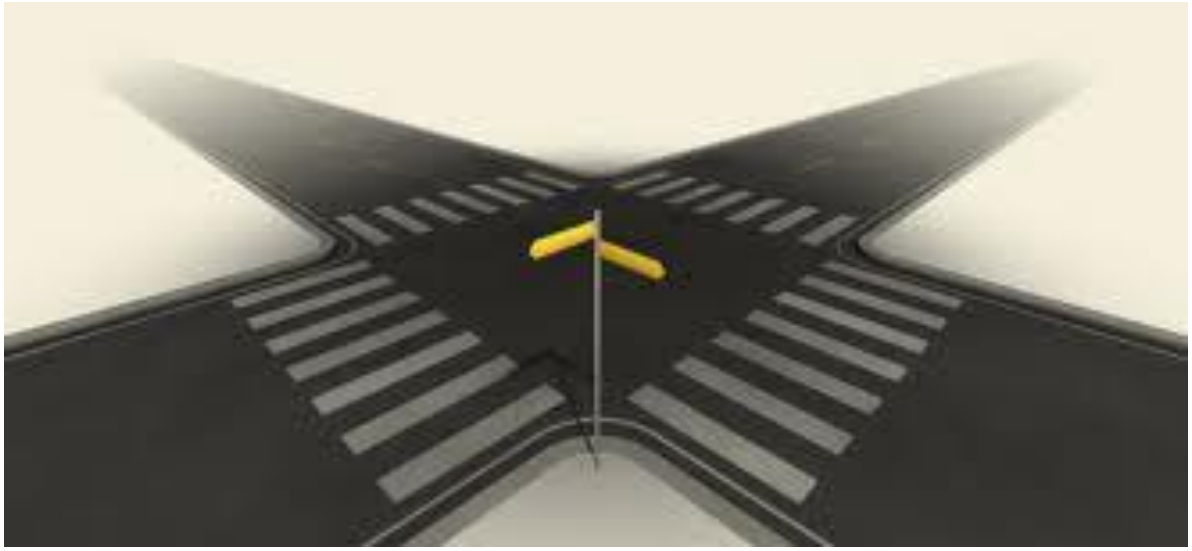
ANALISIS TRAFIK DI PERSIMPANGAN



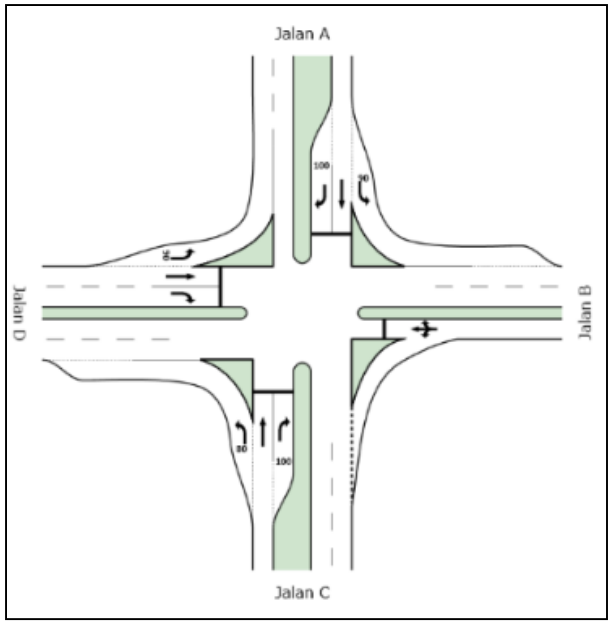
Mohd Syukri bin Md Hanafiah
Jurutera Awam Kanan
BRJ Zon Tengah, PKJJ Cawangan Jalan

Proses Kerja

- Pengumpulan data – bancian trafik, pengukuran layout persimpangan di tapak
- Penukaran kepada Unit Setara Kenderaan Penumpang (PCU)
- Analisis – secara manual atau menggunakan perisian
- Hasil analisis / Laporan
  - Cadangan penambahbaikan / jenis persimpangan

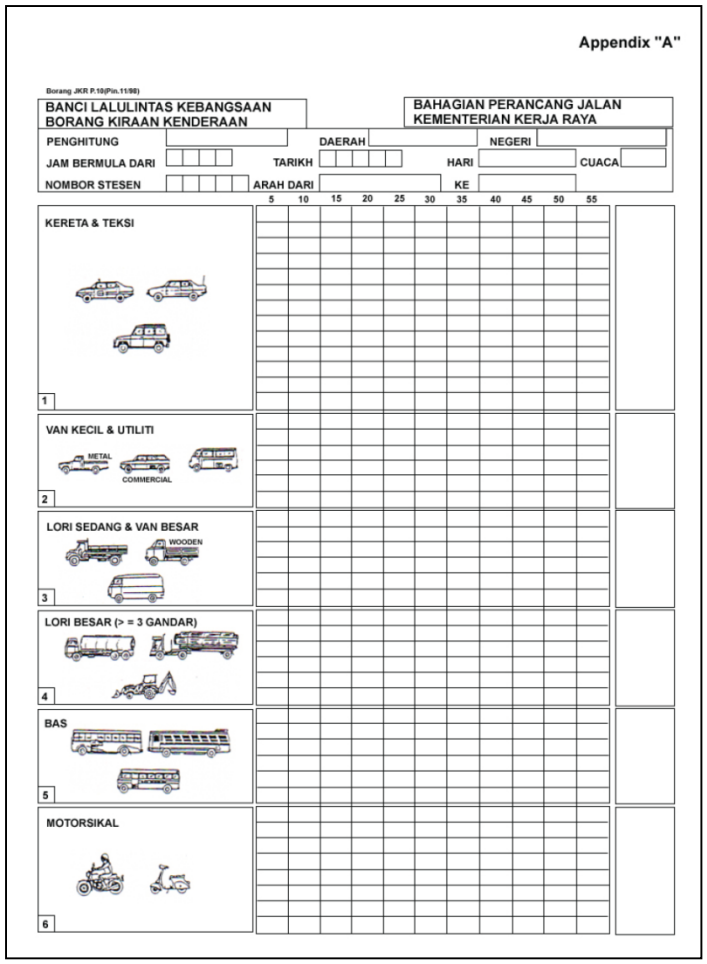
Pengumpulan Data

- **Bancian trafik**
  - Kenalpasti lokasi persimpangan
  - RTVM (Road Traffic Volume Malaysia) – rujuk stesen yang berdekatan untuk kenal pasti waktu puncak (pagi dan petang)
  - Jika tiada maklumat stesyen yang berdekatan, bancian trafik di jalan utama perlu dijalankan untuk mendapatkan waktu puncak
  - Berdasarkan waktu puncak, bancian trafik di persimpangandijalankan bagi setiap pergerakan



  - Bancian trafik dijalankan setiap 15 minit

Borang bancian trafik



Appendix "A"

Borang JKR P.10(Pin.11/98)

BANCI LALULINTAS KEBANGSAAN
BORANG KIRAAN KENDERAAN

BAHAGIAN PERANCANG JALAN
KEMENTERIAN KERJA RAYA

PENGHITUNG | DAERAH | NEGERI

JAM BERMULA DARI | TARIKH | HARI | CUACA

NOMBOR STESEN | ARAH DARI | KE

5 10 15 20 25 30 35 40 45 50 55

1 KERETA & TEKSI

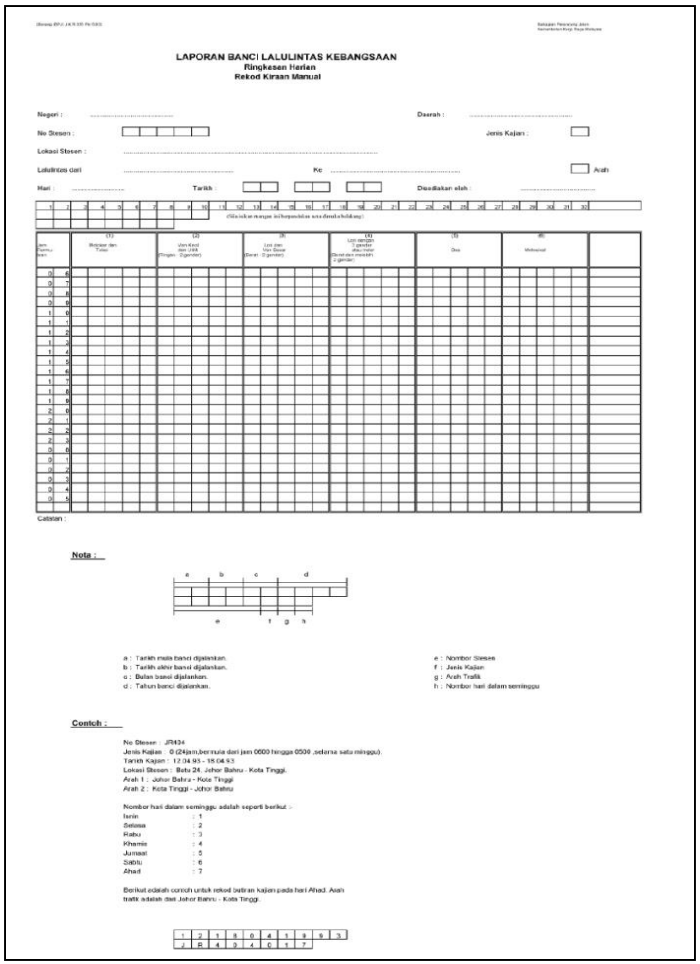
2 VAN KECIL & UTILITI
METAL
COMMERCIAL

3 LORI SEDANG & VAN BESAR
WOODEN

4 LORI BESAR (> = 3 GANDAR)

5 BAS

6 MOTORSIKAL



LAPORAN BANCI LALULINTAS KEBANGSAAN
Ringkasan Harian
Rekod Kiraan Manual

Negeri : Daerah :

No Stesen : Jenis Kajian :

Lokasi Stesen :

Lalulintas dari Ke Arah

Hari : Tarikh : Disediakan oleh :

Catatan :

Nota :

a : Tarikh mula banci dijalankan.
b : Tarikh akhir banci dijalankan.
c : Bulan banci dijalankan.
d : Tahun banci dijalankan.

e : Nombor Stesen
f : Jenis Kajian
g : Arah Trafik
h : Nombor hari dalam seminggu

Contoh :

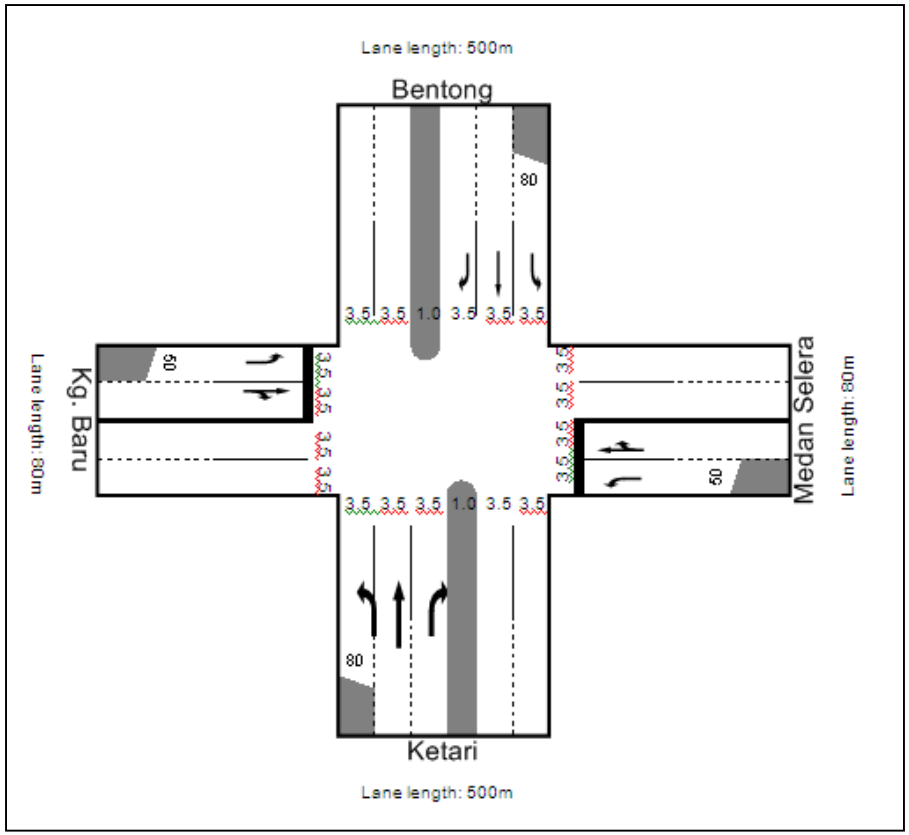
No Stesen : JR424
Jenis Kajian : 0 (24jam,bermula dari jam 0600 hingga 0559 ,selama satu minggu).
Tarikh Kajian : 12.04.95 - 18.04.95
Lokasi Stesen : Batu 24, Johor Bahru - Kota Tinggi.
Arah 1 : Johor Bahru - Kota Tinggi
Arah 2 : Kota Tinggi - Johor Bahru

Nombor hari dalam seminggu adalah seperti berikut :-
Isnin : 1
Selasa : 2
Rabu : 3
Khamis : 4
Jumaat : 5
Sabtu : 6
Ahad : 7

Berikut adalah contoh untuk rekod bahan kajian pada hari Ahad. Arah trafik adalah dari Johor Bahru - Kota Tinggi.

Pengukuran Layout Persimpangan di Tapak

- Lebar jalan
- Lebar median
- Panjang acceleration lane dan deceleration lane



Penukaran kepada Unit Setara Kenderaan Penumpang (PCU)

A Guide on Geometric Design of Roads

TABLE 3-3.CONVERSION FACTORS TO P.C.U.

Type of Vehicles	Equivalent Value in P.C.U.			
	Rural Standard	Urban Standard	Roundabout Design	Traffic Signal Design
Passenger Car	1.00	1.00	1.00	1.00
Motor cycles	1.00	0.75	0.75	0.33
Light Vans	2.00	2.00	2.00	2.00
Medium Lorries	2.50	2.50	2.80	1.75
Heavy Lorries	3.00	3.00	2.80	2.25
Buses	3.00	3.00	2.80	2.25

Source : 1. Road Research Laboratory "Research on Road Traffic", HMSO, London, 1965, pp201
2. Highway Planning Unit, Ministry of Works, Malaysia

Contoh pengiraan penukaran kepada unit setara kenderaan penumpang (pcu) – Waktu puncak pagi

=(356*1)+(19*2)+(58*1.75)+(60*2.25)+(6*2.25)+(257*0.33)
= 729 pcu/hr

Masa	Motokar Teksi	Van kecil & Utiliti	Lori & Van Besar	Lori dengan 3 gandar	Bas	Motosikal	pcu/hr
0600-0700	207.0	31.0	28.0	55.0	6.0	199.0	521
0700-0800	356.0	19.0	58.0	60.0	6.0	257.0	729
0800-0900	292.0	29.0	92.0	55.0	6.0	164.0	702
0900-1000	339.0	19.0	121.0	59.0	8.0	69.0	762
1000-1100	532.0	30.0	189.0	96.0	10.0	122.0	1202
1100-1200	373.0	36.0	95.0	47.0	4.0	98.0	758
1200-1300	403.0	20.0	120.0	50.0	7.0	89.0	811
1300-1400	408.0	26.0	104.0	49.0	8.0	53.0	788
1400-1500	479.0	28.0	110.0	71.0	10.0	109.0	946
1500-1600	462.0	29.0	95.0	55.0	9.0	118.0	869
1600-1700	484.0	31.0	109.0	70.0	4.0	140.0	949
1700-1800	557.0	24.0	76.0	52.0	6.0	145.0	916
1800-1900	550.0	28.0	57.0	51.0	6.0	129.0	877
1900-2000	364.0	20.0	63.0	44.0	4.0	111.0	659
2000-2100	314.0	10.0	27.0	34.0	2.0	83.0	490
2100-2200	307.0	25.0	21.0	53.0	3.0	55.0	538
Jum -16jam	6427.0	405.0	1365.0	901.0	99.0	1941.0	12516

WARRANT FOR A SIGNALISED JUNCTION

Arahan Teknik Jalan 13/87 –A guide to Traffic Signal Design

- Vehicle Operations justify the need for a signalised junction
  - *Total Volume or Peak Hour Volume or Progressive Movement*

- Pedestrian Volume requires a signalised junction
  - *More than 150 pedestrians per hour crossing the major road*

- Accident prone junction requires signalisation
  - *Five or more accidents in a year – can be corrected by the use of signals*

Analisis Waran – Pemasangan Lampu Isyarat

Bil	Warrant Analysis	Data / Maklumat	Waran (√)
	A. Total Volume (Table 2.1 AT(J)13/87)		
	Urban Conditions		
1	Major road (1 lane approach) > 500vph; Minor road (1 lane approach) > 150vph		
2	Major road (>=2 lane approaches) > 600vph; Minor road (1 lane approach) > 150vph		
3	Major road (>=2 lane approaches) > 600vph; Minor road (>=2 lane approaches) > 200vph		
4	Major road (1 lane approach) > 500vph; Minor road (>=2 lane approaches) > 200vph		
	Rural Conditions		
5	Major road (1 lane approach) > 350vph; Minor road (1 lane approach) > 105vph		
6	Major road (>=2 lane approaches) > 420vph; Minor road (1 lane approach) > 105vph		
7	Major road (>=2 lane approaches) > 420vph; Minor road (>=2 lane approaches) > 140vph		
8	Major road (1 lane approach) > 350vph; Minor road (>=2 lane approaches) > 140vph		
	B. Peak Hour Volume		
9	Figure 2.1 AT(J)13/87 for Urban conditions		
10	Figure 2.2 AT(J)13/87 for Rural conditions		
	C. Progressive Movement		
11	Mid-block signals introduced to group vehicles into platoons & move them at desirable speeds		
	D. Pedestrian Safety		
13	Major road (total volume) >= 600 vph; Pedestrians (highest volume) >= 150 ped/hr crossing major road		
14	Adjacent to schools		
	E. Accident Experience		
15	>= 5 reported accidents/year		

** Notes: Traffic control signals should generally **not be installed unless one or more of the warrants** in this guideline are met.*

Analisis

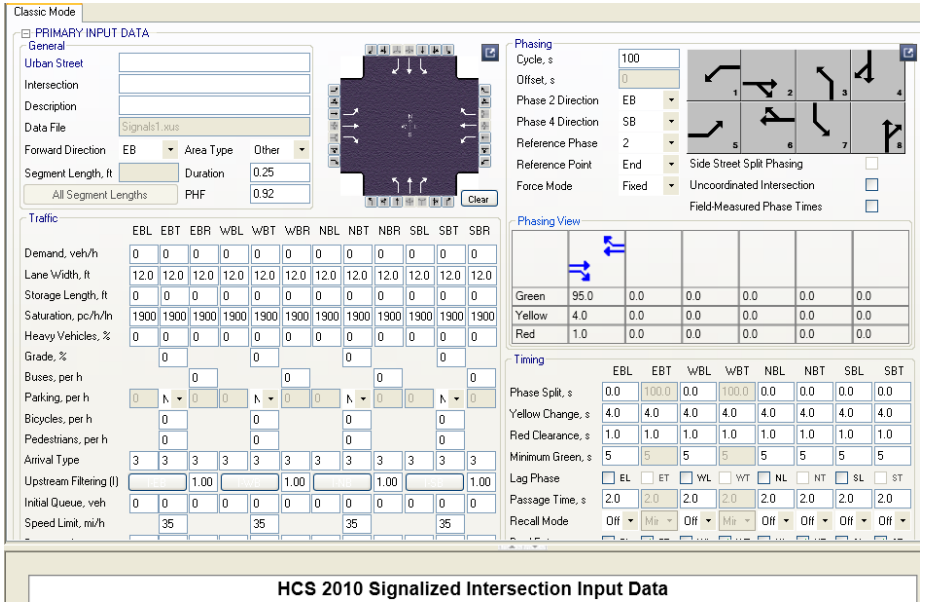
Pengiraan manual

- Arahan Teknik Jalan 11/87
  - Appendix B - Worksheet for Capacity Calculations of Unsignalised Intersection
  - Appendix D – Example Calculations for Capacity of Unsignalised Intersection (T Intersection & Four Leg Intersection)

- Highway Capacity Manual 2010
  - The Transportation Research Board, US

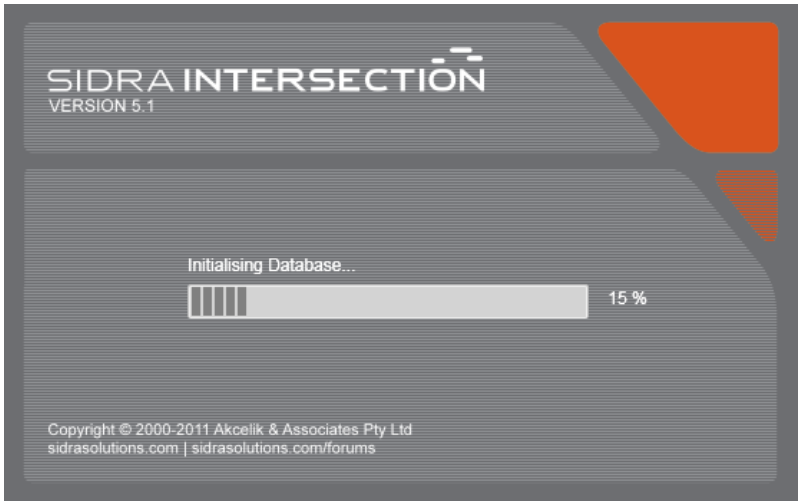
Menggunakan perisian

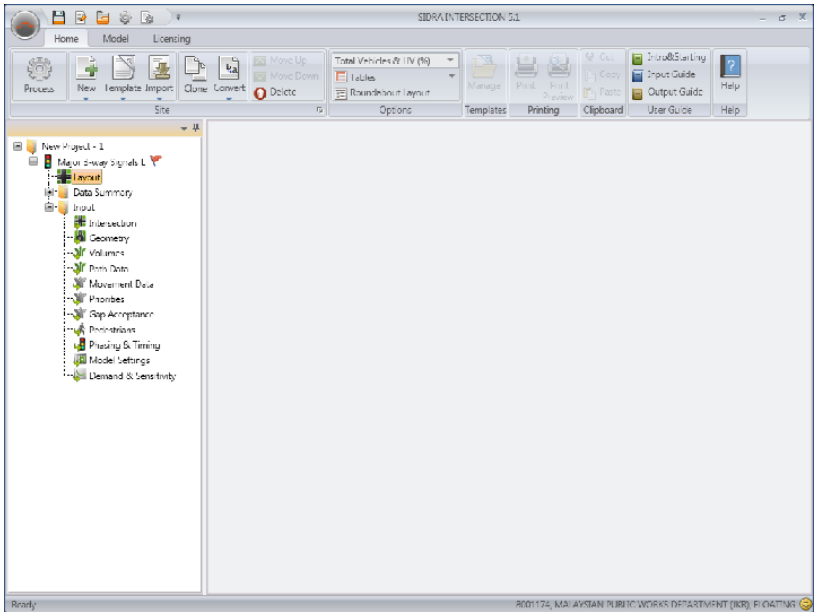
- HCS 2010



HCS 2010 Signalized Intersection Input Data

- SIDRA Intersection





TRAFFIC SIGNAL PARAMETERS

A. Total Flow Period *(ex: 60 mins)*
B. Peak Hour Factor/ Peak Flow Period *(ex: 0.95)*
C. Basic Saturation Flow *(ex: 2000 pcu/hr)*
D. Signal Cycle Time *(ex: 60secs - 180secs)*
E. Intergreen Time *(ex: 3 – 4 secs)*
F. Start Loss Time *(ex: 1 – 2 secs)*
G. End Gain Time *(ex: 1 – 2 secs)*
H. Minimum Green Time *(ex: 6 – 8 secs)*
I. Critical Gap Time *(ex: right turn = 3-5 secs; left turn = 5-7secs)*
J. Follow up Headway *(ex: 2.0 secs)*
K. Practical Degree of Saturation *(ex: 95%)*

TRAFFIC SIGNAL PARAMETERS

A) Total Flow Period

Sidraa → 60

Reason → Usually the traffic data will be analysed over 1 hour period (60 secs)

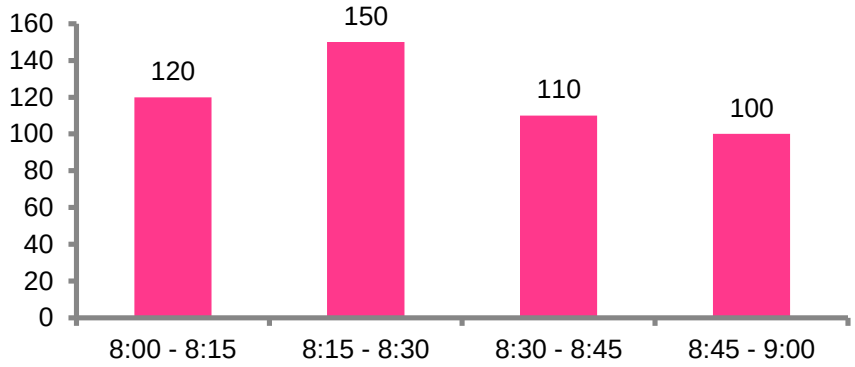
B) Peak Hour Factor / Peak Flow Period

Sidraa → 100

Reason:

1) In an hour (for 15 minutes interval); normally has different traffic volume

2) Example: In an hour; the traffic volume is 480 pcu/hr



Peak Volume = 150 x 4 = 600 pcu/hr

Peak Hour Factor = $\frac{480}{600}$ = 0.80 = 80%

TRAFFIC SIGNAL PARAMETERS

C) Basic Saturation Flow

- Saturation flow rate is defined as the flow rate per lane at which vehicles can pass through a signalised junction.

Sidraa → 1950 – 2200 pcu/hr/lane

Reason → Lane capacity

D) Signal Cycle Time

- Will be calculated by the programme

Sidraa → max = 60secs - 180secs

E) Intergreen Time

- yellow (amber) + all read time

Sidraa → 3 secs – 4 secs

F) Start Loss Time

Sidraa → 1 secs – 2 secs

G) End Gain Time

Sidraa → 1 secs – 2 secs

H) Minimum Green Time

Sidraa → 6 secs – 8 secs

I) Critical Gap Time

- distance (in unit time) between vehicles that required to pass through a signalised junction

Sidraa → right turn = 3-5 secs; left turn = 5-7secs

TRAFFIC SIGNAL PARAMETERS

J) Follow up Headway

- distance (in unit time) between the first and second vehicles to pass through a signalised junction

Sidraa → 2.0 secs

K) Practical Degree of Saturation

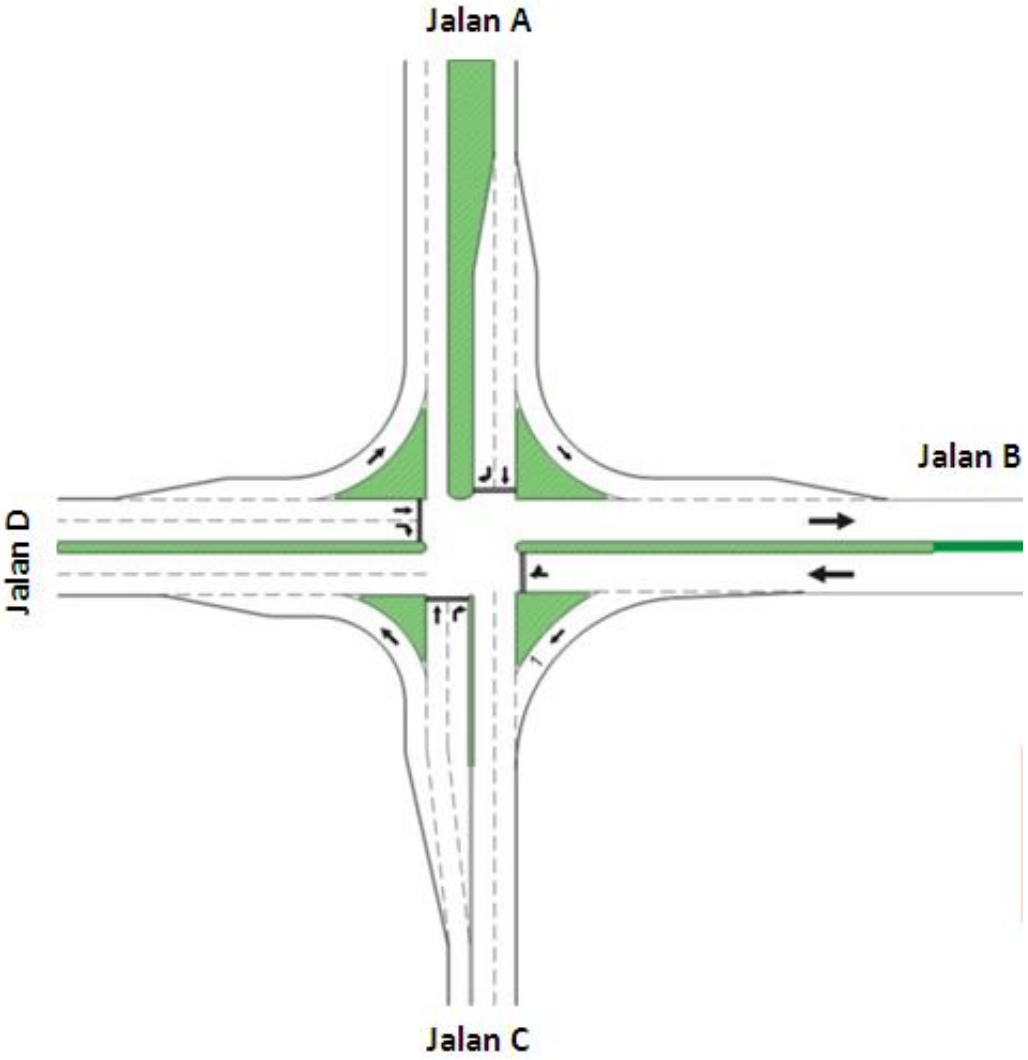
- 95% to 100% of Basic Saturation Flow

Sidraa → 0.95 - 1.00

Analisis Trafik di Persimpangan Menggunakan Perisian SIDRA Intersection

Case Study

Junction Layout



RAW DATA (A1)

From D to C

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	10	7	1	0	0	14	138
7:15	7:30	13	6	0	0	0	15	168
7:30	7:45	27	8	2	3	1	42	211
7:45	8:00	49	10	2	5	0	67	225
8:00	8:15	30	5	2	4	0	44	205
8:15	8:30	45	7	1	3	1	58	209
8:30	8:45	42	2	1	5	0	56	204
8:45	9:00	36	5	0	4	0	47	210
9:00	9:15	36	7	2	2	1	49	221
9:15	9:30	38	4	0	5	1	53	
9:30	9:45	48	3	2	3	1	61	
9:45	10:00	40	7	4	4	0	58	
Total		414	71	17	38	5	563.93	

4:00	4:15	53	11	5	5	0	77	359
4:15	4:30	59	14	3	7	2	89	377
4:30	4:45	56	10	3	10	1	89	374
4:45	5:00	79	11	2	5	3	104	377
5:00	5:15	73	13	1	6	1	95	358
5:15	5:30	70	17	2	2	1	86	355
5:30	5:45	77	8	1	4	1	93	356
5:45	6:00	65	15	1	5	1	85	350
6:00	6:15	71	15	1	3	3	91	346
6:15	6:30	73	17	1	3	0	87	
6:30	6:45	68	14	0	5	1	86	
6:45	7:00	66	15	2	3	0	81	
Total		810	160	22	58	14	1063.3	

From D to B

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	1	0	0	0	0	1	24
7:15	7:30	2	0	0	1	0	4	27
7:30	7:45	2	1	0	1	0	5	27
7:45	8:00	12	0	0	1	0	14	22
8:00	8:15	2	1	1	0	0	4	10
8:15	8:30	4	0	0	0	0	4	7
8:30	8:45	0	0	0	0	0	0	4
8:45	9:00	0	0	1	0	0	2	5
9:00	9:15	1	0	0	0	0	1	3
9:15	9:30	1	0	0	0	0	1	
9:30	9:45	1	0	0	0	0	1	
9:45	10:00	0	0	0	0	0	0	
Total		26	2	2	3	0	36.91	

4:00	4:15	1	0	1	0	0	3	6
4:15	4:30	2	0	0	0	0	2	27
4:30	4:45	1	0	0	0	0	1	26
4:45	5:00	0	0	0	0	0	0	26
5:00	5:15	20	12	0	0	0	24	26
5:15	5:30	1	0	0	0	0	1	2
5:30	5:45	1	0	0	0	0	1	1
5:45	6:00	0	0	0	0	0	0	0
6:00	6:15	0	0	0	0	0	0	0
6:15	6:30	0	0	0	0	0	0	
6:30	6:45	0	1	0	0	0	0	
6:45	7:00	0	0	0	0	0	0	
Total		26	13	1	0	0	32.04	

From D to A

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	4	2	0	0	0	5	13
7:15	7:30	2	2	0	0	0	3	11
7:30	7:45	1	3	0	0	0	2	19
7:45	8:00	4	0	0	0	0	4	25
8:00	8:15	2	1	0	0	0	2	26
8:15	8:30	10	2	0	0	0	11	25
8:30	8:45	7	2	0	0	0	8	17
8:45	9:00	5	0	0	0	0	5	10
9:00	9:15	2	0	0	0	0	2	7
9:15	9:30	2	0	0	0	0	2	
9:30	9:45	1	0	0	0	0	1	
9:45	10:00	2	0	0	0	0	2	
Total		42	12	0	0	0	45.96	

4:00	4:15	2	0	0	0	0	2	11
4:15	4:30	3	0	0	0	0	3	24
4:30	4:45	2	0	0	0	0	2	25
4:45	5:00	4	0	0	0	0	4	25
5:00	5:15	15	0	0	0	0	15	22
5:15	5:30	4	0	0	0	0	4	9
5:30	5:45	2	0	0	0	0	2	7
5:45	6:00	1	1	0	0	0	1	7
6:00	6:15	2	0	0	0	0	2	8
6:15	6:30	1	1	0	0	0	1	
6:30	6:45	2	0	0	0	0	2	
6:45	7:00	2	1	0	0	0	2	
Total		40	3	0	0	0	40.99	

From A to C

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	14	2	0	0	0	15	79
7:15	7:30	18	3	1	1	0	23	84
7:30	7:45	15	2	1	1	0	20	73
7:45	8:00	16	3	0	2	0	21	69
8:00	8:15	12	4	1	2	0	20	56
8:15	8:30	10	1	0	1	0	13	49
8:30	8:45	13	1	0	1	0	16	68
8:45	9:00	7	0	1	0	0	9	72
9:00	9:15	12	1	0	0	0	12	88
9:15	9:30	18	2	2	4	0	31	
9:30	9:45	15	1	0	2	0	20	
9:45	10:00	17	2	0	3	0	24	
Total		167	22	6	17	0	223.01	

4:00	4:15	11	2	0	1	0	14	63
4:15	4:30	9	1	1	0	0	11	85
4:30	4:45	11	3	0	2	0	16	124
4:45	5:00	16	6	1	1	0	22	152
5:00	5:15	24	5	2	3	0	36	175
5:15	5:30	42	5	2	1	0	49	173
5:30	5:45	27	8	1	5	1	45	142
5:45	6:00	21	8	3	6	1	45	125
6:00	6:15	21	5	0	5	0	34	100
6:15	6:30	13	3	0	2	0	18	
6:30	6:45	18	3	1	3	0	27	
6:45	7:00	15	5	2	0	0	20	
Total		228	54	13	29	2	338.32	

RAW DATA (A2)

From A to D

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	33	11	2	1	0	42	254
7:15	7:30	41	18	3	2	1	59	289
7:30	7:45	46	21	3	2	0	63	267
7:45	8:00	69	18	5	3	0	90	269
8:00	8:15	49	21	8	2	1	77	233
8:15	8:30	29	8	2	1	0	37	213
8:30	8:45	50	13	2	3	0	65	226
8:45	9:00	33	9	4	4	1	54	241
9:00	9:15	32	11	8	0	3	56	244
9:15	9:30	32	11	5	3	0	51	
9:30	9:45	40	5	10	7	2	79	
9:45	10:00	39	6	8	1	0	57	
Total		493	152	60	29	8	731.41	

4:00	4:15	29	8	1	4	0	42	213
4:15	4:30	34	10	1	5	0	50	237
4:30	4:45	45	10	3	1	1	58	253
4:45	5:00	51	6	4	1	0	62	292
5:00	5:15	52	5	6	1	0	66	304
5:15	5:30	51	8	2	3	1	66	310
5:30	5:45	68	10	2	7	3	97	298
5:45	6:00	61	10	3	2	0	74	249
6:00	6:15	62	12	0	1	2	73	216
6:15	6:30	39	9	4	2	0	53	
6:30	6:45	36	10	3	1	1	49	
6:45	7:00	33	8	3	0	0	41	
Total		561	106	32	28	8	732.98	

From A to B

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	3	1	0	0	0	3	33
7:15	7:30	5	4	0	0	0	6	40
7:30	7:45	6	4	0	0	0	7	40
7:45	8:00	10	5	1	1	0	16	40
8:00	8:15	6	3	1	1	0	11	30
8:15	8:30	4	1	1	0	0	6	28
8:30	8:45	5	1	0	1	0	8	26
8:45	9:00	3	1	0	1	0	6	25
9:00	9:15	7	1	1	0	0	9	25
9:15	9:30	2	0	1	0	0	4	
9:30	9:45	5	1	1	0	0	7	
9:45	10:00	3	1	0	0	1	6	
Total		59	23	6	4	1	88.34	

4:00	4:15	2	1	1	0	0	4	48
4:15	4:30	3	1	2	0	0	7	55
4:30	4:45	12	1	0	2	0	17	60
4:45	5:00	10	3	3	2	0	21	53
5:00	5:15	6	3	2	0	0	10	44
5:15	5:30	6	5	1	1	0	12	40
5:30	5:45	8	0	1	0	0	10	32
5:45	6:00	12	1	0	0	0	12	27
6:00	6:15	5	3	0	0	0	6	19
6:15	6:30	4	1	0	0	0	4	
6:30	6:45	4	0	0	0	0	4	
6:45	7:00	3	1	1	0	0	5	
Total		75	20	11	5	0	112.1	

From B to D

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	10	2	0	0	0	11	50
7:15	7:30	13	1	0	0	0	13	67
7:30	7:45	12	1	0	0	0	12	75
7:45	8:00	11	2	0	1	0	14	86
8:00	8:15	14	0	0	5	1	28	94
8:15	8:30	13	5	0	3	0	21	86
8:30	8:45	18	4	2	0	0	23	88
8:45	9:00	19	6	1	0	0	23	83
9:00	9:15	15	5	0	0	1	19	82
9:15	9:30	19	2	1	1	0	24	
9:30	9:45	14	2	2	0	0	18	
9:45	10:00	17	1	1	1	0	21	
Total		175	31	7	11	2	226.73	

4:00	4:15	20	8	1	0	0	24	81
4:15	4:30	18	7	0	0	0	20	73
4:30	4:45	21	6	1	0	0	25	80
4:45	5:00	9	7	0	0	0	11	72
5:00	5:15	11	6	2	0	0	16	72
5:15	5:30	13	2	3	4	0	28	66
5:30	5:45	15	4	0	0	0	16	50
5:45	6:00	9	0	0	1	0	11	44
6:00	6:15	10	1	0	0	0	10	44
6:15	6:30	12	0	0	0	0	12	
6:30	6:45	10	0	0	0	0	10	
6:45	7:00	11	1	0	0	0	11	
Total		159	42	7	5	0	196.36	

From B to A

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	1	3	0	0	0	2	11
7:15	7:30	2	4	0	0	0	3	13
7:30	7:45	0	3	0	0	0	1	11
7:45	8:00	2	1	0	1	0	5	13
8:00	8:15	2	0	1	0	0	4	10
8:15	8:30	1	1	0	0	0	1	8
8:30	8:45	3	2	0	0	0	4	10
8:45	9:00	1	0	0	0	0	1	10
9:00	9:15	2	1	0	0	0	2	12
9:15	9:30	1	2	1	0	0	3	
9:30	9:45	1	1	0	1	0	4	
9:45	10:00	2	2	0	0	0	3	
Total		18	20	2	2	0	32.6	

4:00	4:15	4	2	0	0	0	5	24
4:15	4:30	2	2	1	0	0	4	27
4:30	4:45	3	3	1	0	0	6	30
4:45	5:00	5	3	2	0	0	9	36
5:00	5:15	5	2	1	0	0	7	31
5:15	5:30	4	4	1	0	0	7	35
5:30	5:45	8	6	1	0	0	12	31
5:45	6:00	4	2	0	0	0	5	24
6:00	6:15	3	1	2	2	0	11	23
6:15	6:30	2	3	0	0	0	3	
6:30	6:45	2	3	1	0	0	5	
6:45	7:00	2	2	1	0	0	4	
Total		44	33	11	2	0	78.64	

RAW DATA (A3)

From B to C

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	3	1	0	0	0	3	11
7:15	7:30	2	1	0	0	0	2	7
7:30	7:45	3	1	0	0	0	3	5
7:45	8:00	0	0	1	0	0	2	5
8:00	8:15	0	0	0	0	0	0	4
8:15	8:30	0	0	0	0	0	0	4
8:30	8:45	1	0	0	1	0	3	4
8:45	9:00	1	0	0	0	0	1	2
9:00	9:15	0	0	0	0	0	0	1
9:15	9:30	0	0	0	0	0	0	
9:30	9:45	1	0	0	0	0	1	
9:45	10:00	0	1	0	0	0	0	
Total		11	4	1	1	0	16.32	

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
4:00	4:15	0	0	0	0	0	0	1
4:15	4:30	1	0	0	0	0	1	1
4:30	4:45	0	0	0	0	0	0	1
4:45	5:00	0	0	0	0	0	0	2
5:00	5:15	0	0	0	0	0	0	6
5:15	5:30	1	1	0	0	0	1	7
5:30	5:45	1	0	0	0	0	1	7
5:45	6:00	1	0	0	1	0	3	18
6:00	6:15	1	0	0	0	0	1	16
6:15	6:30	1	1	0	0	0	1	
6:30	6:45	11	0	1	0	0	13	
6:45	7:00	1	1	0	0	0	1	
Total		18	3	1	1	0	22.99	

From C to A

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	1	1	0	0	0	1	16
7:15	7:30	2	2	0	0	0	3	15
7:30	7:45	2	2	1	0	0	4	16
7:45	8:00	5	0	0	0	1	7	15
8:00	8:15	1	0	0	0	0	1	10
8:15	8:30	3	0	0	0	0	3	17
8:30	8:45	4	0	0	0	0	4	25
8:45	9:00	2	0	0	0	0	2	28
9:00	9:15	4	0	1	1	0	8	34
9:15	9:30	5	0	2	1	0	11	
9:30	9:45	3	1	1	1	0	7	
9:45	10:00	4	0	2	0	0	8	
Total		36	6	7	3	1	59.23	

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
4:00	4:15	4	1	1	0	0	6	23
4:15	4:30	5	0	0	1	0	7	22
4:30	4:45	4	0	0	0	0	4	23
4:45	5:00	3	0	0	1	0	5	28
5:00	5:15	5	1	0	0	0	5	31
5:15	5:30	6	2	1	0	0	8	34
5:30	5:45	9	1	0	0	0	9	43
5:45	6:00	5	1	0	1	0	8	47
6:00	6:15	4	2	1	1	0	9	52
6:15	6:30	7	5	1	3	0	17	
6:30	6:45	5	3	2	2	0	14	
6:45	7:00	6	4	3	0	0	13	
Total		63	20	9	9	0	105.6	

From C to D

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	0	0	0	0	0	0	16
7:15	7:30	1	0	0	0	0	1	16
7:30	7:45	0	0	0	0	0	0	15
7:45	8:00	15	0	0	0	0	15	17
8:00	8:15	0	0	0	0	0	0	5
8:15	8:30	0	0	0	0	0	0	8
8:30	8:45	0	0	0	1	0	2	8
8:45	9:00	0	0	0	1	0	2	6
9:00	9:15	1	0	0	1	0	3	4
9:15	9:30	0	0	0	0	0	0	
9:30	9:45	0	0	0	0	0	0	
9:45	10:00	1	0	0	0	0	1	
Total		18	0	0	3	0	24.75	

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
4:00	4:15	1	0	0	0	0	1	2
4:15	4:30	0	0	0	0	0	0	12
4:30	4:45	0	0	0	0	0	0	12
4:45	5:00	1	0	0	0	0	1	13
5:00	5:15	8	10	0	0	0	11	12
5:15	5:30	0	0	0	0	0	0	1
5:30	5:45	1	0	0	0	0	1	1
5:45	6:00	0	0	0	0	0	0	0
6:00	6:15	0	0	0	0	0	0	0
6:15	6:30	0	0	0	0	0	0	
6:30	6:45	0	0	0	0	0	0	
6:45	7:00	0	0	0	0	0	0	
Total		11	10	0	0	0	14.3	

From C to B

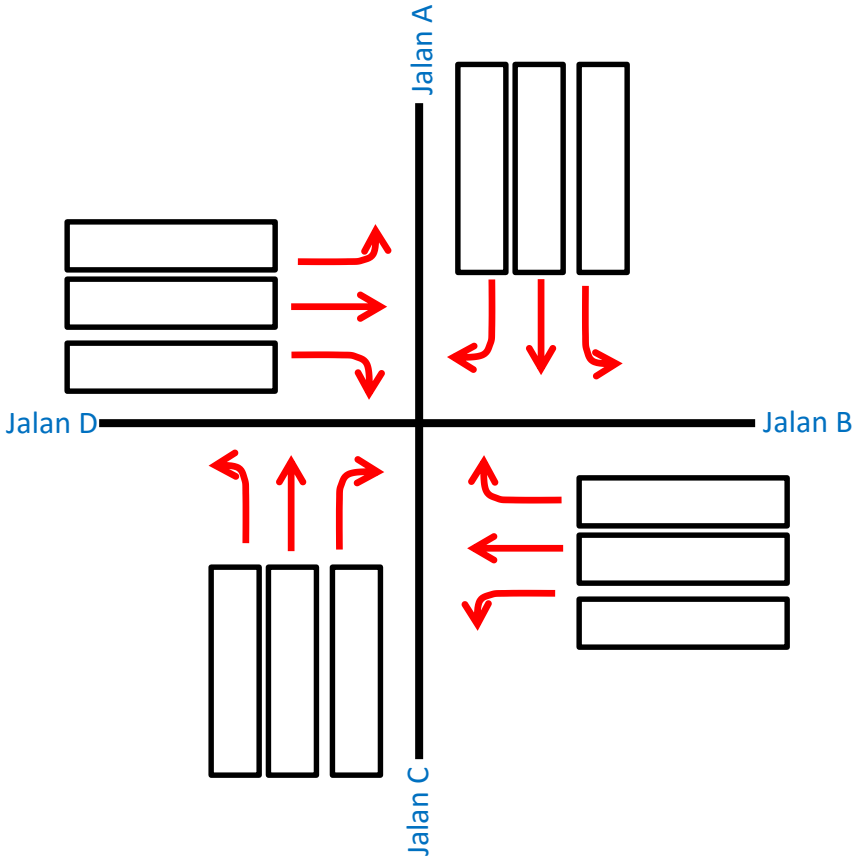
TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
7:00	7:15	2	0	0	0	0	2	12
7:15	7:30	1	0	0	0	0	1	10
7:30	7:45	0	0	0	0	0	0	9
7:45	8:00	6	10	0	0	0	9	10
8:00	8:15	0	0	0	0	0	0	2
8:15	8:30	0	0	0	0	0	0	3
8:30	8:45	1	0	0	0	0	1	5
8:45	9:00	1	0	0	0	0	1	4
9:00	9:15	1	0	0	0	0	1	4
9:15	9:30	1	2	0	0	0	2	
9:30	9:45	0	1	0	0	0	0	
9:45	10:00	1	1	0	0	0	1	
Total		14	14	0	0	0	18.62	

TIME		CAR	M/C	L/T	H/T	BUS	PCU	PCU P'HR
4:00	4:15	0	0	0	0	0	0	3
4:15	4:30	1	1	0	0	0	1	9
4:30	4:45	1	0	0	0	0	1	9
4:45	5:00	1	0	0	0	0	1	9
5:00	5:15	4	5	0	0	0	6	11
5:15	5:30	1	0	0	0	0	1	7
5:30	5:45	1	0	0	0	0	1	7
5:45	6:00	3	1	0	0	0	3	8
6:00	6:15	1	1	0	0	0	1	7
6:15	6:30	1	1	0	0	0	1	
6:30	6:45	1	2	0	0	0	2	
6:45	7:00	2	1	0	0	0	2	
Total		17	12	0	0	0	20.96	

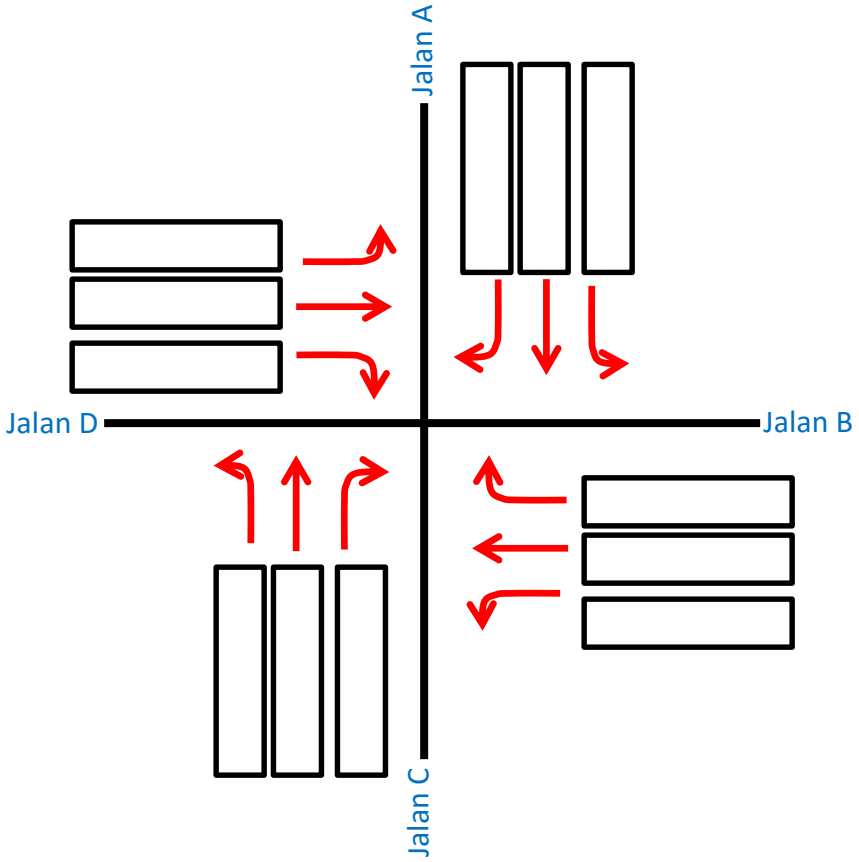
total j1
688
754
774
784
662
637
646
656
688
0
0
0
0
804
944
1011
1099
1115
1058
1012
938
870
0
0
0

EXISTING TRAFFIC VOLUME (2013)

AM PEAK

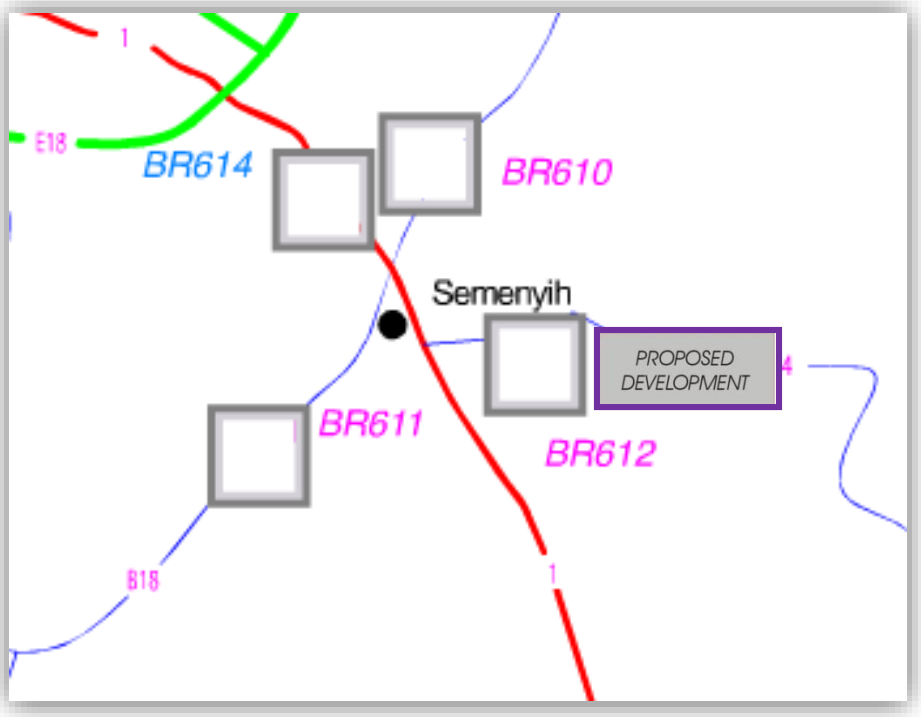


PM PEAK



TRAFFIC GROWTH

$$V_n = V \times (1+r)^n$$

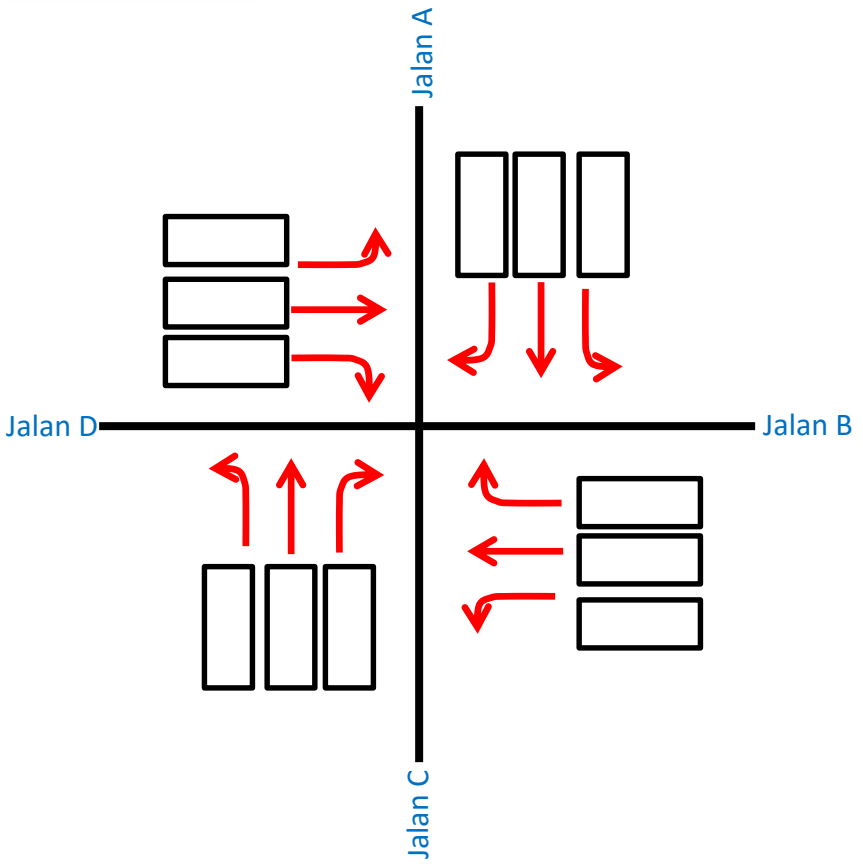


ANNUAL GROWTH RATE AND 16 HOURS TRAFFIC VOLUME 2000-2009 (AVERAGE OF APRIL AND OCTOBER COUNTS) FOR BOTH DIRECTIONS

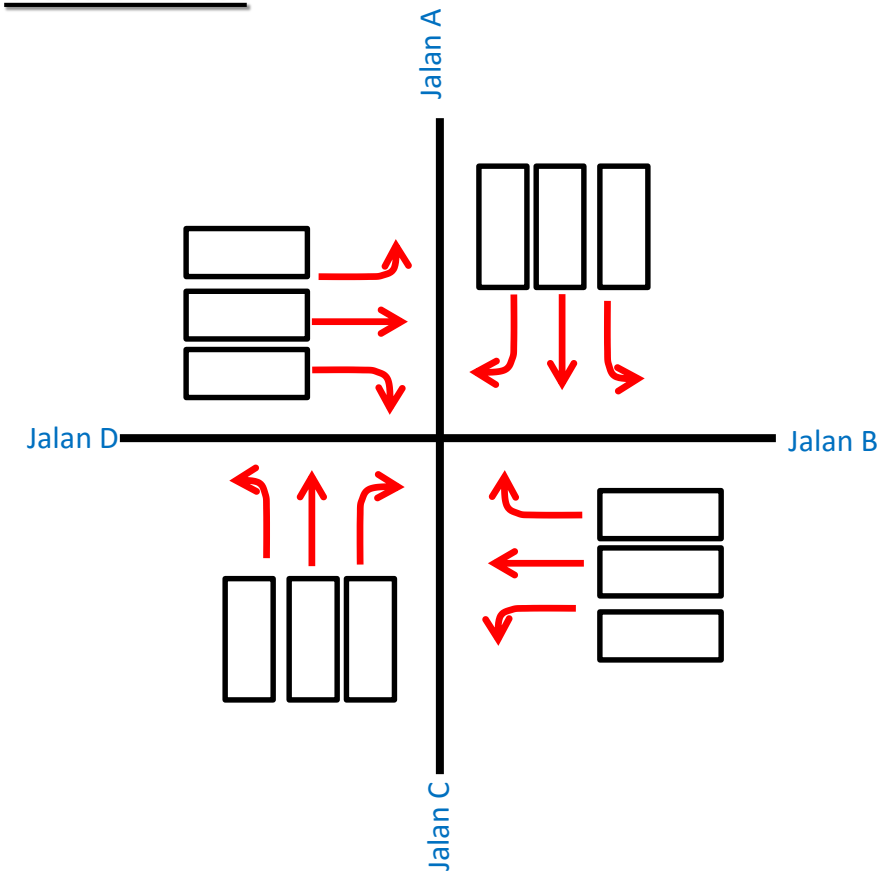
Station No	Route No	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Normal Growth	rsqr	District
BR613	1	794	915	853	1027	1002	837	1080	906	924	972	1.32	0.01	HULU LANGAT
BR612	1	4129	6681	4947	5051	34290	6030	5699	5913	5858	7864	2.7	0.04	HULU LANGAT
BR611	B32	7919	8862	7450	7743	1002	9067	5784	6538	9051	10155	1.87	0.06	HULU LANGAT
BR610	B34	6439	9463	7949	8992	6353	11291	10688	12805	15335	6815	4.57	0.07	HULU LANGAT

FUTURE TRAFFIC VOLUME (2016)

AM PEAK

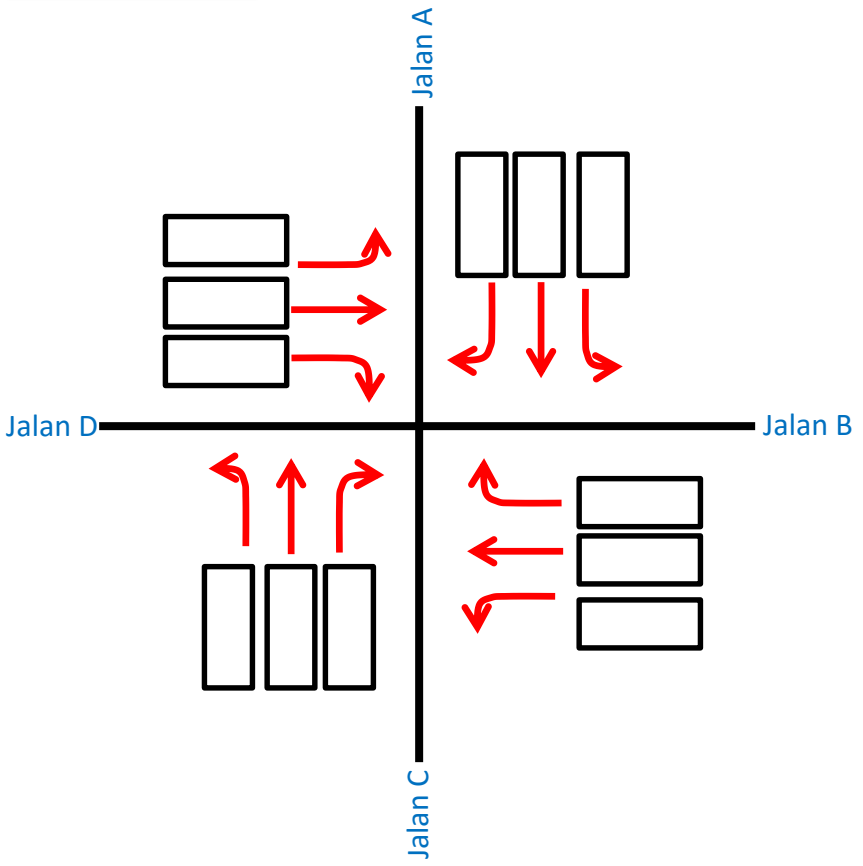


PM PEAK

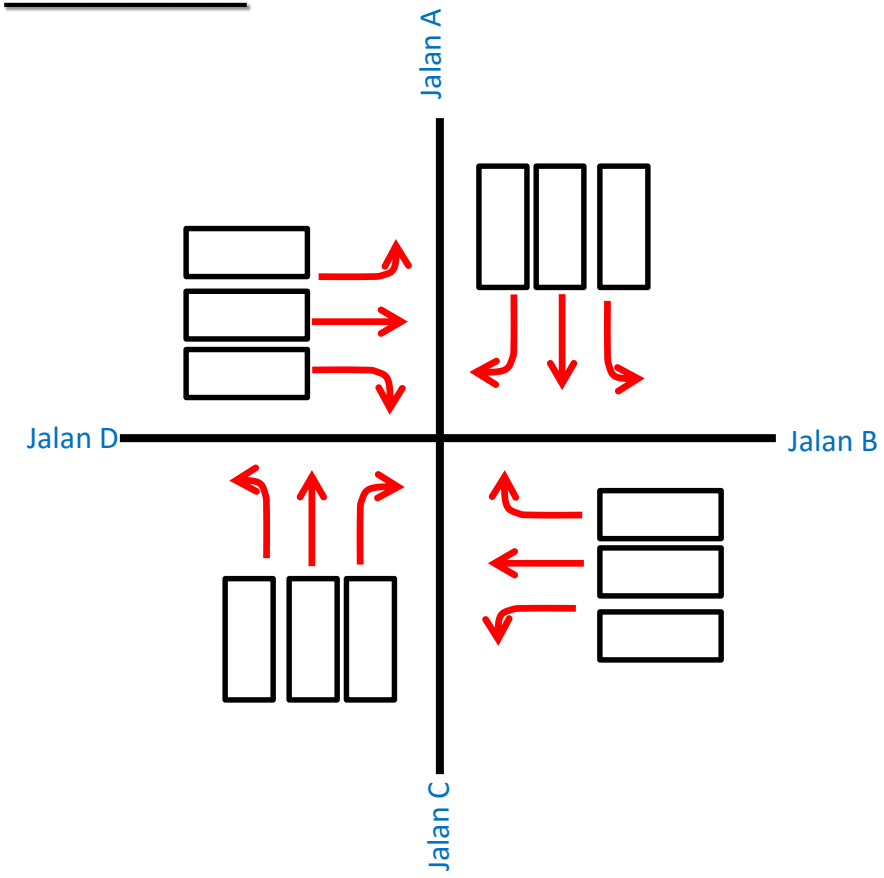


FUTURE TRAFFIC VOLUME (2026)

AM PEAK



PM PEAK



Hasil Analisis / Laporan

INTERSECTION SUMMARY

Site: J1 am peak - 2016

J1
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Persons
Demand Flows (Total)	2417 veh/h	2900 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	1.027	
Practical Spare Capacity	-12.4 %	
Effective Intersection Capacity	2354 veh/h	
Control Delay (Total)	60.30 veh-h/h	72.36 pers-h/h
Control Delay (Average)	89.8 sec	89.8 sec
Control Delay (Worst Lane)	173.8 sec	
Control Delay (Worst Movement)	173.8 sec	173.8 sec
Geometric Delay (Average)	P sec	
Stop-Line Delay (Average)	P sec	
Intersection Level of Service (LOS)	LOS F	
95% Back of Queue - Vehicles (Worst Lane)	109.3 veh	
95% Back of Queue - Distance (Worst Lane)	764.8 m	
Total Effective Stops	2527 veh/h	3033 pers/h
Effective Stop Rate	1.05 per veh	1.05 per pers
Proportion Queued	0.84	0.84
Performance Index	218.0	218.0
Travel Distance (Total)	1472.5 veh-km/h	1767.0 pers-km/h
Travel Distance (Average)	609 m	609 m
Travel Time (Total)	85.8 veh-h/h	103.0 pers-h/h
Travel Time (Average)	127.8 sec	127.8 sec
Travel Speed	17.2 km/h	17.2 km/h
Cost (Total)	2445.31 $/h	2445.31 $/h
Fuel Consumption (Total)	245.0 L/h	
Carbon Dioxide (Total)	612.5 kg/h	
Hydrocarbons (Total)	1.176 kg/h	
Carbon Monoxide (Total)	39.14 kg/h	
NOx (Total)	1.156 kg/h	

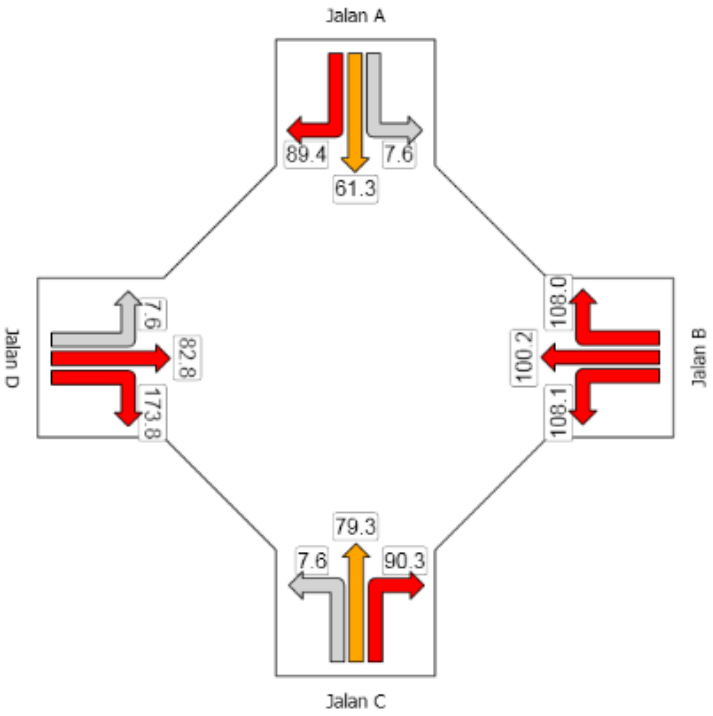
Delay

DELAY (AVERAGE)

Site: J1 am peak - 2016

Average control delay per vehicle, or average pedestrian delay (seconds)

J1
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)



	South	East	North	West	Intersection
Delay (Average)	68.4	103.8	47.2	123.6	89.8
LOS	E	F	D	F	F

Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F | Continuous

Level of Service Method: Delay (HCM 2000)
SIDRA Standard Delay Model used.

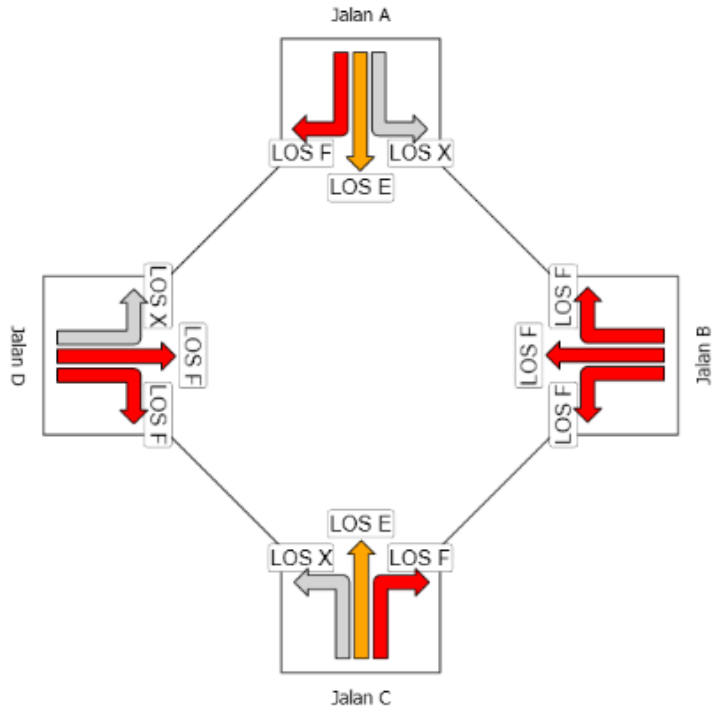
Level of Service

LEVEL OF SERVICE

Level of Service Method: Delay (HCM 2000)

Site: J1 am peak - 2016

J1
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)



	South	East	North	West	Intersection
LOS	E	F	D	F	F

X: Not applicable for Continuous movement.

Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Continuous

SIDRA Standard Delay Model used.

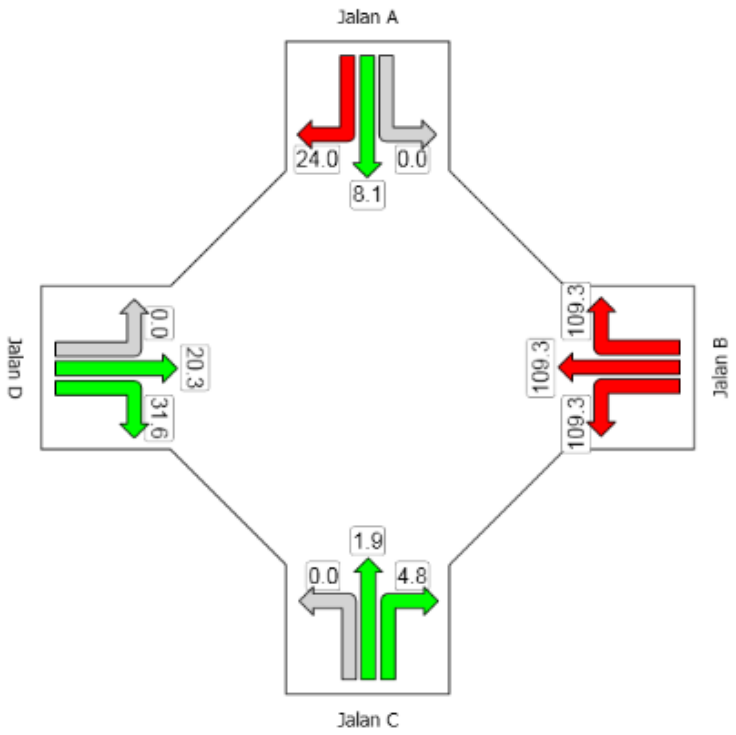
Queue

QUEUE

Largest 95% Back of Queue for any lane used by movement (vehicles)

Site: J1 am peak - 2016

J1
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

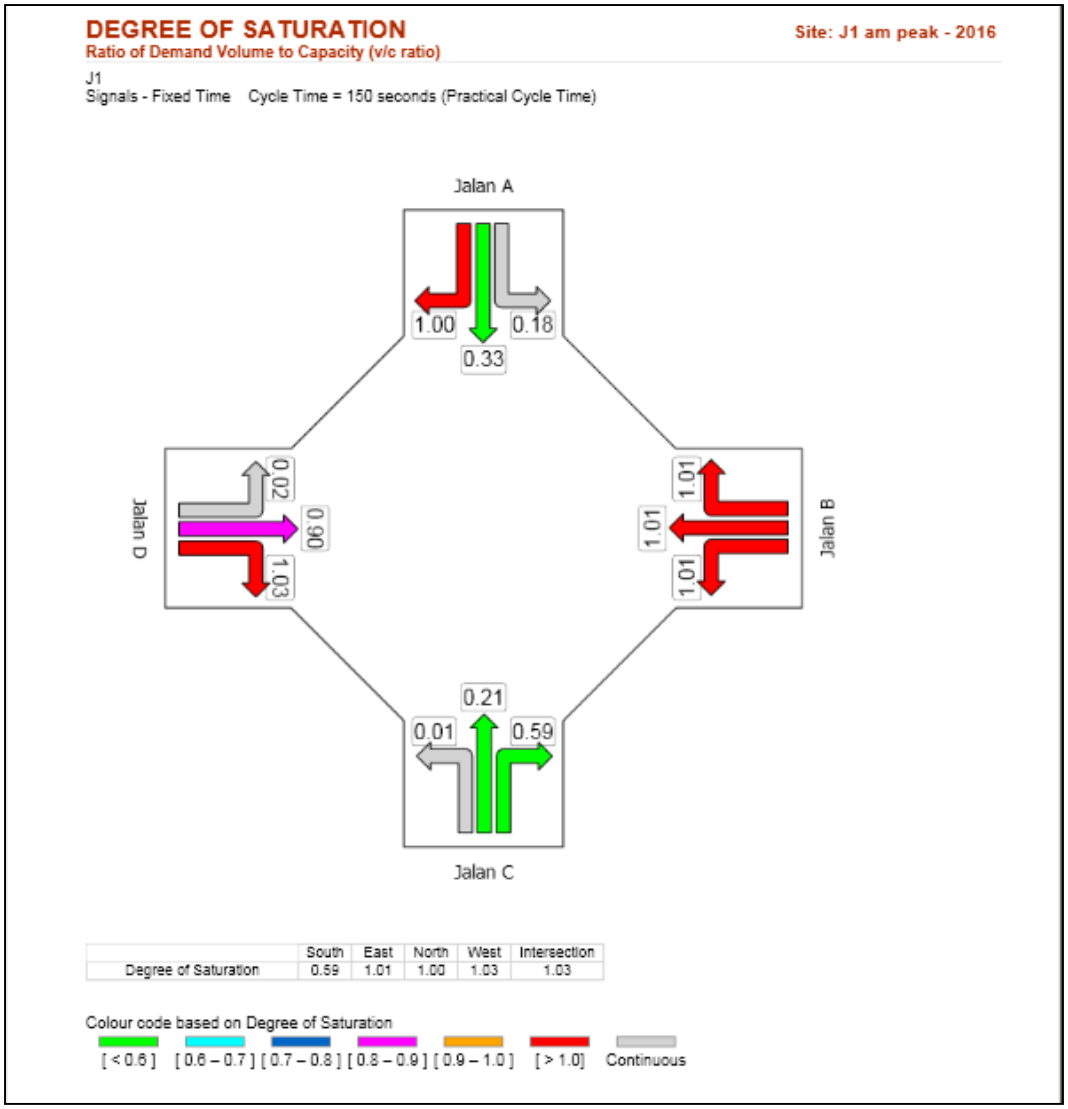


	South	East	North	West	Intersection
Queue	4.8	109.3	24.0	31.6	109.3

Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0] Continuous

Degree of Saturation

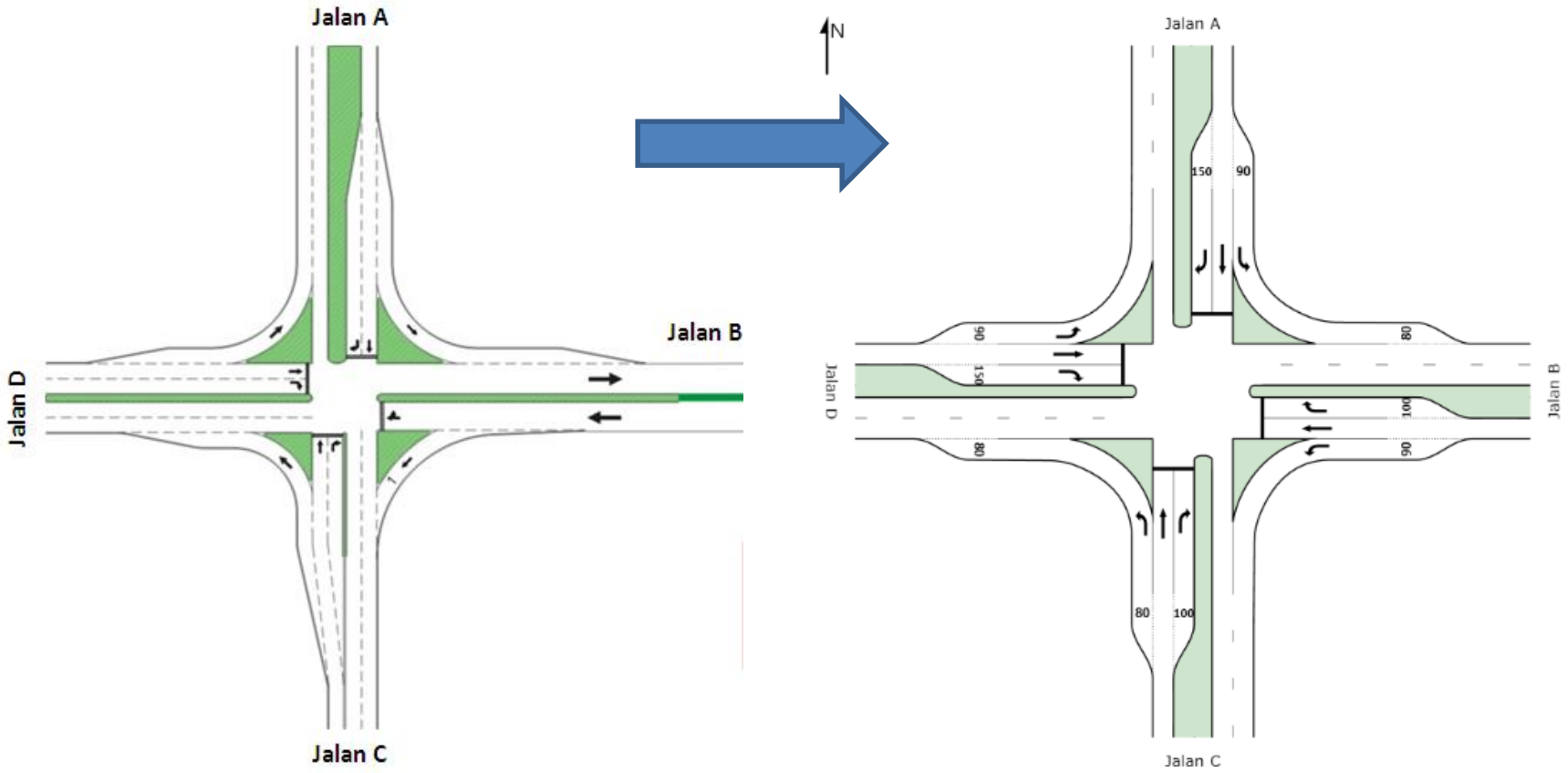


Keperluan LOS bagi persimpangan mengikut kategori jalan

TABLE 4-1: LEVEL OF SERVICE

AREAS	Category of Road	Level of Service
RURAL	Expresssway	C
	Highway	C
	Primary	D
	Secondary	D
	Minor	E
URBAN	Expressway	C
	Arterial	D
	Collector	D
	Local Street	E

Cadangan jenis persimpangan / penambahbaikan



LOS selepas penambahbaikan

- 2016 (semasa pembukaan)

INTERSECTION SUMMARY

Site: J1 am peak - 2016 mitigate

J1
Signals - Fixed Time Cycle Time = 100 seconds (Practical Cycle Time)

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Persons
Demand Flows (Total)	2417 veh/h	2900 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.861	
Practical Spare Capacity	4.5 %	
Effective Intersection Capacity	2807 veh/h	
Control Delay (Total)	23.30 veh-h/h	27.96 pers-h/h
Control Delay (Average)	34.7 sec	34.7 sec
Control Delay (Worst Lane)	60.6 sec	
Control Delay (Worst Movement)	60.6 sec	60.6 sec
Geometric Delay (Average)	P sec	
Stop-Line Delay (Average)	P sec	
Intersection Level of Service (LOS)	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	31.1 veh	
95% Back of Queue - Distance (Worst Lane)	217.6 m	
Total Effective Stops	2007 veh/h	2408 pers/h
Effective Stop Rate	0.83 per veh	0.83 per pers
Proportion Queued	0.66	0.66
Performance Index	109.5	109.5
Travel Distance (Total)	1474.8 veh-km/h	1769.8 pers-km/h
Travel Distance (Average)	610 m	610 m
Travel Time (Total)	48.8 veh-h/h	58.5 pers-h/h
Travel Time (Average)	72.7 sec	72.7 sec
Travel Speed	30.2 km/h	30.2 km/h
Cost (Total)	1456.79 $/h	1456.79 $/h
Fuel Consumption (Total)	188.8 L/h	
Carbon Dioxide (Total)	472.1 kg/h	
Hydrocarbons (Total)	0.844 kg/h	
Carbon Monoxide (Total)	34.55 kg/h	
NOx (Total)	1.038 kg/h	

LOS – 10 tahun akan datang

INTERSECTION SUMMARY

Site: J1 am peak - 2026

J1
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	3154	veh/h	3784	pers/h
Percent Heavy Vehicles	0.0	%		
Degree of Saturation	0.991			
Practical Spare Capacity	-9.2	%		
Effective Intersection Capacity	3181	veh/h		
Control Delay (Total)	57.00	veh-h/h	68.41	pers-h/h
Control Delay (Average)	65.1	sec	65.1	sec
Control Delay (Worst Lane)	128.3	sec		
Control Delay (Worst Movement)	128.3	sec	128.3	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	LOS E			
95% Back of Queue - Vehicles (Worst Lane)	81.1	veh		
95% Back of Queue - Distance (Worst Lane)	567.9	m		
Total Effective Stops	2913	veh/h	3496	pers/h
Effective Stop Rate	0.92	per veh	0.92	per pers
Proportion Queued	0.65		0.65	
Performance Index	223.5		223.5	
Travel Distance (Total)	1924.4	veh-km/h	2309.3	pers-km/h
Travel Distance (Average)	610	m	610	m
Travel Time (Total)	90.3	veh-h/h	108.3	pers-h/h
Travel Time (Average)	103.0	sec	103.0	sec
Travel Speed	21.3	km/h	21.3	km/h
Cost (Total)	2624.24	$/h	2624.24	$/h
Fuel Consumption (Total)	287.6	L/h		
Carbon Dioxide (Total)	719.0	kg/h		
Hydrocarbons (Total)	1.346	kg/h		
Carbon Monoxide (Total)	48.39	kg/h		
NOx (Total)	1.441	kg/h		


Thank You