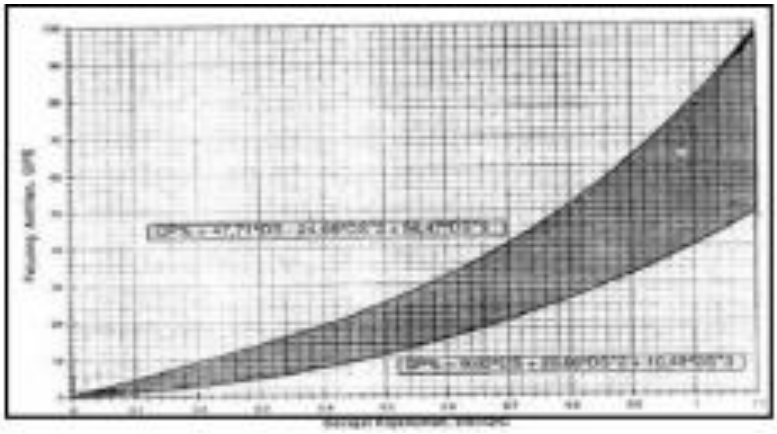
So = current fed up elementary (junior high school / green jam)

We = width effective (m)

5. Opportunity Queue

Range mark opportunity queue determined from connection empirical between opportunity queue to degrees boredom , relationship the can seen through graphbetween opportunity queue to degrees saturation

Table 3. Opportunities Queue to Degrees Saturation



RESULTS AND DISCUSSION

1. Geometric Data

Last survey location cross carried out at the unsignalized intersection of Jalan Raya Narogong - Jalan Pangkalan 5, Bantargebang District, Bekasi City, West Java Province

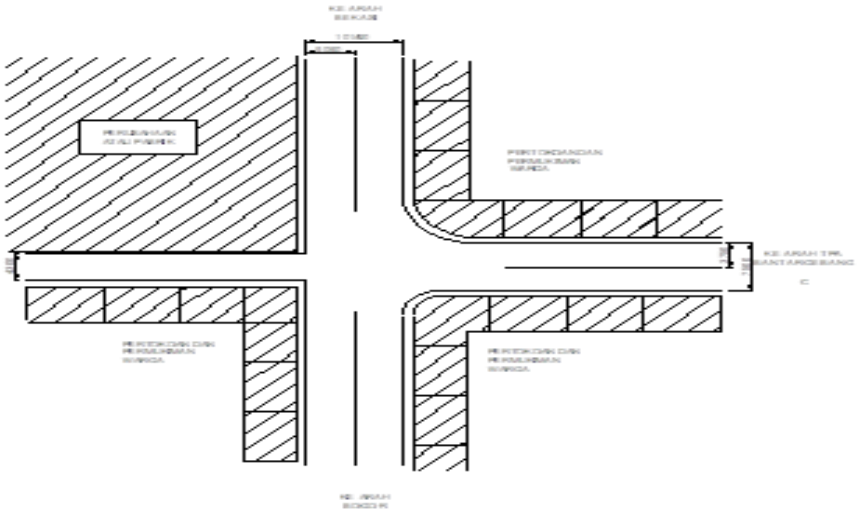


Figure. 3. Sketch of Observation Location n

Geometric data for Jalan Raya Narogong and Jalan Pangkalan 5 as following :

a) Narogong Highway (north)
Number of Lanes : 2 Lanes
Lane Width : 10.1 meters
Width Per lane : 5.05 meters

b) Narogong Highway (south)
Number of Lanes: 2 Lanes
Lane Width: 10.1 meters
Width per lane : 5.05 meters

c) Base road 5 (West)
Number of Lanes : 2 Lanes
Lane Width : 4.3 meters
Width per lane : 2.15 meters

d) Base road 5 (East)
Number of Lanes: 2 Lanes
Lane Width: 7.5 meters
Width per lane : 3.75 meters

2. Traffic Data at Intersections

On calculations above that has been done for 4 days that is Monday 23 May 2022, Thursday 26 May 2022, Saturday 28 May 2022 and Sunday 29 May 2022. Get seen difference amount passing vehicles _ intersection that . Following traffic data table for 8 hours each day.

Table 4. Total Results Current Vehicle at the Intersection

	WAKTU	JALAN RAYA NAROGONG			JALAN RAYA NAROGONG			JALAN PANGKALAN 5			JALAN PANGKALAN 5		
		ARAH BEKASI			ARAH BOGOR			ARAH TPA			ARAH GANG BUNTU		
		UTARA			SELATAN			TIMUR			BARAT		
		ST	LT	RT	ST	RT	LT	LT	RT	ST	LT	ST	RT
PAGI	06.00 - 06.15	502	58	14	685	99	16	103	40	11	12	9	11
	06.15 - 06.30	513	66	14	709	102	16	108	45	11	12	9	14
	06.30 - 06.45	568	66	14	786	97	14	125	61	13	16	13	16
	06.45 - 07.00	601	87	19	749	117	21	114	50	13	16	13	19
	07.00 - 07.15	615	92	22	813	135	23	120	67	15	12	12	16
	07.15 - 07.30	585	75	17	810	98	26	109	53	15	14	14	15
	07.30 - 07.45	684	92	17	882	144	25	150	51	15	13	12	18
	07.45 - 08.00	517	90	18	710	117	21	133	52	10	8	8	14
	08.00 - 08.15	467	99	16	522	69	21	93	54	9	12	10	16
	08.15 - 08.30	383	93	17	510	68	20	86	39	10	12	10	12
	08.30 - 08.45	426	84	17	444	59	22	107	44	13	11	9	13
	08.45 - 09.00	427	91	14	480	60	18	118	63	10	12	10	14
SIANG	11.00 - 11.15	428	53	13	396	65	16	74	44	11	15	13	20
	11.15 - 11.30	411	63	11	415	68	11	66	33	13	14	12	14
	11.30 - 11.45	405	63	16	444	70	22	67	54	10	14	12	14
	11.45 - 12.00	402	67	14	430	67	15	90	46	11	14	11	17
	12.00 - 12.15	407	52	15	438	64	13	69	50	11	15	12	15
	12.15 - 12.30	420	61	12	436	70	13	80	49	12	13	10	12
	12.30 - 12.45	448	63	15	440	58	11	71	55	10	14	11	12
	12.45 - 13.00	444	83	15	451	69	14	67	54	10	13	10	14
SORE	15.00 - 15.15	342	48	13	381	68	13	74	52	9	13	10	11
	15.15 - 15.30	399	53	15	493	82	14	71	60	9	12	9	14
	15.30 - 15.45	469	57	14	453	88	15	68	55	12	13	10	14
	15.45 - 16.00	567	64	14	633	93	17	118	52	10	13	10	13
	16.00 - 16.15	450	68	15	554	63	17	161	75	9	12	9	12
	16.15 - 16.30	540	75	19	535	76	18	150	85	13	12	9	17
	16.30 - 16.45	586	46	19	584	70	18	112	73	17	15	12	17
	16.45 - 17.00	613	44	21	465	67	21	91	55	14	17	14	17
	17.00 - 17.15	658	54	22	605	135	23	116	59	14	16	13	21
	17.15 - 17.30	634	47	22	630	137	23	108	71	12	16	13	18
	17.30 - 17.45	594	48	15	547	94	23	106	60	9	13	10	17
	17.45 - 18.00	586	53	15	463	88	19	94	58	10	14	11	17

3. Secondary Data

Required secondary data _ for this data namely quantity data resident Bekasi city , way For get secondary data This that is with method observe viewing and downloading the data direct from the official website of the Bekasi City Central Statistics Agency, the data is downloaded namely quantity data residents of Bekasi City. Secondary data results can seen as following :

Table 5. Total Resident According to Group Age and Type Gender in Bekasi City

Kelompok Umur *Age Groups*	Jenis Kelamin/*Sex*		
	Laki-Laki *Male*	Perempuan *Female*	Jumlah *Total*
(1)	(2)	(3)	(4)
0–4	102 437	96 983	199 420
5–9	97 919	93 684	191 603
10–14	105 755	99 419	205 174
15–19	103 719	97 328	201 047
20–24	104 878	102 691	207 569
25–29	111 627	112 297	223 924
30–34	115 026	114 752	229 778
35–39	107 821	106 682	214 503
40–44	100 907	101 341	202 248
45–49	87 992	89 089	177 081
50–54	77 892	80 293	158 185
55–59	64 898	68 966	133 864
60–64	50 421	49 973	100 394
65–69	34 456	31 707	66 163
70–74	16 284	15 543	31 827
75+	9 950	12 211	22 161
Kota Bekasi	**1291 982**	**1272 959**	**2564 941**

Analysis Unsignalized intersection _ According to the 1997 MKJI calculations

On analysis intersection not signal This The 1997 MKJI formula issued by the Directorate is used General Binamarga as well as two mandatory forms filled , ie USIG-I form and USIG-II form . From the table below This obtained on Thursday , May 26 2022 at 07.00 – 08.00 total passing vehicles intersection the is 7523 vehicles / hour or 4520.5 pcu / hour. Ratio turn left and right on each approach and amount vehicle No motorized is 24 vehicles / hour

Table 6. Results Past Volume Analysis Cross Intersection Hour Peak Maximum

Pendekat	Kendaraan ringan LV		Kendaraan berat HV		Sepeda motor MC		Rasio Belok	Rasio Belok	Kend. tak bermotor	Total Kendaraan	
	kend/jam	smp/jam	kend/jam	smp/jam	kend/jam	smp/jam	Kiri			kend/jam	smp/jam
Utara	353	353,0	210	273,0	2222	1111,0	0,155	0,024	8	7523	4520,5
Selatan	452	452,0	96	124,8	3205	1602,5	0,022	0,127	8		
Barat	18	18,0	6	7,8	162	81,0	0,430	0,343	2		
Timur	63	63,0	83	107,9	653	326,5	0,600	0,346	6		

From the table below This is peak hour Maximum is at 07.00 – 08.00. with an average approach width at the intersection of 4.54 meters. The intersection capacity is also obtained namely 3408.23 pcu / hour. Degree value boredom is 1.33. And queue probability is 72.79 - 151.63

Table 7. USIG-II Analysis Results of Approach Width, Capacity and Intersection Traffic Behavior at Peak Hours

1. Lebar Pendekat dan Tipe Simpang

Pilihan	Jumlah Lengan Simpang	Lebar Pendekat (m)						Jumlah Lajur Gambar B-1:2			Tipe Simpang
		Jalan Minor			Jalan Utama			Lebar Pendekat	Jalan Minor	Jalan Utam	
		W_A	W_C	W_{AC}	W_B	W_D	W_{BD}				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	4	4,3	3,75	4,025	5,05	5,05	5,05	4,54	2	2	422

2. Kapasitas

Pilihan	Kapasitas Dasar C_0	Faktor Penyesuaian Kapasitas (F)							Kapasitas
		Lebar Pendekat	Median Jalan Utama	Ukuran Kota	Hambatan Samping	Belok Kiri	Belok Kanan	Rasio Minor Total	
		F_W	F_M	F_{CS}	F_{RSU}	F_{LT}	F_{RT}	F_{MI}	C
	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
1	2900	1,0929	1,00	1,00	0,95	1,08	1,00	1,05	3408,23

3. Perilaku Lalu Lintas

Pilihan	Arus Lalu Lintas	erajat Kejenuha	Tundaan Lalu Lintas Simpang	Tundaan Lalu Lintas Jl.	Tundaan Lalu Lintas Jl.	Tundaan Geometrik	Tundaan Simpang	Peluang Antrian	Sasaran
	USIG-I	(DS)	DT_I	D_{MA}	D_{MI}	(DG)	(D)	(QP %)	
	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)
	4520,50	1,33	313,32	53,86	1995,10	4,00	317,32	72,79 - 151,63	DS > 0,85

From the evaluation that has been done done previously obtained superior results _ from conditions that have been determined Good That degrees saturation (DS), as well as postponement that refers to the conditions that have been met determined in the Indonesian Road Capacity Manual (1997), so step next thing to do is plan repair with objective For increase system control intersection at the intersection of Jalan Raya Narogong - Jalan Pangkalan 5. There are several alternative repair who will planned and ultimately will chosen One alternative best For repair system control intersection this .

4. Alternative Planning Traffic Light Conditions Existing

From the results calculation seen that wide road on approach north and south The same namely 5.05 meters. Road width western approach 4.30 meters and wide road approach east 3.75 meters.

Table 8. Geometry and Environment at Intersections

Pendekat	Hambatan Samping	Median	Belok kiri Langsung	Lebar Pendekat	Masuk WENTRY	Keluar W EXIT
(1)	(2)	(3)	(4)	(5)	(6)	(7)
U	S	Tidak	Tidak	5,05	5,05	5,05
S	S	Tidak	Tidak	5,05	5,05	5,05
T	S	Tidak	Tidak	3,75	3,75	4,30
B	S	Tidak	Tidak	4,30	4,30	3,75

From the calculations that have been made done obtained results on each direction intersection covers the last volume cross vehicle or car passenger, comparison turn left and right as well as amount vehicle No motorized.

Table 9. Results of Traffic Volume Calculations at Intersections the

Pendekat	Kendaraan ringan LV		Kendaraan berat HV		Sepeda motor MC		Rasio Belok Kiri	Rasio Belok Kanan	Kend. tak bermotor	Total Kendaraan	
	kend/jam	smp/jam	kend/jam	smp/jam	kend/jam	smp/jam				kend/jam	smp/jam
Utara	353	353,0	210	273,0	2222	444,4	0,187	0,019	8	7523	2810,9
Selatan	452	452,0	96	124,8	3205	641,0	0,018	0,131	8		
Timur	63	-63,0	83	107,9	653	261,2	0,581	0,413	6		
Barat	18	18,0	6	7,8	162	64,8	0,485	0,361	2		

From the results calculations that have been made done , value SIG - IV form is obtained from calculation current saturation all approach , time green every approach , degree saturation every approach , and total time cycle at the intersection . can seen in the table following this .

Table 10. Analysis Results Capacity and Signal Time at Intersections

pendekat	Arah dari	Arah lawan	Nilai dasar	Ukuran kota	Hambatan Samping	kelan-dalan	Parkir	Belok Kanan	Belok Kiri	Nilai disesuaikan	Rasio Arus	Rasio fase	Waktu hijau	Kapasitas	Derajat jenuh	Waktu siklus disesuaikan
	Q_{RT}	Q_{RTO}	So	F_{CS}	F_{SF}	F_G	F_P	F_{RT}	F_{LT}	S	Q/S	IFR	g	Sxg/c	Q/C	c (det)
U			3030,0	1,0	0,950	1,0	1,00	1,00	0,97	2806	0,381	0,375	-498	1061,6	1,008	-1317
S			3030,0	1,0	0,950	1,0	1,00	1,03	1,00	2968	0,410	0,403	-536	1207,8	1,008	
T	156	31	1945,0	1,0	0,980	1,0	1,00	1,11	0,91	1914	0,226	0,222	-295	428,6	1,008	
B	31	156	1863,8	1,0	0,980	1,0	1,00	1,09	0,92	1843	0,049		-295	412,5	0,220	

From the calculations that have been made carried out in the approach north , south , east and west are obtained results from mark amount long queue of vehicles _ queue , amount stops , and delays . Calculation results entered to in form provided by MKJI 1997.

Table 11. Results of Analysis of Queue Length , Number Vehicle Stop and Delay at Intersections

Pendekat	Rasio Hijau	NQ_1	NQ_2	NQ_{MAX}	Panjang Antrian	Angka Henti	Kendaraan Terhenti	Tundaan lalu lintas rata"	Tundaan geo-metrik rata"	Tundaan rata-rata	Tundaan total
U	0,38	18,77	-393,72	-489,35	-1938,01	0,86	922,08	-347,97	3,62	-344,35	-368593,04
S	0,41	20,20	-448,22	-559,09	-2214,20	0,86	1052,61	-332,71	3,58	-329,13	-400811,76
T	0,22	11,36	-158,51	-190,05	-1013,58	0,84	361,88	-417,08	4,32	-412,76	-178355,00
B	0,22	-0,36	-27,07	-32,73	-304,51	0,74	67,45	-420,50	4,28	-416,22	-37709,88

5. Alternative Planning Light Then Cross for Condition Geometric Widening

Widening the can seen as following : a. Widening existing on the approach east minor road by 1 meter, b. Road width on approach the western minor road is not carried out widening .

c. Widening existing approach road main north by 2.5 meters

d. Widening existing approach road main south by 2.5 meters

e. The planned median on Jalan Raya Narogong is 1 meter

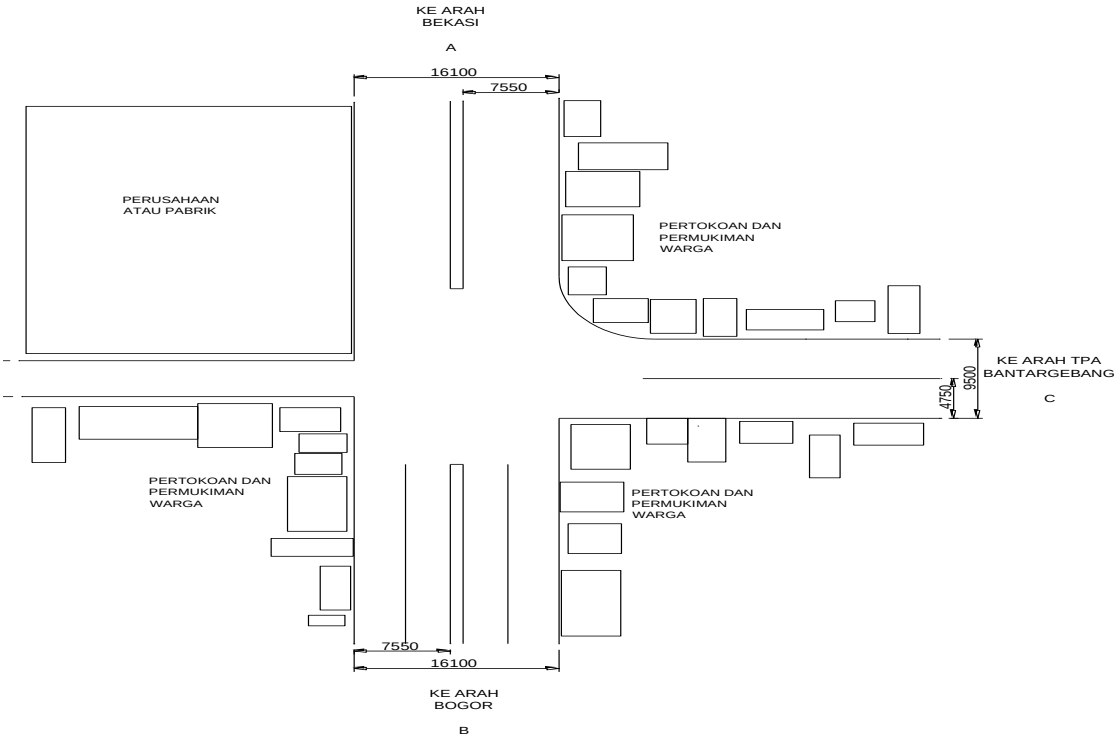


Figure 4. Sketch of the Road After Geometric Widening of Jalan Raya Narogong

From the results calculation seen that wide roadapproach north and south The same namely 7.55 meters. The width of the road western approach 4.30 meters and wide road approach east 4.75 meters. From the calculations that have been made done results are obtained for each direction intersection includes vehicle traffic volume or car passenger, comparebeol left and right as well as amount vehicle No motorized .

Table 12. Geometry and Environment at Intersections

Pendekat	Hambatan Samping	Median	Belok kiri Langsung	Lebar Pendekat	Masuk WENTRY	Keluar W EXIT
(1)	(2)	(3)	(4)	(5)	(6)	(7)
U	S	Tidak	Tidak	7,55	7,55	7,55
S	S	Tidak	Tidak	7,55	7,55	7,55
T	S	Tidak	Tidak	4,75	4,75	4,30
B	S	Tidak	Tidak	4,30	4,30	4,75

Table 13 Results of Traffic Volume Calculations at Intersections Such

Pendekat	Kendaraan ringan LV		Kendaraan berat HV		Sepeda motor MC		Rasio Belok Kiri	Rasio Belok Kanan	Kend. tak bermotor	Total Kendaraan	
	kend/jam	smp/jam	kend/jam	smp/jam	kend/jam	smp/jam				kend/jam	smp/jam
Utara	353	353,0	210	273,0	2222	444,4	0,187	0,019	8	7523	2810,9
Selatan	452	452,0	96	124,8	3205	641,0	0,018	0,131	8		
Timur	63	-63,0	83	107,9	653	261,2	0,581	0,413	6		
Barat	18	18,0	6	7,8	162	64,8	0,485	0,361	2		

From the results calculations that have been made carried out , the value of the SIG-IV form is obtained from calculation current saturation all approach, time green every approach , degree saturation every approach , and total time cycle at the intersection . can seen in the table following this .

Table 14. Analysis Results Capacity and Signal Time at Intersections

pendekat	Q_{RT}	Q_{RTO}	Nilai dasar So	Ukuran kota F_{CS}	Hambatan Samping F_{SF}	kelan-daian F_G	Parkir F_P	Belok Kanan F_{RT}	Belok Kiri F_{LT}	Nilai disesuaikan S	Rasio Arus Q/S	Rasio fase IFR	Waktu hijau g	Kapasitas Sxg/c	Derajat jenuh Q/C	Waktu siklus c (det)
U			4530,0	1,0	0,950	1,0	1,00	1,00	0,97	4195	0,255	0,357	24	1275,5	0,839	80
S			4530,0	1,0	0,950	1,0	1,00	1,03	1,00	4437	0,274	0,384	26	1451,1	0,839	
T	156	31	2381,0	1,0	0,980	1,0	1,00	1,11	0,91	2344	0,184	0,258	18	514,9	0,839	
B	31	156	1863,8	1,0	0,980	1,0	1,00	1,09	0,92	1843	0,049		18	404,8	0,224	

From the calculations that have been made carried out in the approach north, south, east and west are obtained results from mark amount long queue of vehicles _ queue, amount stops, and delays. Calculation results entered to in form provided by MKJI 1997.

Table 15. Results of Analysis of Queue Length, Number Vehicles Stopped and Delayed at the Intersection

Pendekat	Rasio Hijau	NQ_1	NQ_2	NQ_{MAX}	Panjang Antrian	Angka Henti	Kendaraan Terhenti	Tundaan lalu lintas rata"	Tundaan geo-metrik rata"	Tundaan rata-rata	Tundaan total
U	0,30	2,07	22,34	35,37	93,69	0,92	983,45	31,98	3,78	35,76	38273,46
S	0,33	2,07	25,23	39,17	103,76	0,90	1100,10	30,24	3,70	33,94	41327,47
T	0,22	2,01	9,23	18,07	76,10	1,05	453,11	44,08	3,90	47,98	20733,10
B	0,22	-0,36	1,66	5,01	23,32	0,58	52,54	22,57	4,45	27,03	2448,52

From the results calculation after done widening geometric during peak hours maximum , yield total ratio value current maximum of 0.714, long queue maximum 104 meters and value degrees saturation maximum of 0.839 where degrees saturation < 0.85. so that time the cycle will obtained is 80 seconds . From the results the , time cycle has fulfil recommendations recommended by MKJI 1997 , namely time cycle maximum for 3 phases is 100 seconds . So that can concluded that the resulting cycle time worthy For implemented .

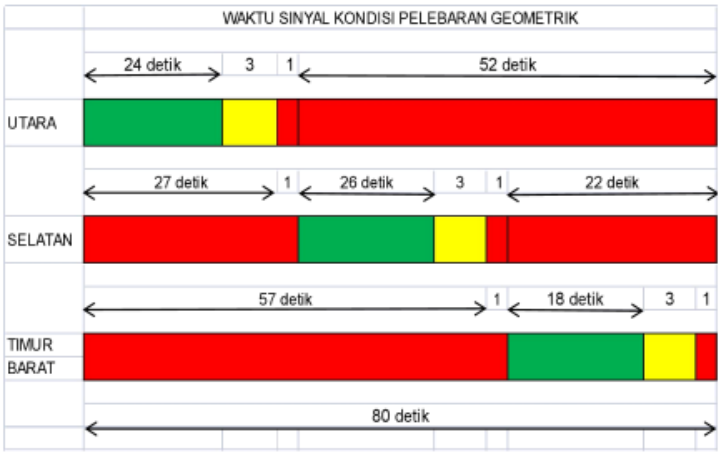


Figure 5. 3-Phase Traffic Signal Time with Geometric Widening

CONCLUSION

From several the conclusions that have been obtained , then can given suggestions and input expectedas material consideration For improvements to the intersection of Jl. Raya Narogong - Jl. Pangkalan5Bantargebang, Bekasi City became more Good performance in the future come , that is as following : 1. Necessary done widening geometric For Installation of traffic lights with the correct light settings recommended , ie with planninglights traffic uses 3 phases with widening geometric . 2. For repair study Next , expect to Do the survey again to get maximum results , though results from the 1997 MKJI evaluation show appropriate for installing traffic lights, necessary reviewed back to installing traffic lights.

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