COURS

THÉORIE DE LA CIRCULATION

L'ACCEPTATION DES CRÉNEAUX

(Recueil des acétates utilisées)

par:

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Attention: Il n'est pas suffisant de consulter ces acétates. Elles ne remplacent pas les cours et les références bibliographiques choisies pour le cours.

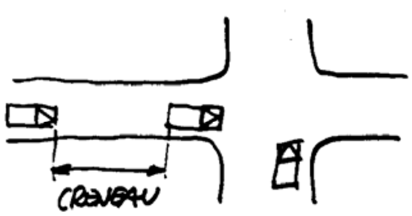
Janvier 2003

L'ACCEPTATION DES CRENEAUX

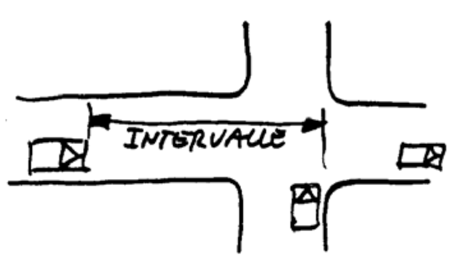
DEFINITIONS:

ECART (headway) : LE TEMPS OU LA DISTANCE ENTRE LE PASSAGE DE 2 VEHICULES MESURÉ ENTRE LES PARE-CHOCS AVANT DE 2 VEHICULES CONSECUTIFS.

CRENEAU (gap) : LE TEMPS OU LA DISTANCE ENTRE LE PASSAGE DE DEUX VEHICULES MESURÉ ENTRE LE PARE-CHOC ARRIERE DU VEHICULE EN TETE ET LE PARE-CHOC AVANT DU VEHICULE SUIVANT.



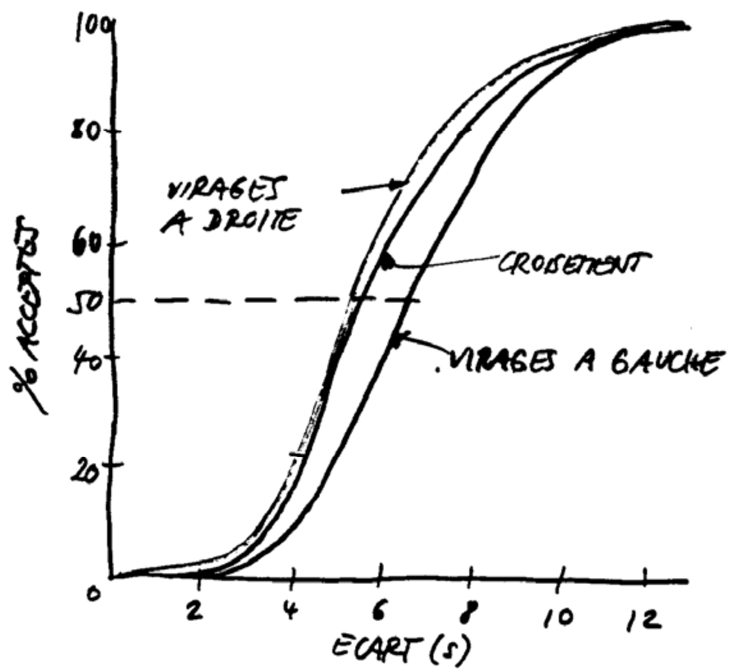
INTERVALLE (lag) : C'EST LE TEMPS ENTRE LE MOMENT OÙ LE VEHICULE SUR LA RUE SECONDAIRE EST EN POSITION POUR ACCEPTER OU DE REJETER UNE OPPORTUNITE DE TRAVERSER OU DE CONVERGER DANS LA CIRCULATION SUR LA RUE PRINCIPALE, ET L'ARRIVEE D'UN VEHICULE SUR LA RUE PRINCIPALE.



L'INTERVALLE CRITIQUE: 3 DEFINITIONS

CRENEAU CRITIQUE (critical gap):

- EST DEFINI COMME L'INTERVALLE t POUR LEQUEL LE NOMBRE TOTAL D'INTERVALLES ACCEPTES PLUS COURT QUE t EST EGAL AU NOMBRE TOTAL D'INTERVALLES REJETES PLUS LONGS QUE t.

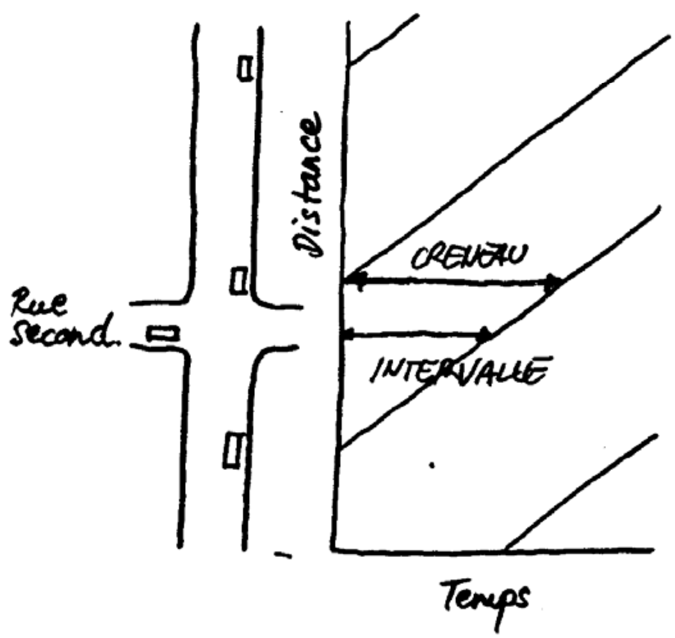


ACCEPTATION DE CRENEAUX AU STOP

- CORRESPOND A LA MEDIANE (50% CENTILE) DES ECARTS.

CERTAINES ETUDES SE SONT BASEES SUR LES CRENEAUX, D'AUTRES SUR LES INTERVALLES.
LA MESURE DES CRENEAUX EST PLUS PRATIQUE.

- LE CRENEAU MOYEN, QUI CORRESPOND A LA MOYENNE DE LA DISTRIBUTION DES CRENEAUX

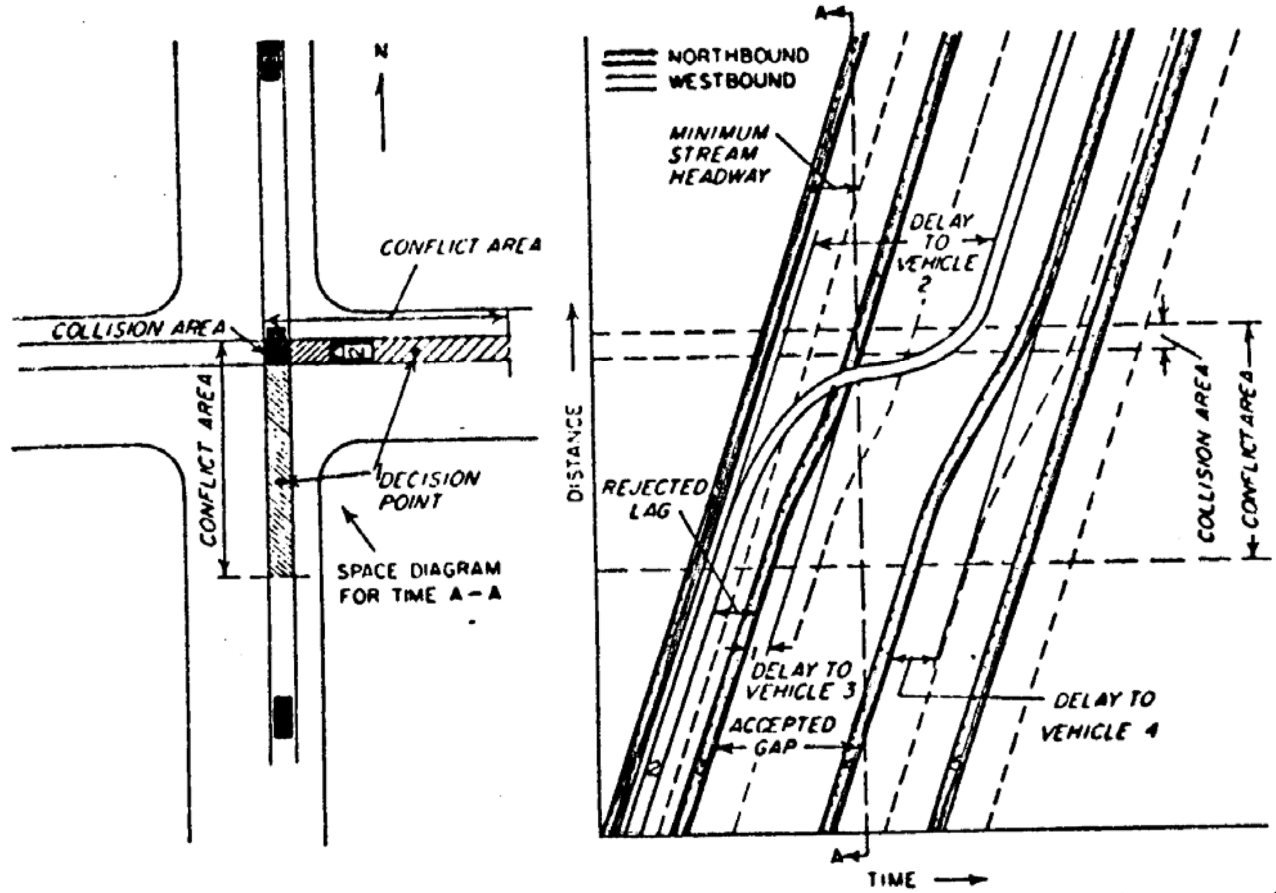


UTILISATION

- CALCUL DE LA CAPACITE DES CARREFOURS SANS FEUX (CHAPITRE 10, HCM 85)
- CALCUL DE LA CAPACITE DES BRETELLES D'AUTOROUTES.
- GESTION DES BRETELLES.
- MODELES DE SIMULATION DE LA CIRCULATION AUX CARREFOURS.
- CALCUL DES RETARDS SUBIS PAR LES CONDUCTEURS AUX CARREFOURS SANS FEUX.
- ETUDE D'ENTRECROISEMENT
- TRAVERSES DE PIETON
- ETUDES DE SECURITE

CROISEMENT

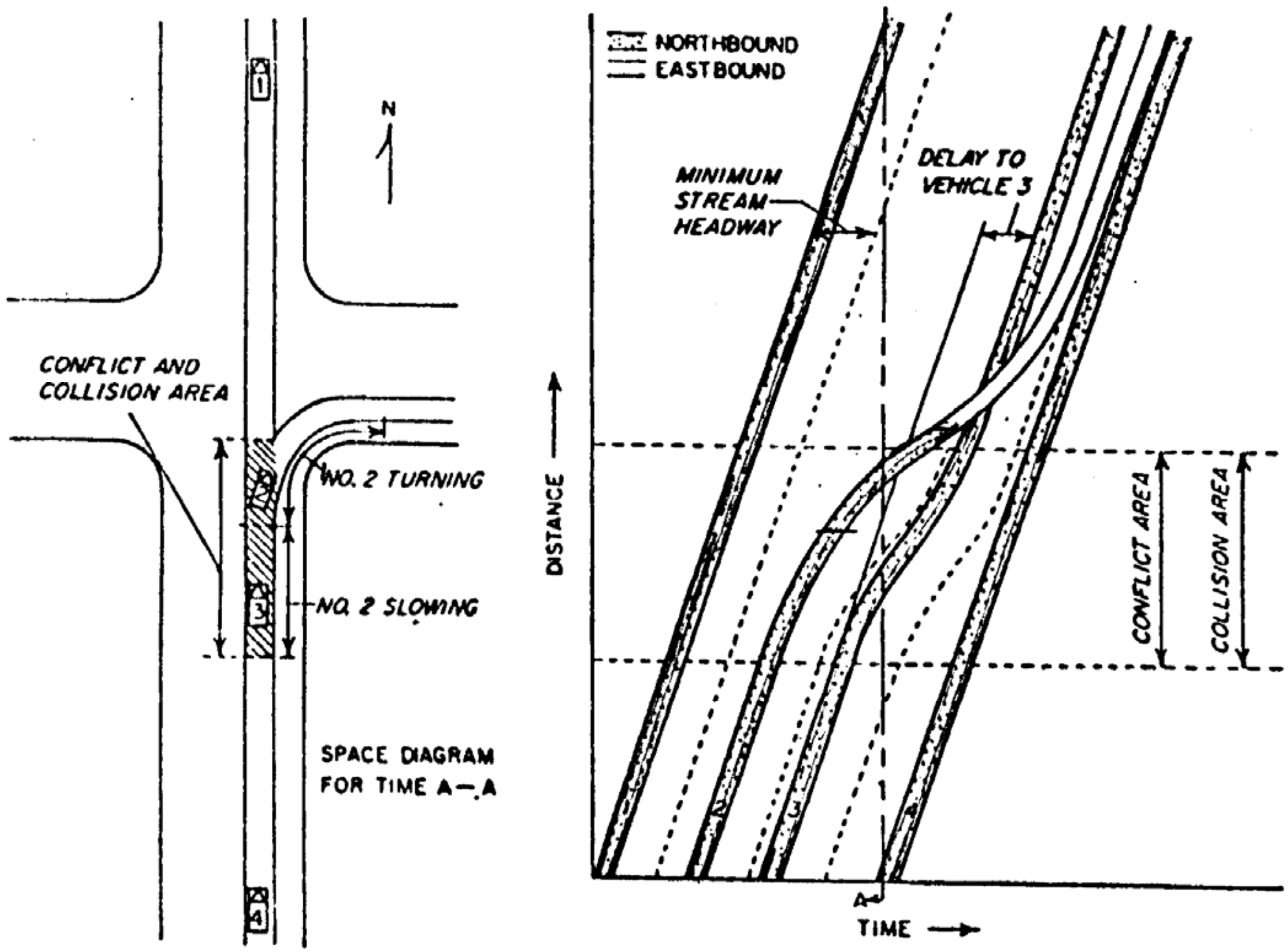
- CONDUCTEUR 3 SUBIT DES RETARDS. IL REDUIT SA VITESSE POUR S'ASSURER DU COMPORTEMENT DU CONDUCTEUR 2
- VEHICULE 4, QUI EST TROP PROCHE, DOIT EGALEMENT REDUIRE SA VITESSE



Time-space relationships of crossing maneuver. (Matson)

DIVERGENCE

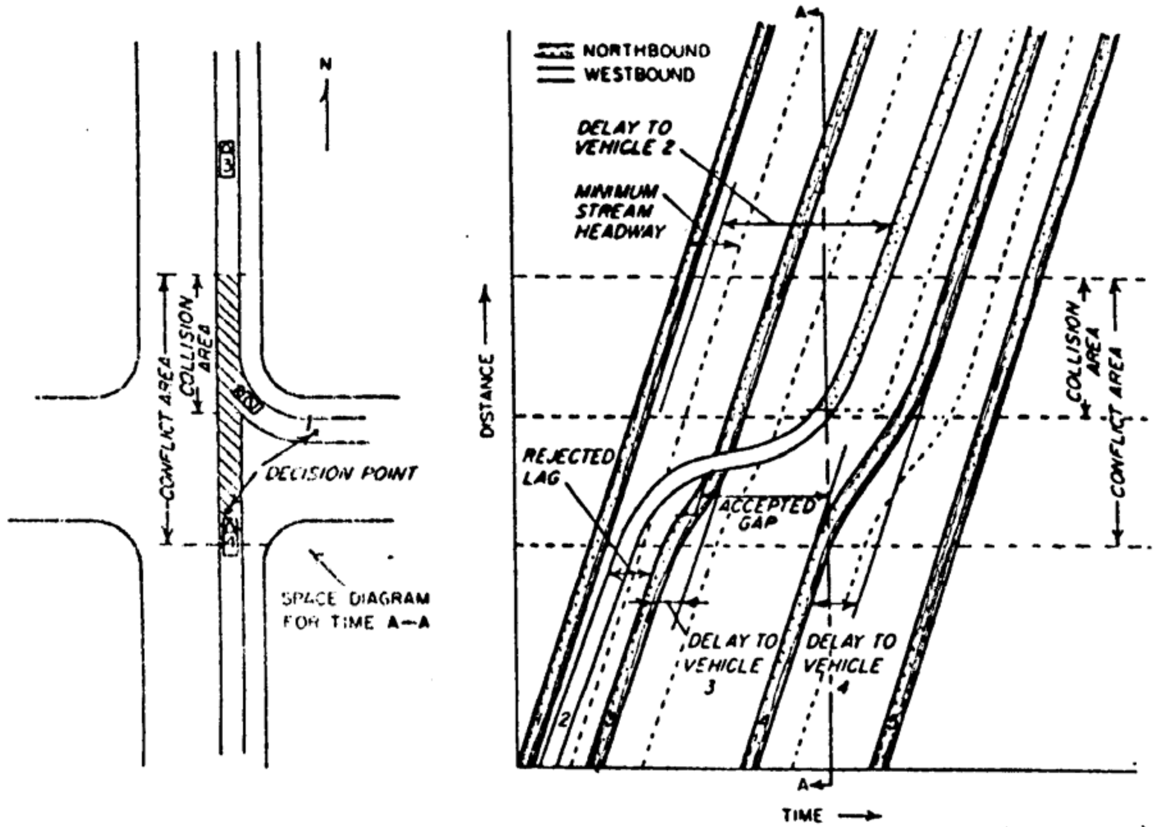
- CONDUCTEUR 3 SUBIT UN RETARD, A CAUSE DU RALENTISSEMENT DU VEHICULE 2.



Time-space relationships of diverging maneuver. (Matson)

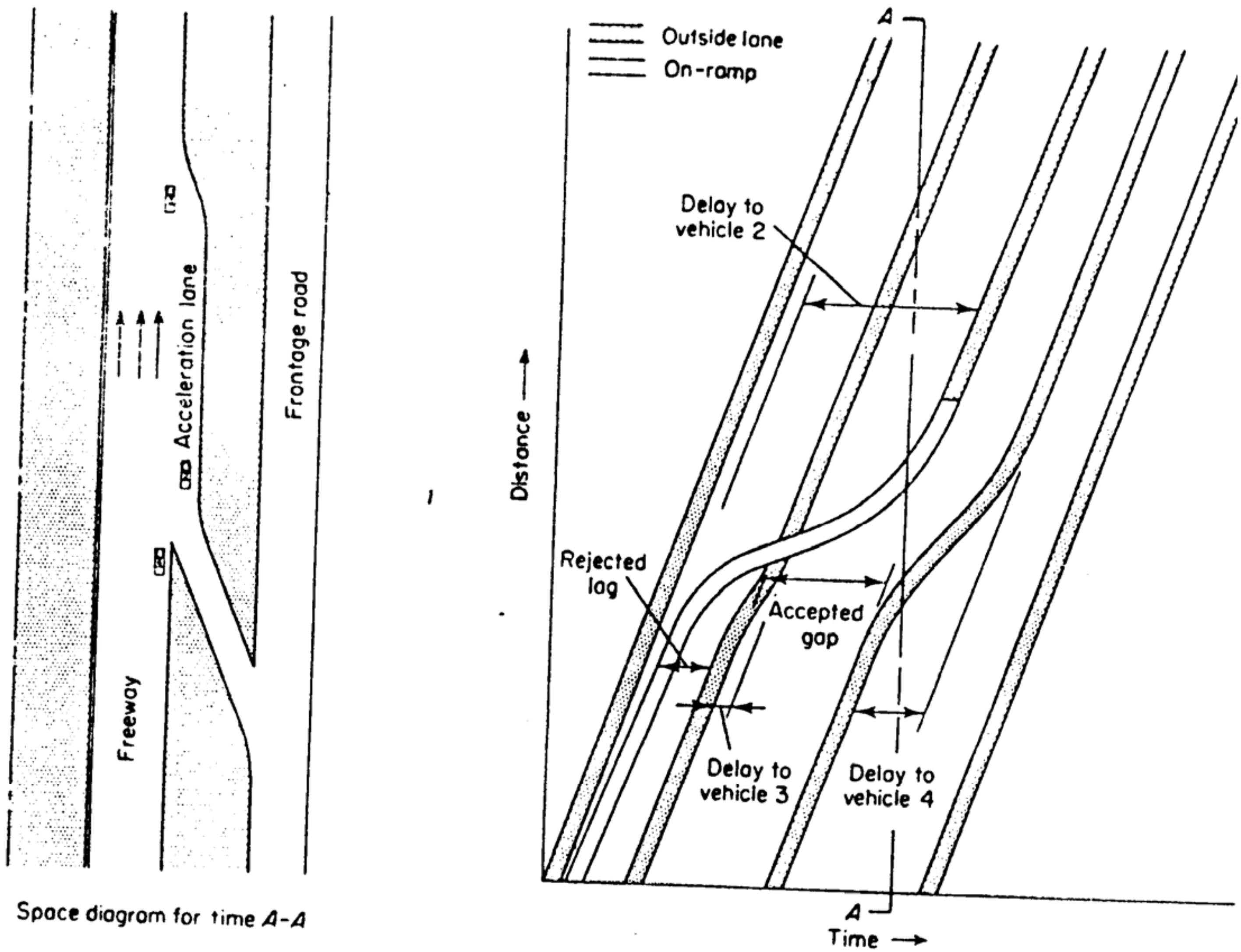
CONVERGENCE

- CONDUCTEURS 3,4 REDUIT SA VITESSE POUR TENIR COMPTE DU COMPORTEMENT DE 2.
- CONDUCTEUR 4 DOIT REDUIRE SA VITESSE PUISQU'IL EST TROP PROCHE DE 2.



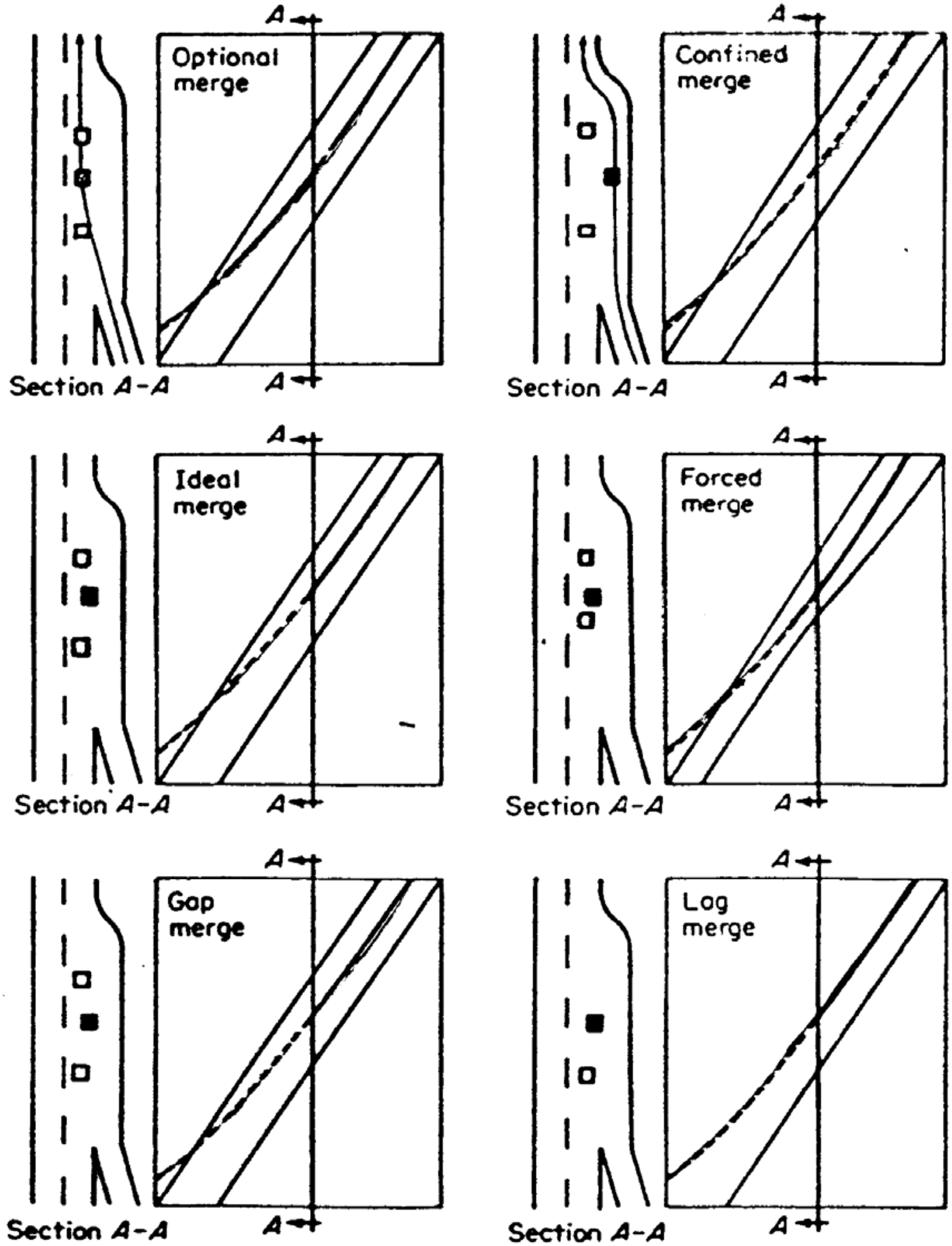
Time-space relationships of merging maneuver. (Matson)

"CONVERGENCE FORCEE", CAR LE VEHICULE 2 ENGENDRE DES RETARDS AU VEHICULE 4. UNE "CONVERGENCE IDEALE" NE CREERA PAS DE RETARDS AUX CONDUCTEURS 3 ET 4.



¯ime-space relationships of freeway merging maneuver.

(Drew)



Types of freeway merges. (Drew)

LE CRENEAU CRITIQUE

- ON ACCEPTE LE CRENEAU SI ON TRAVERSE AVANT LE VEHICULE VENANT DANS LE COURANT DE LA ROUTE PRINCIPALE ; ON LE REJETTE SI ON ATTEND UNE AUTRE OCCASION.

- LE COMPORTEMENT DES CONDUCTEURS A UN CARREFOUR SANS FEUX PEUT ETRE DECRIT PAR LE CRENEAU CRITIQUE (MEDIANE) OU MIEUX ENCORE PAR LA DISTRIBUTION STATISTIQUE DE L'ACCEPTATION DES CRENEAUX.

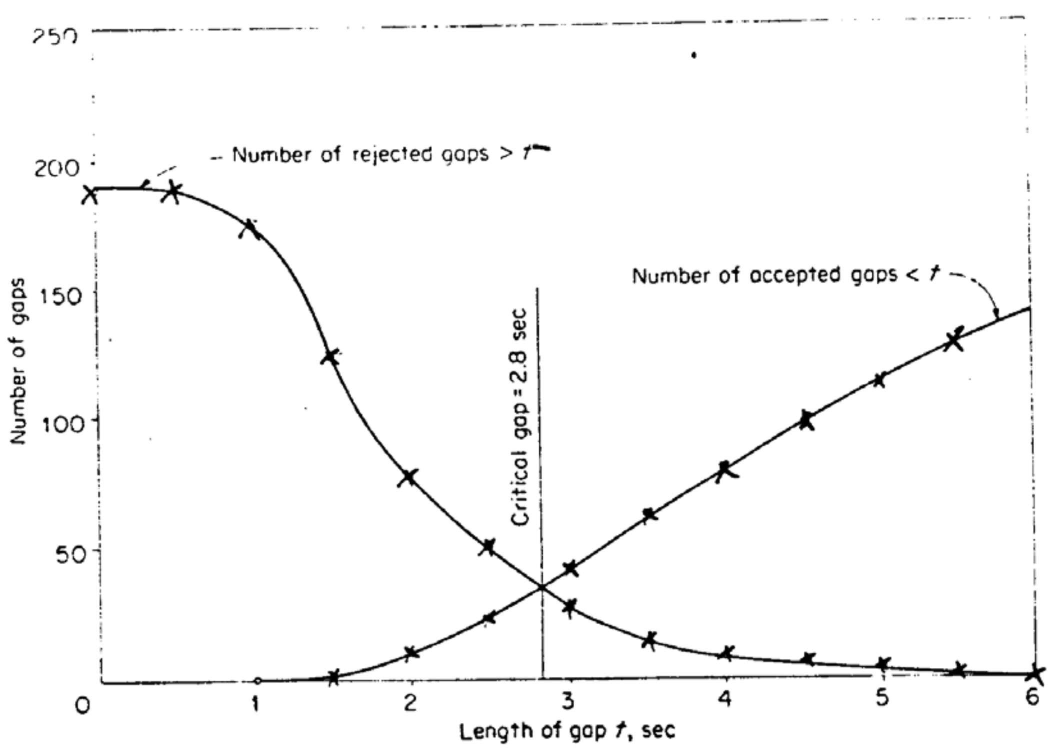
- LE CRENEAU CRITIQUE t_c
  - DEPEND DE LA GEOMETRIE DU CARREFOUR
  - DEPEND DE LA LARGEUR DE LA RUE PRINCIP.
  - DEPEND DE LA DISTANCE DE VISIBILITE
  - DEPEND DE LA VITESSE SUR LA RUE PRINCIP.
  - VARIE D'UN ENDROIT A L'AUTRE (COMPORTEMENT DES CONDUCTEURS : RURAL-URBAIN ETC)
  - LE DEBIT N'A PAS OU PEU D'INFLUENCE

Table 9.1 Accepted and rejected gaps at Dumble ramp (DREW)

	Stopped vehicles		Moving vehicles		All vehicles	
Length of gap t, sec	Accepted gaps $< t$	Rejected gaps $> t$	Accepted gaps $< t$	Rejected gaps $> t$	Accepted gaps $< t$	Rejected gaps $> t$
0.0	0	100	0	89	0	189
Δt = 0.5	0	100	0	89	0	189
1.0	0	95	0	80	0	175
1.5	0	71	1	52	1	123
2.0	2	49	7	27	9	76
2.5	11	34	a = 13	c = 16	a = 24	c = 50
3.0	a = 15	c = 20	b = 26	d = 7	b = 41	d = 27
3.5	b = 23	d = 10	38	4	61	14
4.0	32	5	46	3	78	8
4.5	41	4	55	3	96	7
5.0	48	2	63	2	111	4
5.5	57	0	70	1	127	1
10.0	100	0	106	0	206	0

Critical gap $T = t + \dfrac{(c - a)\Delta t}{(b + c) - (a + d)}$ $= 3 + \dfrac{(20-15)\cdot 0.5}{(23+20)-(15+10)} = 3.1$ s

T (stopped) = 3.1 T (moving) = 2.5 T (all) = 2.8



Accepted and rejected gaps for all vehicles at Dumble ramp.

Critical Gap Criteria for Unsignalized Intersection[a]

BASIC CRITICAL GAP FOR PASSENGER CARS (sec)

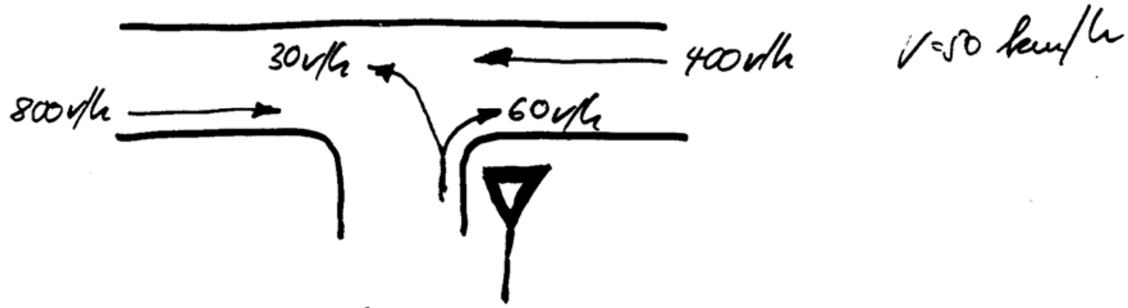
Vehicle Maneuver and Type of Control	Average Running Speed, Major Road[b] 30 miles/hr		55 miles/hr	
	Number of Lanes on Major Road 2	4	2	4
RT from minor road				
Stop	5.5	5.5	6.5	6.5
Yield	5.0	5.0	5.0	5.0
LT from major road	5.0	5.5	5.5	6.0
Cross major road				
Stop	6.0	6.5	7.5	8.0
Yield	5.5	6.0	6.5	7.0
LT from minor road				
Stop	6.5	7.0	8.0	8.5
Yield	6.0	6.5	7.0	7.5

ADJUSTMENTS AND MODIFICATIONS TO CRITICAL GAP (sec)

Condition	Adjustment
RT from minor street: curb radius > 50 ft or turn angle < 60[c]	–0.5
RT from minor street: acceleration lane provided	–1.0
All movements: population ≥ 250,000	–0.5
Restricted sight distance[a]	Up to +1.0

Maximum total decrease in critical gap = 1.0 sec; maximum critical gap = 8.5 sec.
For values of average running speed between 30 and 55 miles/hr, interpolate.
This adjustment is made for the specific movement impacted by restricted sight distance.

EXEMPLE



QUEL EST LE % DU TEMPS PENDANT LEQUEL LES VEHICULES SUBISSENT UN RETARD?

SELON LE TABLEAU

t_c POUR T.A.D ET CEDEZ : 5.0 s

t_c POUR T.A.G ET CEDEZ : 6.0 s

{ POUR ETRE PLUS PRECIS, IL FAUT SOUSTRAIRE LA LONGUEUR MOYENNE DES VEHICULES DE L'ECART }

T.A.D

LA PROBABILITE D'UN CRENEAU $h \geq 5$ sec ?

$$P(h \geq 5) = e^{-\frac{Q \cdot t_c}{3600}} = e^{-\frac{800 \cdot 5}{3600}} = 0.33$$

DONC ON A UNE PROBABILITE D'ATTENDRE DE 67%

T.A.G

ON DOIT TRAVERSER D'ABORD LE COURANT DE 800 v/h ($t_{c_1} = 5.5$) ET S'INSERER ENSUITE DANS LE COURANT DE 400 v/h. ($t_{c_2} = 6$)

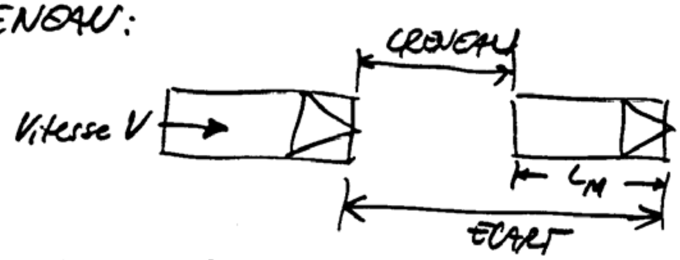
$$P_1(h \geq 5.5) = e^{-\frac{Q_1 t_{c_1}}{3600}} \qquad P_2(h \geq 6) = e^{-\frac{Q_2 t_{c_2}}{3600}}$$

SELON LA THEORIE DE PROBABILITE, LA PROBABILITE DE L'OCCURENCE DE P_1 ET DE P_2 EN MEME TEMPS EST $P_1 \times P_2 = P_{12}$

$$P_{12} = P_1 \cdot P_2 = e^{-\frac{Q_1 t_{c_1}}{3600}} \cdot e^{-\frac{Q_2 t_{c_2}}{3600}} = e^{-\frac{800 \cdot 5.5 + 400 \cdot 6}{3600}} = 0.15$$

RETARD EN 85% DES CAS

SI ON CONSIDERE LA DIFFERENCE ENTRE ECART ET CRENEAU:



$\Delta h = ECART - CRENEAU$

$$L_M = \frac{P_C \cdot L_C + P_A L_A}{100}$$

$$\Delta h = \frac{3.6\, L_m}{V}$$

$$\Delta h = \frac{3.6\,(P_C L_C + P_A L_A)}{100\, V}$$

si $P_C = 10\%$ $P_A = 90\%$

$L_A = 6m$ AUTO
$L_C = 10\,m$ CAMION

$$\Delta h = \frac{3.6\,(10 \cdot 10 + 90 \cdot 6)}{100 \cdot 50} = 0{,}46\ s$$

IL FAUDRAIT DONC AJOUTER 0.46 s AUX CRENEAUX CRITIQUES.

DISTRIBUTIONS DE CRENEAUX CRITIQUES

- L'HYPOTHESE QUE TOUS LES CONDUCTEURS ONT UN MEME COMPORTEMENT, DONC UN MEME CRENEAU CRITIQUE, N'EST QU'APPROXIMATIVE.
- IL EST PLUS REALISTE DE CONSIDERER QU'A CHAQUE CRENEAU QUI SE PRESENTE S'ASSOCIE UNE CERTAINE PROBABILITE D'ETRE ACCEPTE PAR UN CONDUCTEUR DONNE.
- ON PEUT CONSIDERER DIFFERENTES FONCTIONS, TELLES QUE :
  - LA DISTRIBUTION RECTANGULAIRE
  - LA DISTRIBUTION NEGATIVE EXPONENTIELLE DEPLACEE
  - LA DISTRIBUTION ERLANG
  - LA DISTRIBUTION LOG-NORMALE

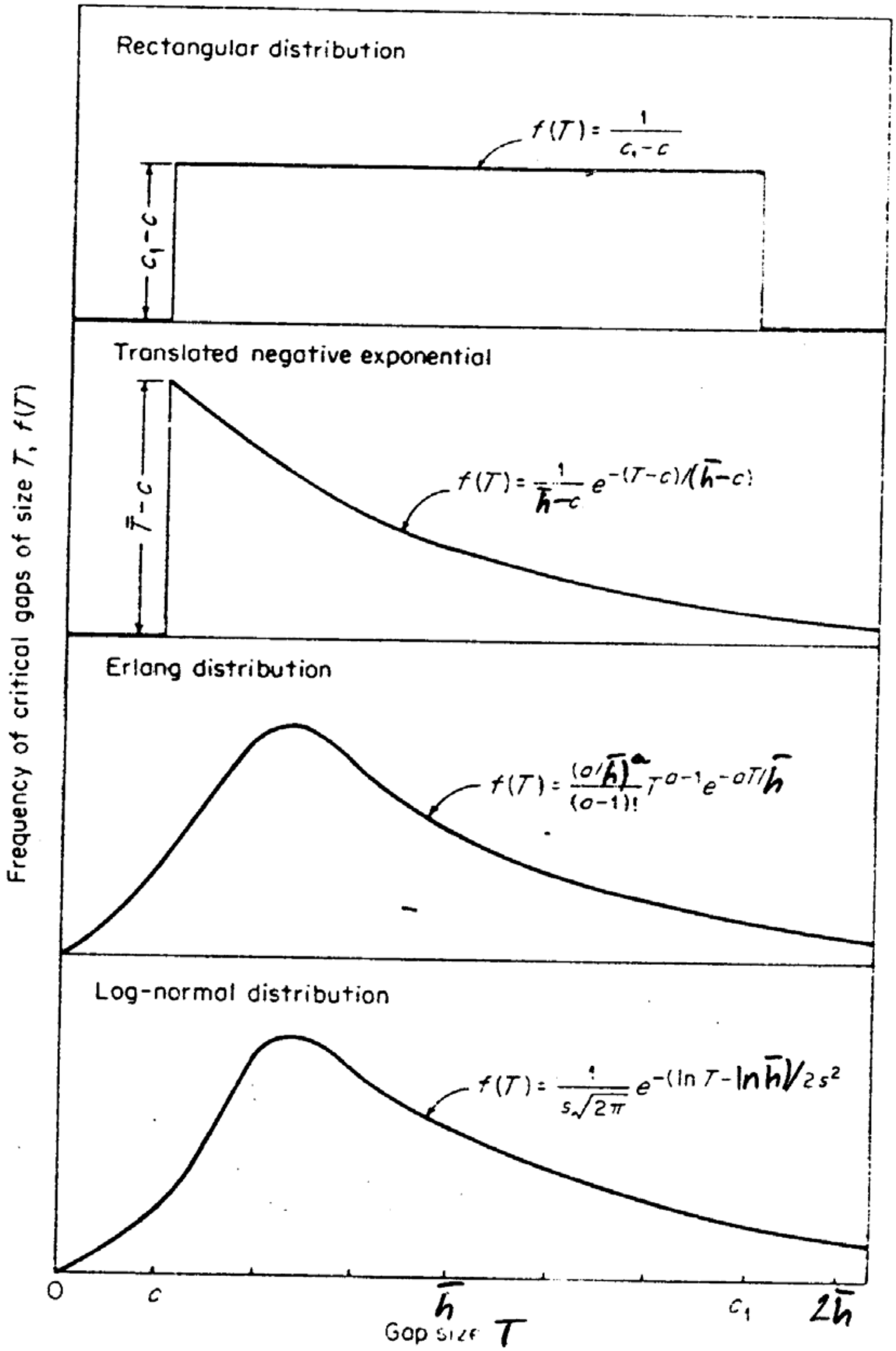


Fig. 9.6 Representative forms for critical-gap distributions. (DREW)

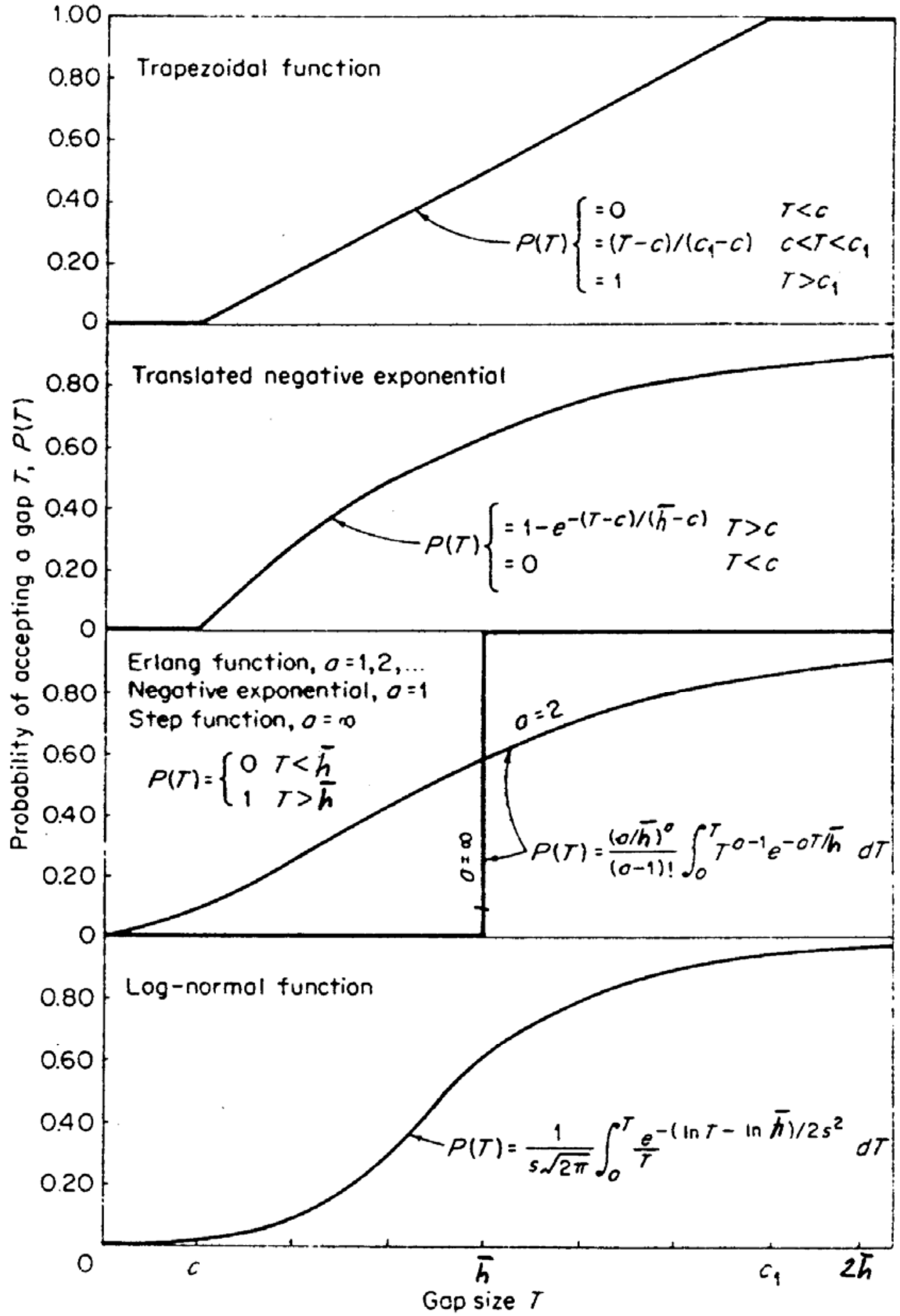


Fig. 9.7 Representative forms for gap acceptance functions.

La méthode pour mesurer les créneaux est décrite dans le manuel suivant:

FHWA- TS-81-220 Highway Safety Engineering Studies. Procedural Guide. Federal Highway Administration. Wash. D. C. p 176-188.

PROCEDURE 12 GAP Study

Purpose

Gap studies are used to measure the time headway or gap between vehicles along a highway or at an intersection and to analyze the capability of a major traffic stream to accomodate a minor or alternate traffic stream.

Application

- Definitions

Two terms, i.e., gap and lag are normally used to describe gap characteristics. A gap is a measure of the time or distance between successive vehicles passing a particular point on a highway. Lag is a measure of time between the arrival of a minor stream vehicle and the arrival of a conflicting major stream vehicle. A pictorial representation of these terms is shown in Figure 32.

Several measures are used to describe the gap characteristics for a traffic situation. They include: (1) the gap accepted by half of the drivers; (2) the gap for which the number of accepted gaps shorter is equal to the number of rejected lags longer, defined as critical gap; (3)

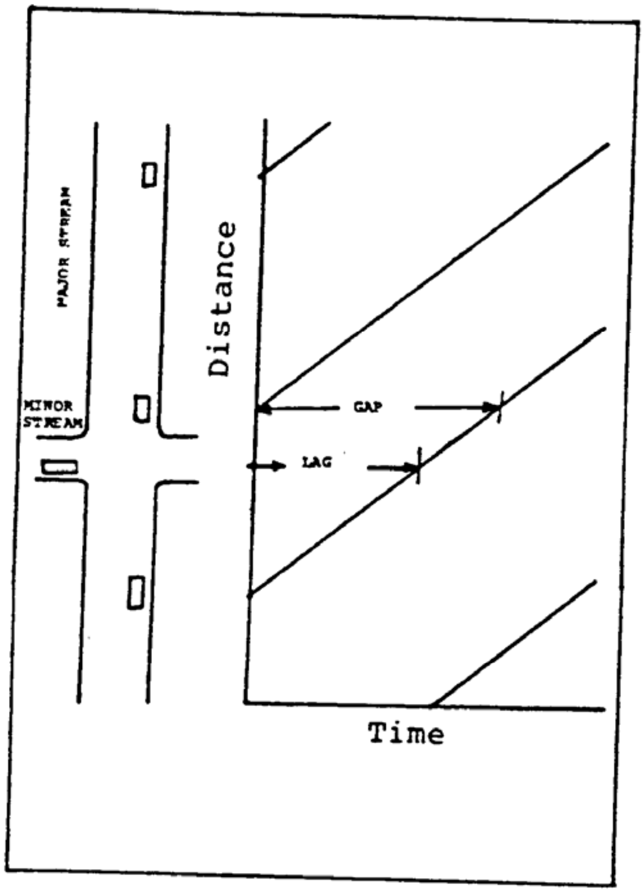


Figure 32. Pictorial representation: gap and lag.

the average gap, and (4) the lag between side street and main street traffic such that the number of rejected lags larger and accepted lags smaller will be equal, defined as the critical lag.

In most intersection studies, the use of lag data is preferred, as lag describe conditions relating to both the major and minor stream traffic flow. Gap data describes solely the major traffic stream. However, depending on the field situation, both terms have been used in intersection studies.

● Need For Gap Study

The need for a gap study is normally indicated by the occurrence of accidents involving crossing or merging traffic. Although defined relationships between gap characteristics and safety at a site have not been developed, it is generally felt that inadequate gaps in a major traffic stream can result in unnecessary risk being taken by a minor stream traffic flow which can result in accidents. Typical accident patterns are shown in Table 31.

Table 31. Accident patterns relating a need for a Gap Study.

Location	Situation	Factor Reviewed
Freeway Ramp or Weave Junction	• Pattern of Sideswipe Accidents and Rear-End Accidents	• Vehicular Gap • Length of Weave or Merge
Signalized Inter-section	• Pattern of Pedestrian Accidents or Conflicts	• Pedestrian Crossing Gaps • Speed Distri-bution
Unsignalized Intersection	• Pattern of Right-Angle or Rear-End Accidents	• Vehicular Gap • Traffic Signal Needs • Speed Distri-bution • Sight Obstruc-tion
Unsignalized Intersection	• Pattern of Pedestrian Acci-dents or Conflicts	• Pedestrian Crossing Gap • Speed Distri-bution
Mid-Block Locations	• Pattern of Pedestrian Acci-dents or Conflicts	• Pedestrian Crossing Gap • Speed Distri-bution
	• Pattern of Right-Angle Accidents	• Vehicular Gap • Traffic Sig-nal Needs • Speed Distri-bution • Sight Obstruc-tion

In addition to these situations, the need for a gap study can be determined from field reviews of the location and from complaints by local citizens.

- <u>Use of Gap Study</u>

The information obtained from gap studies is useful for:

- Identifying operational deficiencies in a traffic situation.
- Determining the safety of crossing, merging and weaving situations.
- Assessing the need for additional traffic controls i.e., countermeasure development.
- Evaluating the effectiveness of a safety improvement.

- Period of Data Collection

The period of the data collection activities is normally determined from the accident data.

The studies should also be performed under favorable weather conditions. Poor weather conditions will tend to lower traffic speeds, thus influencing the gap distribution.

- Sample Size Determination

In collecting gap information, a variety of methods are available to compute a minimum sample size [1,3]. The method used depends upon the field situation. For most highway safety applications, the sample size can be determined from the following formula.

$$N = \left[\frac{SK}{E}\right]^2$$

Where N = minimum sample size

S = standard deviation (sec.)

K = constant corresponding to the selected confidence level

E = permitted error in the gap or lag estimate (sec.)

The standard deviation and the permitted error, E, depend on the situation under study. Sample data taken at the site will assist in defining S and E for use in the above formula. Values of the constant, K, for given confidence levels are:

K	Confidence Level (%)
1.64	90.0
1.96	95.0
2.58	99.0

Gap Study Techniques

Available techniques for collecting gap information include:

- Manual method.
- Manual/machine method.
- Photographic techniques (time lapse and videotape).
- The Instrumented site method.

Primary considerations of these techniques are included in Table 32.

Manual Method

The manual method [2,4] requires an observer (technician) at the location to record gaps manually with a stopwatch. The observer is stationed at the study location, situated in a position to view and accurately time all vehicles. Care should be taken to insure that the observer's presence does not influence driver behavior in the area.

As the first vehicle's front end passes over a defined reference point, the observer activates a stopwatch. When the front end of the second vehicle crosses the reference point, the stopwatch is stopped and the time (measured as the time gap between vehicles) is recorded onto a summary data sheet. A second observer can be used to record the minor stream gap needs by assuming an average demand rate for the study period (based on the volume of approach vehicles divided by the period of data collection) or by actual measurement of the accepted and rejected gaps or lags.

A sample data sheet is shown in the Appendix (page I-12).

Advantages:

1. Equipment needs are minimal.
2. Data are reliable.
3. Can be performed with very little preparation or setup.
4. Data manipulation is minimal.

Disadvantages:

1. Personnel costs could be high.
2. Timing subject to human biases.
3. Data can be influenced by the presence of the observer.

This method is suitable for pedestrian situations (signalized or unsignalized intersection, or midblock locations) and for many unsignalized intersections and midblock situations. However, where volumes or the complexity of the situation make the manual technique difficult to apply, other more efficient means may be utilized.

Table 32. Primary considerations of Gap Study techniques.

Consideration / Technique	Function	Equipment Requirements	Manpower Requirements	Time Requirements
. Manual Method	. Obtains gap data by observer timing individual vehicles	. Stop watch . Data sheets	. Technician to observe and record data . Engineer to adjust data	. One half-one hour per study . Approx. one-half hour to adjust data
. Manual/Machine Method	. Obtains gap data using observer to activate the gap recording device	. Recorder . Data summary sheets	. Technician to observe data . Technician to record tape data on summary sheets . Engineer to adjust data	. One half-one hour per study . Approx. one hour to record tape data onto summary sheets . Approx. one-half hour to adjust data
. Photographic Technique	. Obtains gap data manually from film records of location	. Camera equipment . Stop watch or timing mechanism . Data sheets	. Trained technician to set up camera . Trained technician or engineer to record data from film . Engineer to adjust data	. Approx. one hour to set up or remove camera equipment . One-half to one hour filming time . One-two hours to view and record data . Approx. one-half hour to adjust data
. Instrumented Site Method	. Obtains gap data through field detection and sampling methods	. Detection device . Recording device . Program instrument . Data summary sheets	. Two technicians to set up and remove equipment . Trained technician to record data . Engineer to adjust data	. Approx. one-half hour to set up or remove equipment . Approx. one-half hour to record data . Approx. one-half hour to adjust data

Table 32. Primary considerations of Gap Study techniques (continued).

Technique \ Consideration	Associated Cost	Data Input	Data Obtained	Data Output
. Manual Method	. Stop watch $25 to $150	. Defined location . Study period	. Vehicle gap durations	. Gap distribution characteristics (mean gap, standard duration, etc.)
. Manual/Machine Method	. Recording device $50 - $300	. Defined location . Study period	. Vehicle gap durations . Tape record of gap data	. Gap distribution characteristics
. Photographic Techniques	. Camera equipment $500 - $2,000	. Defined location . Study period	. Film record of location . Traffic stream characteristics	. Various traffic stream characteristics, including gap distribution characteristics
. Instrumented Site Method	. Detection and recording equipment $500 - $3,000	. Defined location . Study period	. Tape record of gap data . Traffic stream characteristics	. Various traffic stream characteristics, including gap distribution characteristics

● Manual/Machine Method

The manual/machine method [2,4] uses an observer to record the gap distribution data using a recorder-type machine. Typically, the recorder utilizes a marking pen and a timer. The recording pen is actuated as the first vehicle passes the reference line. As the second vehicle passes the reference line, the pen is de-activated. The length of the pen line (based on the time relationship of the gap timer to the pen movement) records the gap size relationship. From these recordings, the gap data are computed using simple mathematical relationships.

This technique requires a minimum of one recording device be used per gap study. For a section of roadway requiring both directions of travel to be studied, separate recorders are required for each direction. Observers may also be used to minimize the possibilities of error in recording the data.

The gap acceptance characteristics are obtained by manual methods, as described in the previous technique.

Advantages:

1. Provides a record of the gap data.
2. Requires minimal setup or preparation.
3. Simple to perform.
4. Reduces bias by observer.

Disadvantages:

1. Maintenance of portable power source for gap recorder is required.
2. Personnel costs could be high.
3. Data can be influenced by presence of observer and equipment.

This method is favorable for use in situations similar to the manual methods. However, it is more appropriate under higher volume or more complex situations due to the automatic recording capabilities of the equipment.

● Photographic Technique

The photographic technique is described in Procedure 7 - "VOLUME STUDIES."

Advantages:

1. Able to obtain other traffic variables.
2. Provides a permanent record.
3. Obtains reliable data.

Disadvantages:

1. Requires time-consuming review and analysis of data.
2. Relatively high cost due to personnel and equipment needs.

This method is most favorable for complex traffic situations (freeway cross-weave situations, merge situations) where the high number of movements can limit the accurate study of conditions by manual methods. The film record permits the review of the field situation under a controlled environment.

● Instrumented Site Method

The instrumented site method [5] uses sensors placed on the pavement to detect the vehicle gap. This information is recorded onto a tape or cassette. Gap characteristics can be obtained directly or indirectly by computer programs.

The detection device is connected to a recorder located along the side of the road. Various recording devices are available. One such device is the FHWA Traffic Analyzer which is a multi- channel recorder used for complex traffic studies. Another device is the Traffic Counter Device (also developed for FHWA). This unit uses a reconverted traffic counting device to record gap and volume data. A third device is the RATEM (Recording and Analysis of Traffic Engineering Measures) system. This device utilizes microprocessor control to scan 16 input channels and perform seven different types of traffic studies, including: speed, volume, and occupancy. Other devices providing similar capabilities have been developed. These devices can record the gap data and other output in a variety of forms, dependent on the recorder capabilities. Available programs for each device can directly provide gap distribution curves and other gap characteristics.

Advantages:

1. Able to obtain other traffic data.
2. Output is reliable.
3. Eliminates human biases in recording data.
4. Available computer program can easily output data in a usable form.

Disadvantages:

1. Equipment setup and costs can be considerable.
2. Requires trained personnel to operate equipment.
3. Difficult to detect malfunctioning equipment.

This technique is favorable for most highway situations due to its ability to obtain a number of traffic variables; i.e., speed, volume, occupancy, etc. in a limited amount of time. However, the availability and high costs associated with the use of this technique have tended to limit its use in most cases.

Selection Of Alternate Techniques

The use of a particular data collection technique is related to the management concerns involved in the study. The primary management concerns include: the time, equipment, and manpower requirements, the data needs and the level of accuracy. Table 33 displays the technique utility of each technique based on the management concerns.

Either of the four listed techniques are applicable in most situations. To select a favorable technique, a review of the management concerns is necessary. A major requirement in this selection process is equipment availability. In the absence of special recording equipment, the manual method must be used. The availability of other equipment will dictate the gap measurements technique to be used.

Several guidelines are provided for selecting a technique.

1. The use of the instrumented site method is recommended for complex traffic situations where additional traffic data should be collected.

2. The photographic techniques are preferable where a film record of the field situation is needed.

3. For most gap studies, the manual methods are feasible. To reduce the data collection load for an observer, the manual/machine method is favorable. The manual method should be used where gap recording equipment is not available.

Findings

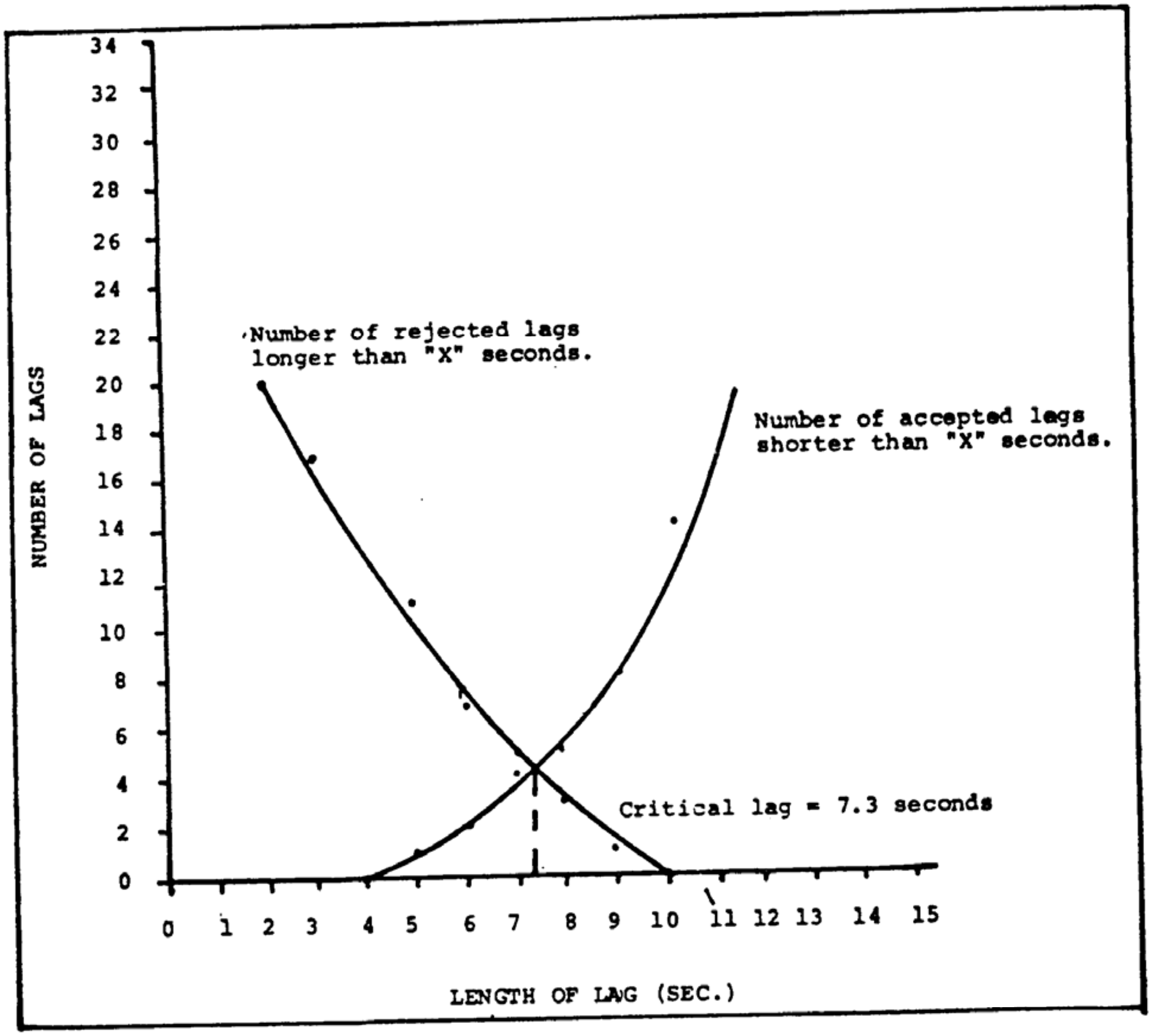
The data obtained from a gap study can be presented in a variety of formats. The simplest method of presenting gap distribution information for a traffic stream is a tabular list of the gap information by frequency, similar to a spot speed summary sheet. For data analysis, the average gap value within an increment is used to represent each observed gap.

Alternate means of presenting gap distribution data is by a graphical summary. Graphs of the frequency of gaps versus the gap duration may be prepared.

Gap acceptance data are typically presented in graphical form, as shown in Figure 33. One axis indicating the length of the gap (or lag) and the other axis represents the frequency of gaps (or lags) of a particular gap (or lag) duration. Two criteria are plotted, the number of accepted gaps (or lags) shorter than "X" seconds; and (2) the number of rejected

Table 33. Technique Utility for Gap Study.

Technique / Management Concerns	Manual Method	Manual/Machine Method	Photographic Techniques	Instrumented Site Mehtod
. Equipment Requirements	. Stop watch . Other needs, minimal	. Gap recording machine . Other needs, minimal	. Camera equipment . Stop watch or gap recording machine . Other needs, minimal	. Detection, recording and analyzing device
. Manpower Requirements	. Technician level to collect data . Engineer level to manipulate data	. Technician level to collect data . Engineer level to manipúlate data	. Technician level to collect data . Engineer level to manipulate data	. Technician level to set up and collect data . Data manipulation can be performed by recording device
. Time Requirements	. Data Collection	. Equipment set up . Data collection	. Equipment set up . Equipment checks . Data Collection	. Equipment set up
. Data	. Obtains gap distribution and acceptance data	. Obtains gap distribution and acceptance data	. Obtains gap distribution and acceptance data and others (limited traffic data-volume, speed)	. Obtains gap distribution and acceptance data and a wide number of traffic variables (volume, speed, occupancy, density, etc.)
. Level of Accuracy	. Reliable	. Reliable	. Very reliable	. Reliable



LOCATION: Adams Rd. North of Tienken Rd.

TIME: 2:40 pm-2:55 pm DATE: 5/22/79

WEATHER: Clear

Figure 33. Graphical presentation of gap acceptance data.

gaps (or lags) longer than "X" seconds. "X" represents the gap (lag) duration along the axis. The crossing of these data lines represents the critical gap.

- **Use of Findings**

The findings obtained from such methods as the graphical summary (Figure 33) are used to evaluate the field situations by comparing the gap acceptance characteristics of the minor stream to the gap distribution characteristics of the major stream. Where conditions are found deficient, countermeasures to alleviate the deficiency will be warranted.

Analysis methods for specific situations are provided in the following references.

- Freeway or highway merging [6,7].
- Weaving [4,6,7].
- Crossing stop sign controlled intersections [2,8].
- Signalized intersections [2].
- Pedestrian crossing [Procedure 20].