UNIVERSITI TEKNOLOGI MALAYSIA
PROGRAM PENGAJIAN DIPLOMA

KURSUS KEJURUTERAAN AWAM

MAKMAL JALAN RAYA & LALU LINTAS

SEMESTER/SESI	
TAJUK UJIKAJI	KAPASITI SIMPANG TIDAK BERLAMPU ISYARAT
TARIKH UJIKAJI	
NAMA PELAJAR	
NAMA AHLI KUMPULAN	1.
	2.
	3.
	4.
	5.
	6.
	7.
	8.
	9.
	10.
	11.
	12.
NAMA PENSYARAH	
COP DITERIMA	TANDATANGAN PEMERIKSA MARKAH
ULASAN PEMERIKSA	

KAPASITI SIMPANG TIDAK BERLAMPU ISYARAT

Tujuan

Untuk menilai tahap perkhidmatan simpang keutamaan.

Teori

Muatan persilangan bermaksud keupayaan persilangan menampung pergerakkan lalulintas. Ia mencerminkan isipadu lalulintas maksimum sejam yang dapat ditanggung oleh persilangan tersebut. Apabila paras perkhidmatan yang diperolehi adalah rendah, maka pembaikan atau pertukaran kawalan adalah perlu bagi meningkatkan kelancaran pergerakan. Hasilnya kapasiti simpang tersebut akan meningkat.

Cara Kerja

1. Cerap kenderaan mengikut arah membelok selama 30 minit.
2. Tandakan dengan kaedah tally di dalam borang klasifikasi kenderaan
3. Hitung semua kenderaan mengikut arah di akhir cerapan.
4. Tukarkan jumlah kenderaan mengikut arah tersebut kepada kadar aliran sejam.
5. Berpandukan kepada rajah di dalam buku panduan, lengkapkan analisis *worksheet* yang dikepilkan
6. Kapasiti simpanan (C_s) yang diperoleh hasil daripada ($C_r - V$) dibandingkan dengan kapasiti simpanan yang disaran di Jadual 4.4
7. Lengkapkan paras perkhidmatan simpang tersebut mengikut arah aliran.

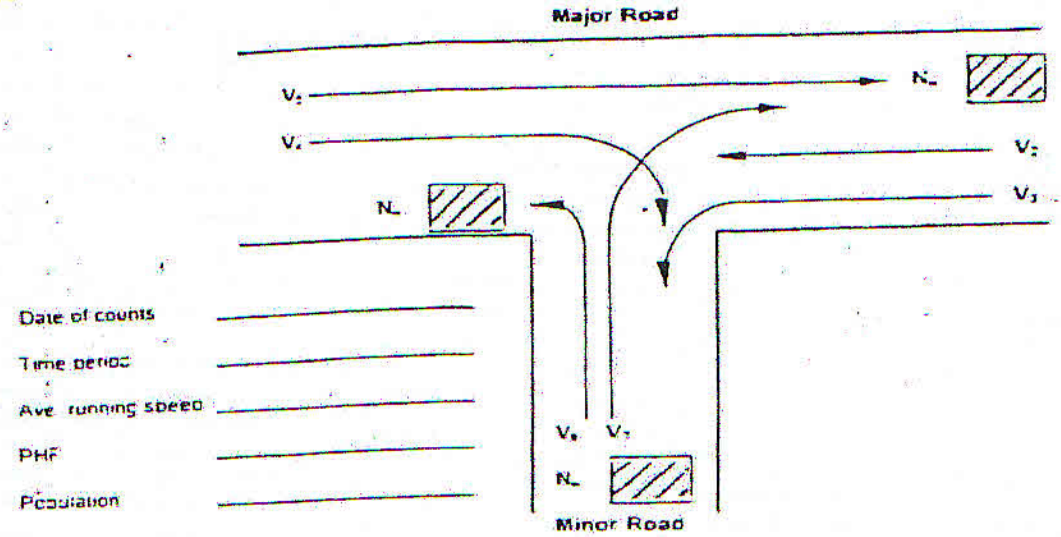
Data Kiraan Kenderaan

Penghitung:		Daerah:		Negeri:		Cuaca:	
Jam Bermula Dari:		Tarikh:		Hari:			
Nombor Stesen:		Arah Dari:		Ke:			

	5	10	15	20	25	30	35	40	45	50	55	60	T
Kereta dan teksi  													
Van Kecil dan Utiliti 													
Lori Sedang dan Van Besar 													
Lori Besar (≥ 3 gandar) 													
Bas 													
Motosikal 													

Analysis of T-Intersection

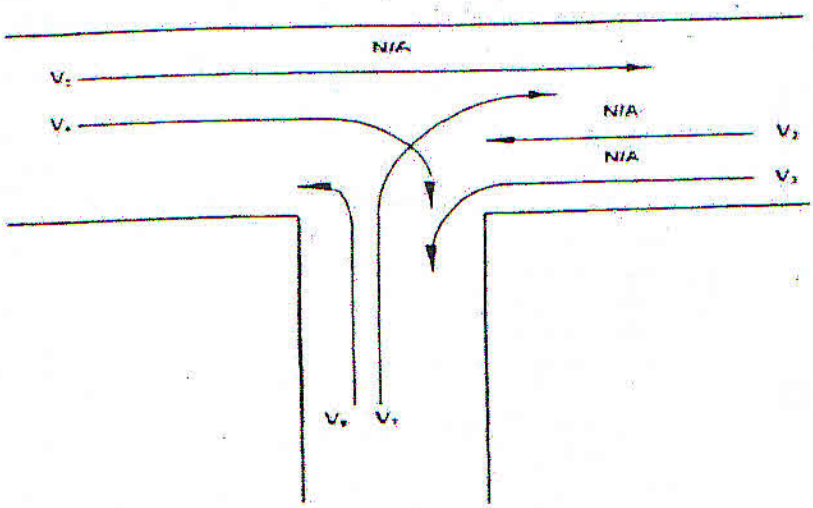
Location:	Name:
Hourly Vc... :2:	



Grade _____%

Volume Adjusments

Movement No	2	3	4	5	7	9
Volume (vph)						
Vol (pcph) - Table 1-2						



Worksheet For Analysisi Of T – Intersection

Step 1 : LT From Minor Road	
Conflicting Flow, V_c Critical gap, T_c And potential capacity, C_p Actual capacity, C_m	½ V_3 + V_2 = _____ + _____ = _____vph (V_{c8}) T_c = _____ sec (Table C) C_{p4} = _____ *pcph* (Figure 2) C_{m8} = C_{p8} = _____ *pcph*
Step 2 : RT From Major Road	
Conflicting Flow, V_c Critical gap, T_c and potential capacity, C_p percent of C_p Utilized and impedance factor, P_4 Actual capacity, C_m	V_3 + V_2 = _____ + _____ = _____vph (V_{c4}) T_c = _____ sec (Table C) C_{p4} = _____ *pcph* (Figure 2) $\left[V_4 / C_{p4} \right]$ X 100 P_4 = _____ C_{m8} = C_{p8} = _____ *pcph*
Step 3 : RT From Minor Road	
Conflicting Flow, V_c Critical gap, T_c and potential capacity, C_p Actual capacity, C_m	½ V_3 + V_2 + V_5 + V_4 = ____ + ____ + ____ + ____ = ____ vph (V_{c7}) T_c = _____ sec (Table C) C_{p7} = _____ *pcph* (Figure 2) C_{m7} = C_{p7} X P_4 = ____ x _____ = *pcph*
Shared - Lane Capacity, SH =	$\dfrac{V_7 + V_8}{\left[V_7 / C_{m7} \right] + \left[V_8 / C_{m8} \right]}$ if lane shared

Movement no	V (*pcph*)	C_m (*pcph*)	CSH (*pcph*)	C_R	LOS
9					
4					
7					

COMMENTS:

THEORY

Level of service is a qualitative measure of the effect of a number factors, which include speed and travel time, traffic interruptions, freedom to manoeuvre, safety driving comfort and convenience and operating costs. The level of service concept is used in the capacity analysis of intersections along the various categories of roads are shown in **Table A.**

TABLE A: Level Of Service.

AREAS	CATEGORY OF ROAD	LEVEL OF SERVICE
Rural	Expressway	C
	Highway	C
	Primary	D
	Secondary	D
	Minor	E
Urban	Expressway	C
	Arterial	D
	Collector	D
	Local Street	E

PROCEDURE.

The basic structure of the procedure is summarized below:

1. Define the existing geometric and volume conditions for the intersections through which each minor road movement and the major road right turn must cross. The includes number of lanes, channelisation, approach gradient, kerb radius, approach angle and sight distances.
2. Determine the traffic volume for each direction. Depending on the approach gradient, conversion of vehicles per hour to passenger per hour is accomplished using the passenger -car equivalent values given in **Table B.**

Table B: Conversion to P.C.U for Unsignalised Intersection.

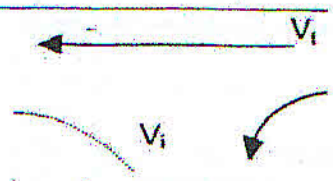
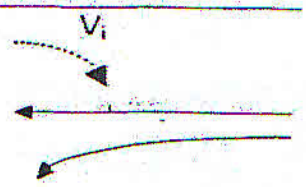
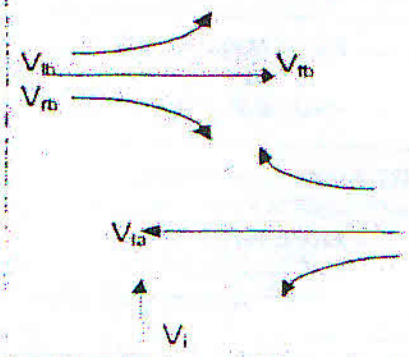
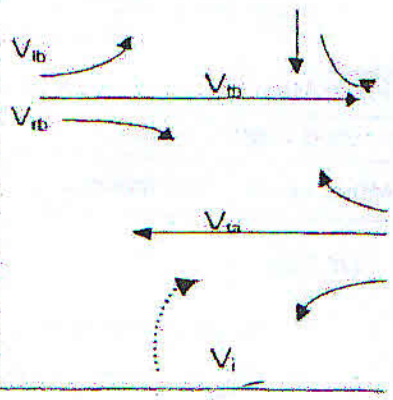
TYPE OF VEHICLE	GRADE (%)				
	-4%	-2%	0%	+2%	+4%
Motorcycle	0.3	0.4	0.5	0.6	0.7
Passenger Cars	0.8	0.9	1.0	1.2	1.4
SU	1.0	1.2	1.5	2.0	3.0
WB – 50	1.2	1.5	2.0	3.0	6.0
All Vehicles*	0.9	1.0	1.1	1.4	1.7

* if vehicle composition is unknown, these values may be used as an approximation.

3. Determine the 'conflicting volume' for movement *i*, which is denoted V_{ci}. The V_{ci} is the total volume which conflicts with movement *i*, expressed vehicles per hour. Definition and computation of conflicting traffic volumes is shown in Figure 1.
4. Determine critical gap size T_c (in seconds) from Table C. the critical gap is defined as the median time headway between successive vehicles in the major road traffic stream that is accepted by drivers in a subject movement that must cross and / or merge with road flow. The basic critical gap size is firstly based on the type of the movement, control and major road speed. Adjustments and modifications to the basic critical gap size may be necessary for a variety of conditions.
5. Based on the conflicting traffic volume, V_c in vehicles per hour and the critical gap T_c in seconds, determine the potential capacity in the passenger cars per hour, C_{pi} by referring to Figure 2. The potential capacity movement is defined as the 'ideal' capacity for a specific subject movement, assuming the following conditions:

a. Traffic on the major roadway does not block the minor road.

Figure 1 : Definition and Computation Traffic Volumes

MOVEMENT	CONFLICTING TRAFFIC, V_{ci}	ILLUSTRATOR
1) Left Turn from minor road	$\frac{1}{2}\ (V_i)^{**} + V_i^{*}$	
2) Right-Turn from major road	$V_i^{***} + V_t^{*}$	
3) Through MVT from minor road	$\frac{1}{2}\ V_i^{**} + V_{ta} + V_{ra} + V_{lb} + V_{tb} + V_{rb}$	
4) Right Turn from minor road	$\frac{1}{2}\ (V_{la})^{**} + V_{ta} + V_{ra} + V_{lb}^{***} + V_{tb} + V_{rb} + V_i + V_{01}$	

NOTE:

* v_t includes only the volume in the left hand lane.

** Where a left turn lane is provided on the major role road V_i or V_{la} should be deleted.

*** Where the left turn radius into the minor road is large and or where these movements are STOP / GIVE WAY controlled, V_i (case 2) and V_{la} and / or V_{lb} can also be deleted for multilane major roads.

Table C: Critical Gap Size Selection.

BASIC CRITICAL GAP FOR PASSENGER CARS (SEC)				
VEHICLE MANEOUVER AND TYPE OF CONTROL	AVERAGE RUNNING SPEED, MAJOR ROAD 50 km / hr		90 km / hr	
	NUMBER OF LANES ON MAJOR ROAD 2	4	2	4
LT From Minor Road **STOP**	5.5	5.5	6.5	6.5
GIVEWAY	5.0	5.0	5.5	5.5
RT From Major Road	5.0	5.5	5.5	6.0
Cross From Major Road **STOP**	6.0	6.5	7.5	8.0
GIVEWAY	5.5	6.0	6.5	7.0
RT From Minor Road **STOP**	6.5	7.0	8.0	8.5
GIVEWAY	6.0	6.5	7.0	7.5

ADJUSTMENTS AND MODIFICATIONS TO CRITICAL GAP, SEC	
CONDITION	ADJUSTMENT
LT From Minor Road: Kerb Radius > 15 m Or Turn Angle < 60°	- 0.5
LT From Minor Road : Acceleration Lane Provided	- 1.0
Restricted Sign Distance *	Up to + 1.0
All Movements: Population ≥ 250,000	- 0.5

NOTE:

Maximum total decrease in critical gap = 1.0 sec

Maximum critical gap = 8.5 sec

For values of average running speed between 50 and 90 km / hr, interpolate.

* This adjustments is for the specific movement affected by restricted sight distance.

b. Traffic from nearby intersections does not back up into the intersection under consideration.

c. A separate lane is provided for the exclusive use for each minor road movement under consideration..

d. No other movements impede the subject movement.

e. Vehicles utilize gaps in a prioritized manner at unsignalised intersections. The potential capacity of a lower priority movement can be impeded when traffic become congested. The impact of impedance is taken into the consideration by multiplying the potential capacity of the movement C_{pi} by a series of impedance factors P_i for each impeding movement *i*. Impedance factors P_i are found from Figure 3 are based solely on the percent of potential capacity of impeding movement used by existing demand. Figure 4 illustrates the computations for the calculation of the movement capacity, C_{mi} which is the adjusted capacity of the movement.

7. Frequently, two or three movements share a single lane on the minor road approach. When this occurs, vehicles from different movement do not have simultaneous access to gaps. Where several movements share the same lane, and cannot stop side by side at stop line, the following equation is used to compute the capacity of the shared lane:

$$C_{sh} = \frac{V_i + V_t + V_r}{\left[\frac{V_i}{C_{mi}}\right] + \left[\frac{V_t}{C_{mt}}\right] + \left[\frac{V_r}{C_{mr}}\right]}$$

Where,

C_{sh} = capacity of the shared lane

V_i = volume or flow rate of left turn movement in shared lane, in *pcph*

V_t = volume or flow rate of through movement in shared lane, in *pch*

V_r = volume or flow rate of right turn movement in shred lane, in *pch*

C_{mi} = movement capacity of the left turn movement in shared lane, in *pch*

C_{mt} = movement capacity of the through movement in shared lane, in *pch*

C_{mr} = movement capacity of the right turn movement in shared lane, in *pch*

If the shared lane includes only left-turn and through movements, both numerator and denominator terms for right-turners are deleted in the equation.

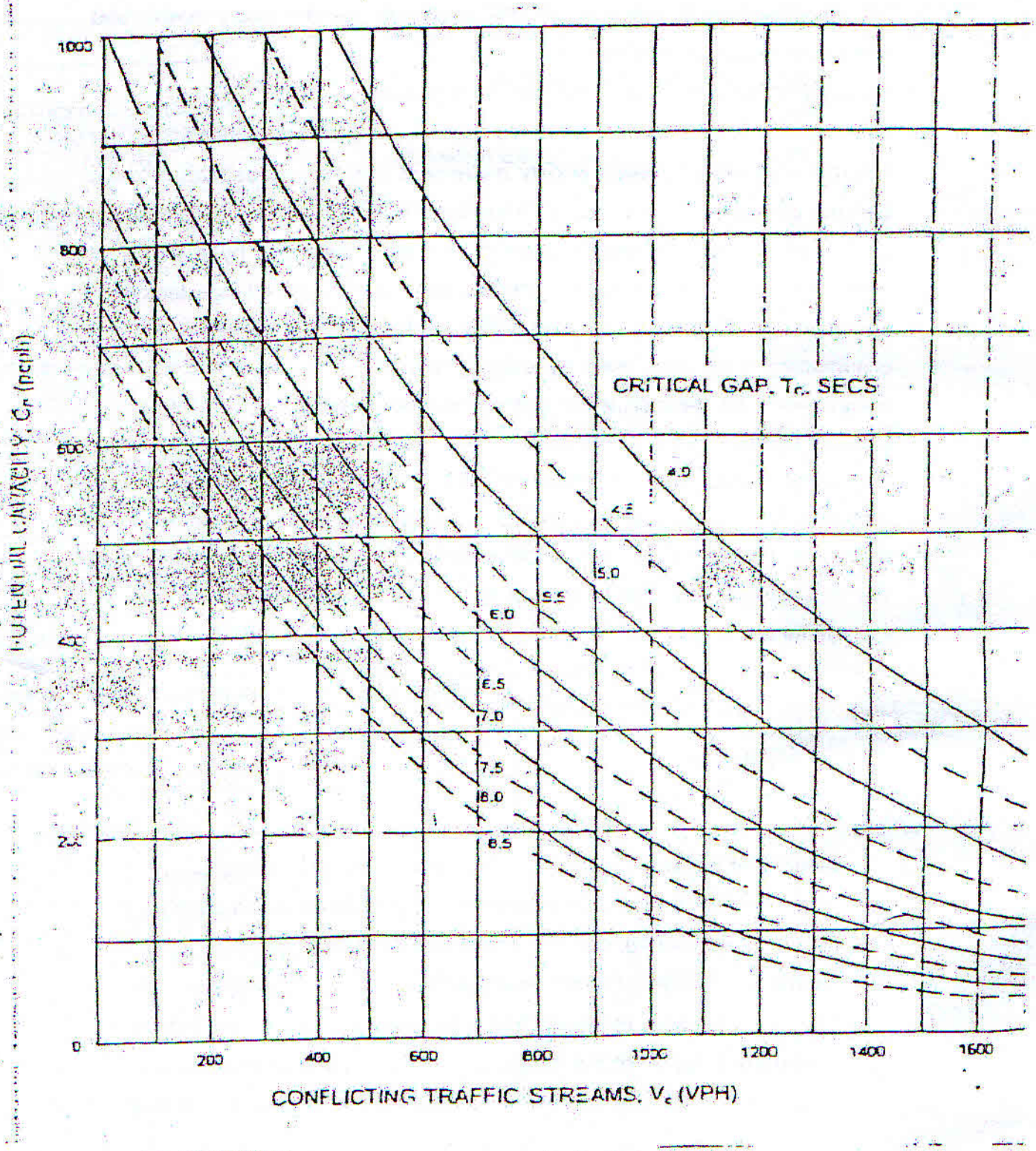


FIGURE 2 Potential Capacity Based On Conflicting Traffic Volume And Critical Gap Size

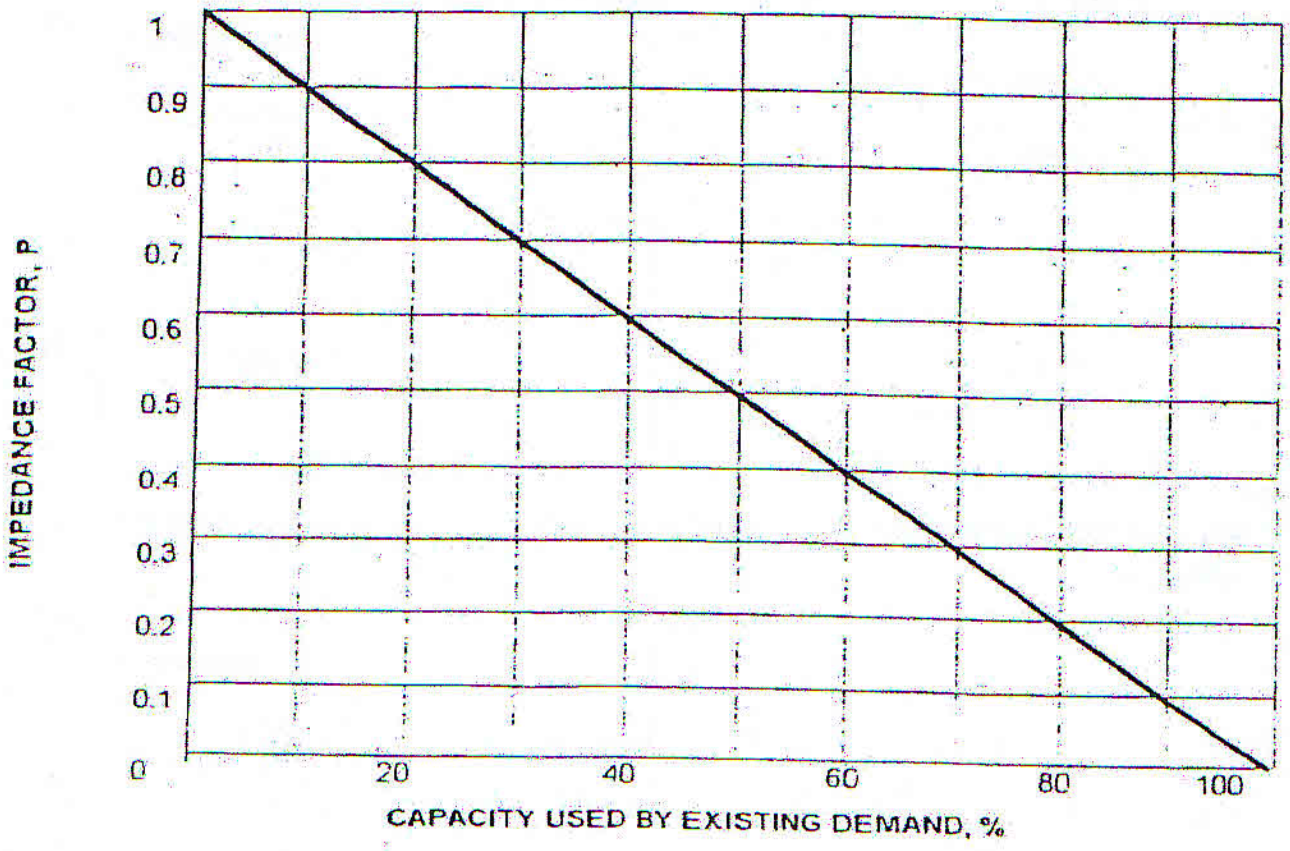


Figure 3: Impedance Factors As A Result Of Congested Movements

8. Compute the reserve capacity of the minor road approach lane using the equation below:-

$$C_R = C_{SH} - V$$

Where,

C_R = reserve capacity of the lane in *pcph*

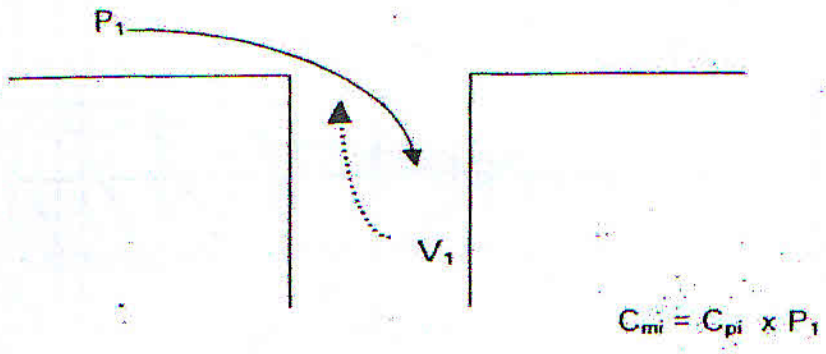
C_{SH} = shared lane capacity of the lane in *pcph*

V = total volume or flow rate using the lane

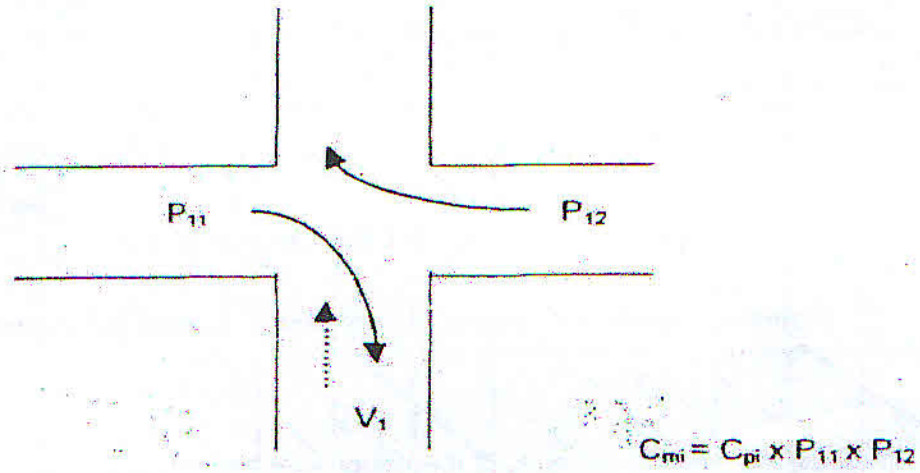
9. Determine the level service by comparing the value of reserve capacity in Table D.

Figure 4 : Illustration Of Impedance Calculations

CASE 1: Right Turn From Minor Road At a T-Intersection



CASE 2: Through Traffic From Minor Road At a 4 Leg Intersections



CASE 3: Right Turns From Minor Road At a 4 Leg Intersections

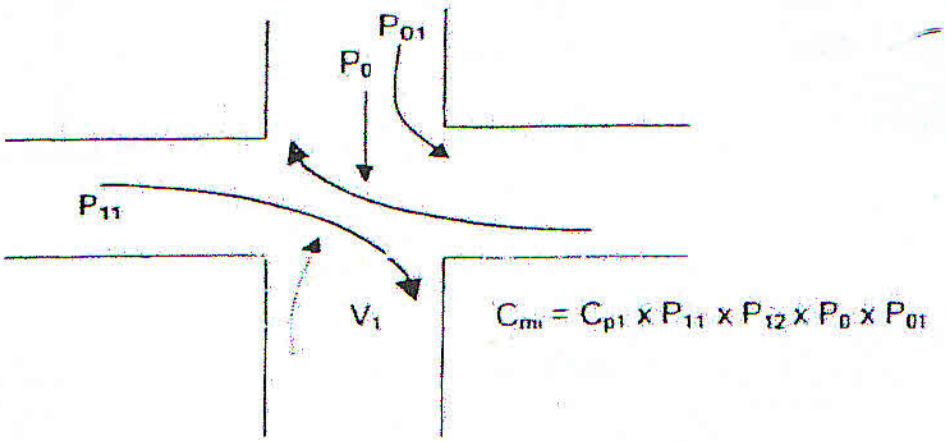


Table D : Level Service Criteria For Unsignalised Intersection.

Reserve Capacity (*pcph*)	Level Of Service	Expected Delay To Minor Road Traffic
400	A	Little Or No Delay
300 – 399	B	Short Traffic Delays
200 – 299	C	Average Traffic Delays
100 – 199	D	Long Traffic Delays
0 – 99	E	Very Long Traffic Delays
	F	

When demand volume exceeds the capacity of the lane extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement to the intersection.