Traffic Conflict Characteristics—Accident Potential at Intersections

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Traffic conflict characteristics are measures of traffic accident potentials. A traffic conflict is any potential accident situation. Over 20 objective criteria for traffic conflicts (or impending accident situations) have been defined as to specific accident patterns at intersections. Essentially, these traffic conflicts are defined by the occurrence of evasive actions, such as braking or weaving, that are forced on a driver by an impending accident situation or a traffic violation. A method of systematically observing an intersection for traffic conflicts has been devised. In three 12-hr observation sessions, it is possible to evaluate completely an intersection; the information obtained is much more comprehensive than that normally available from accident histories. Further, the initial causes of the incidents, which accident records often fail to reveal, are uncovered. Traffic conflict studies use objective criteria to obtain significant quantities of data in short observation periods.

•DRIVERS, vehicles, and roads are complicated co-contributors in traffic accidents. All three can vary significantly in character from one area to another, from one year to the next. To study and understand the basic causes of accidents, preliminary work was aimed at determining detectable measures of traffic characteristics that could develop into accidents. Numerous techniques were considered and tested, including continuous camera monitoring and near-miss accident criteria. Near-miss accident criteria were found to be highly subjective and nonrepeatable.

Analysis of traffic accident reports at high-accident intersections showed that the reported numbers of any particular type of accident circumstance were not large enough for adequate analysis. Furthermore, it was felt that it should be possible to objectively measure the accident potential of a given area—to evaluate an intersection dynamically without waiting for an accident history to evolve.

A systematic method of observing an intersection for traffic accident potential was devised. Through the "traffic conflicts" technique, it is possible to evaluate completely an intersection in three 12-hr observation sessions. By tallying observed impending accident situations that are defined as traffic conflicts, information can be obtained that is much more comprehensive than that normally available from accident histories. Over 20 objective criteria for traffic conflicts have been defined for specific accident patterns at intersections.

A traffic conflict is any potential accident situation. There are two categories of traffic conflicts—evasive actions of drivers and traffic violations. When confronted with an impending accident situation, a driver takes evasive action to avoid collision. Evasive actions of drivers are evidenced by vehicle braking or weaving as attested by brake-light indication or lane change. Traffic violations are defined in accordance with the uniform traffic code. A traffic violation is a traffic conflict, a potential accident situation; no other vehicle need be in close proximity to the violation.

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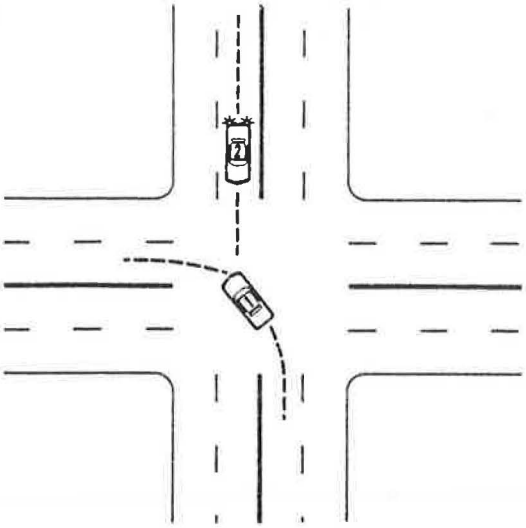

Figure 1. Left-turn conflict.

A traffic accident, the collision of vehicles, is thus viewed as a traffic conflict with the addition of a driver, road, or vehicle fault: the driver was not paying attention, the road was slippery, the brakes failed.

TRAFFIC CONFLICT CHARACTERISTICS AT INTERSECTIONS

The basic types of accidents at intersections are left-turn, weave, cross-traffic, red-light violation, and rear-end incidents. For these five basic categories, over 20 objective conflict criteria have been defined for specific potential accident patterns at intersections.

A left-turn conflict is defined as a situation in which a left-turn vehicle crosses directly in front of an opposing through vehicle. The criterion of the conflict is the evasive action—braking or weaving—of the through vehicle. In a left-turn conflict (Fig. 1), a left-turn vehicle, 1, crosses directly in front of a through vehicle, 2, causing vehicle 2 to brake or weave. If vehicle 2 is viewed from the rear as it approaches the intersection, a brake-light indication or a weave can be observed during a conflict.

The problem directions at an intersection are quickly revealed by traffic conflict counts. Further, the effectiveness of protective measures is readily noted. For example, at intersection G-H, the number of left-turn conflicts per hour (7 a.m. to 7 p.m.) averaged:

Northbound	Southbound	Eastbound	Westbound
0.3	0	8.0	16.7

This intersection is provided with a special left-turn green-arrow sequence for northbound and southbound traffic; left turns are allowed only on the green-arrow signal.

The weave conflict, associated with a weave or sideswipe accident, is defined as a situation in which a vehicle changes lanes into the path of another vehicle. The offended vehicle is caused to brake or weave to avoid the impending collision. In a weave conflict (Fig. 2), vehicle 1 weaves, changes lanes, causing a following vehicle, 2, to brake. As the conflict is viewed from the rear, a brake-light indication can be observed on vehicle 2. Weave conflicts can occur as a result of lane changes, turns from improper lanes, and turns into wrong lanes.

Comparison of traffic conflict results from "before and after" studies indicates many ramifications of engineering changes. For example, at intersection A-R, the number of weave conflicts per hour (7 a.m. to 7 p.m.) averaged:

Month	Northbound	Southbound	Eastbound	Westbound
August	22.3	11.8	2.9	0.4
October	3.8	15.1	3.3	2.3

In August, northbound weave conflicts were primarily a result of weaves from the left lane to avoid waiting left-turn vehicles. In October, northbound left-turn was prohibited. Prohibiting the northbound left turn at this intersection not only reduced the left-turn incidents and increased the through volume capacity of the intersection, but also markedly decreased the number of weave conflicts which could result in sideswipe or rear-end accidents.

A cross-traffic conflict is defined as a situation in which a vehicle crosses or turns into the path of a through, right-of-way vehicle, causing the through vehicle to brake or weave. In a cross-traffic conflict (Fig. 3), a cross-road vehicle, 1, crosses directly in front of through vehicle, 2, causing vehicle 2 to brake or weave. The criterion of the conflict is a brake-light indication or weave of the through, right-of-way vehicle.

Cross-traffic conflicts are generally observed at nonsignalized intersections, where the cross-road vehicles are supposed to stop and give right-of-way to arterial traffic. Cross-traffic conflicts can also occur at signalized intersections having special signal control phases, e.g., right-turn red-arrow sequences. Cross-traffic conflicts are recorded in three categories: through vehicles that completely cross the artery, left-turn cross-road vehicles that cross one direction of traffic and turn left into the path of a right-of-way vehicle, and right-turn cross-road vehicles that turn right into the path of a right-of-way vehicle.

A red-light violation conflict is defined as a situation in which a vehicle enters the intersection—crosses the curb-line—on a red signal. Vehicles that have entered the intersection legally and complete their movement after the signal changes are not considered violators. The three categories of red-light violators, through, left-turn, and right-turn, are separated because they appear to have different probabilities of developing into accidents. At intersections that have all-red phases, special counts are made of red-light violators that enter the intersection after the all-red phase.

Figure 4 shows the hourly variations in the left-turn red-light violations at one of the intersections that was measured. It can be seen that the situations that were observed throughout the day varied significantly hour by hour, and the number of incidents is adequately high for examination.

A rear-end conflict, in general, can be defined as a situation in which a vehicle stops unexpectedly and causes a following vehicle to take evasive action to avoid a rear-end collision. There are four general categories of rear-end conflict situations: a vehicle that prematurely stops for an amber traffic signal while being followed by another vehicle, a vehicle that stops or slows while turning from a traffic lane used by through

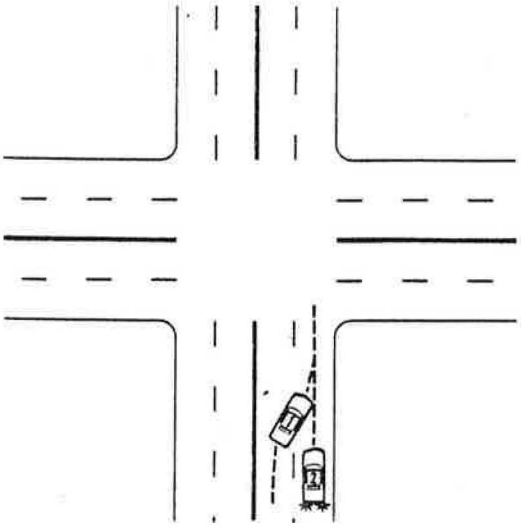

Figure 2. Weave conflict.

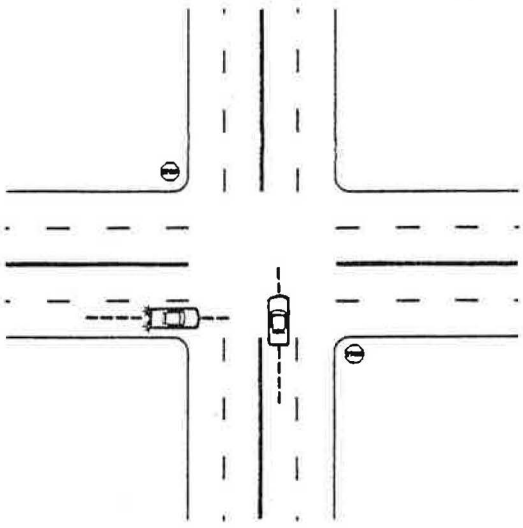

Figure 3. Cross-traffic conflict.

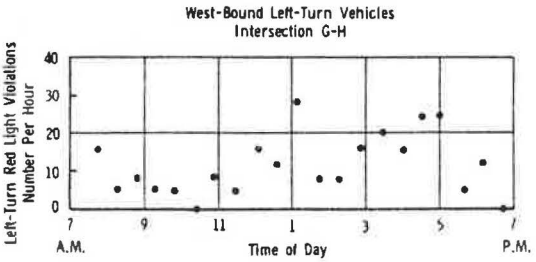

Figure 4. Left-turn red light violations (westbound left-turn vehicles, intersection G-H).

traffic while being followed by a through vehicle, a vehicle that stops or slows in a through traffic lane while being followed by another vehicle, and a vehicle that stops or slows because it is involved in a traffic conflict while being followed by another vehicle. In each case, the criterion of the conflict is the evasive action of the following vehicle—braking as evidenced by a brake-light indication or weaving as evidenced by changing lanes. Within the four basic categories of rear-end incidents, over 10 specific rear-end conflicts have been defined.

The first type of rear-end conflict (Fig. 5) is defined as a circumstance in which a vehicle, 1, stops for an amber traffic signal causing a following vehicle, 2, to brake or weave; vehicle 2 could have legally entered the intersection at his approach speed. If, for example, vehicle 2 is traveling at 45 mph approaching an intersection having a 4-sec amber light and the traffic signal changed from green to amber when vehicle 2 is less than 264 ft from the intersection, vehicle 2 could enter the intersection legally. A vehicle at 45 mph can travel 264 ft in 4 sec. If, however, vehicle 1, traveling in front of vehicle 2, stops for the traffic signal, vehicle 2 could be caused to stop or weave, the criterion of the conflict.

The second category of rear-end conflict (Fig. 6) is defined as a situation in which a vehicle slows and turns from a traffic lane used by through traffic while being followed by a through vehicle. As vehicles 1 and 2 approach the intersection as a pair, vehicle 1 slows to turn right from a lane used by through traffic. Through vehicle 2 is caused to brake or weave to avoid vehicle 1, the criterion of the conflict. Left-turn and right-turn incidents are recorded separately so that initial causations of incidents may be noted.

The third type of rear-end conflict is defined as a circumstance in which a vehicle stops or slows in a through-traffic lane, causing a following through vehicle to brake or weave. Vehicles approaching an apparently clear intersection on a green signal have been observed coming to a complete stop before proceeding through the intersection. If such a vehicle, 1 (Fig. 7), were followed by another vehicle, 2, which was caused to

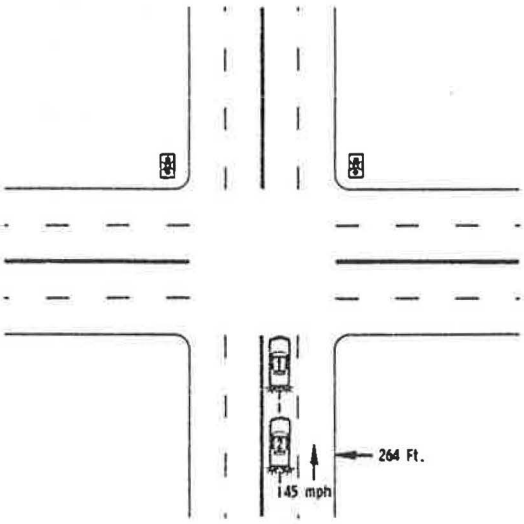

Figure 5. Stop-on-amber rear-end conflict.

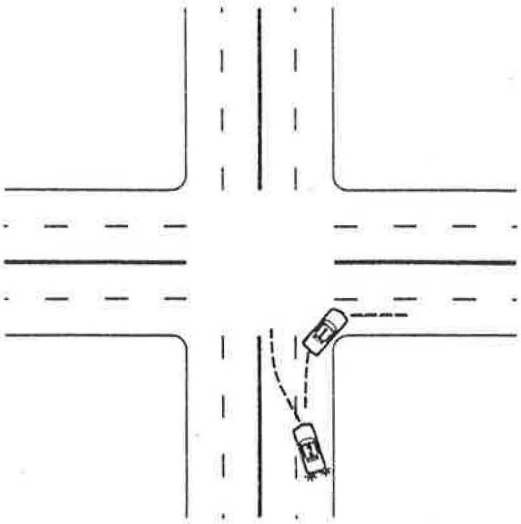

Figure 6. Slow-for-turn rear-end conflict.

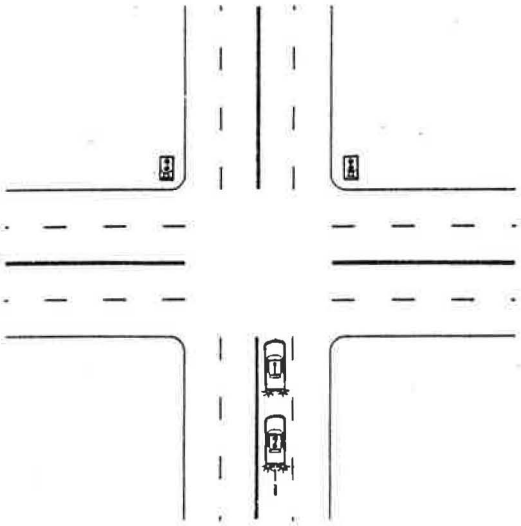

Figure 7. Slow-in-through-lane rear-end conflict.

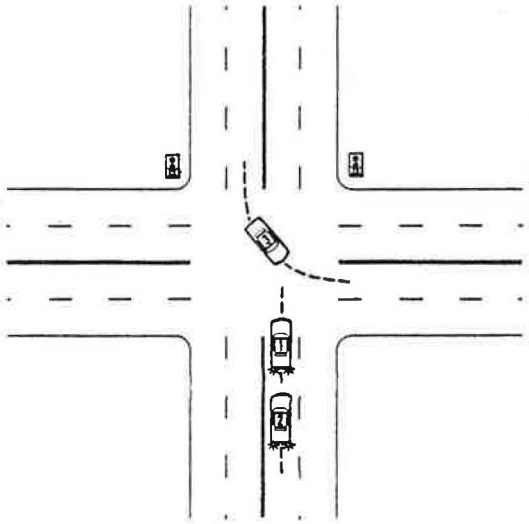

Figure 8. Slow-for-traffic-conflict rear-end conflict.

take evasive action, the situation would be termed a rear-end conflict. This type of rear-end conflict can also be initiated by shopping entrances beyond an intersection causing vehicles to back up into the intersection, slow trucks beyond the intersection, merging situations, disabled vehicles, emergency vehicles, general congestion, and traffic back-ups.

The fourth type of rear-end conflict is defined as a situation in which a vehicle slows or stops when involved in a traffic conflict and causes a following vehicle to take evasive action to avoid a rear-end collision. For example (Fig. 8), if vehicle 1 slowed or stopped because it was involved in a left-turn conflict with vehicle 3, the incident would also be counted as a rear-end conflict if vehicle 2 was caused to brake or weave to avoid vehicle 1. Left-turn conflicts, weave conflicts, and cross-traffic conflicts can produce slow-for-traffic conflict rear-end conflicts.

Problem directions for potential rear-end collisions are quickly indicated by traffic conflict analysis. Specific causes of the rear-end conflicts are pinpointed as indicated in Table 1.

ADDITIONAL OBSERVATIONS

In addition to counting the conflicts that were previously mentioned, several other counts are taken that are felt to affect the accident potential of an intersection. They include counts of the proportion of through vehicles that are stopped by the traffic signal and all traffic movements of the intersection.

TABLE 1

REAR-END CONFLICTS
Intersection B-S, Average Conflicts per Hour, 7 a.m. to 7 p.m.

Type	Northbound	Southbound	Eastbound	Westbound
Stop-on-amber	2.9	3.7	1.3	1.1
Slow-for-turn				
Left-turn	0	0	0.5	0
Right-turn	1.4	18.9[a]	0.8	1.1
Slow-in-through-lane	13.2[b]	4.8	3.5	3.7
Slow-for-conflict				
Left-turn-conflict	1.4	0.3	0.8	0.8
Weave conflict	1.1	1.1	0	0

[a] No right-turn flare for southbound traffic.
[b] Traffic back-up from shopping entrance north of intersection.

The ability of a traffic signal to accommodate the vehicles approaching the intersection is indicated by the percentage of vehicles that are disturbed by the intersection. Only through vehicles are counted for this purpose, since turning vehicles normally slow or stop as they approach the intersection. In the case shown in Table 2, although southbound traffic is confronted with a red signal only 39 percent of the time, 90 percent of the southbound through traffic approaching the intersection is stopped.

TABLE 2

THROUGH VEHICLE SERVICING
Intersection A-R, 7 a.m. to 7 p.m. Average

Direction	Stopped Vehicles, Percent	Slowed Vehicles, Percent	Undisturbed Vehicles, Percent
Northbound	67.6	4.9	27.5
Southbound	90.3	1.2	8.5
Eastbound	92.2	4.4	3.4
Westbound	84.1	5.4	10.5

TABLE 3

LANE USAGE
Intersection G-H, Average Vehicles per Hour, 7 a.m. to 7 p.m.

Direction	Left Lane Left Turn	Center Lanes Thru	Center Lanes Thru	Right Lane Thru	Right Lane Right
Northbound	129	376	386	11	130
Southbound	89	353	431	12	82

TABLE 4

OPERATING BRAKE-LIGHTS
Intersection G-H, 7 a.m. to 7 p.m. Average

Direction	Operating Brake-Lights, Percent	Nonfunctional Brake-Lights, Percent
Northbound	94.7	5.3
Southbound	95.8	4.2
Eastbound	95.6	4.4
Westbound	96.2	3.8

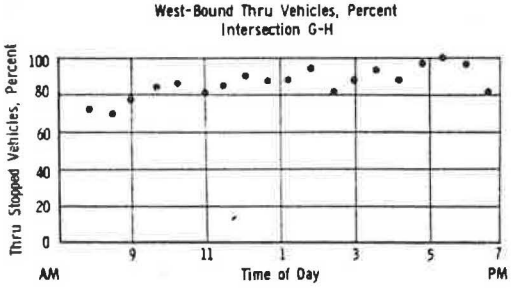

Figure 9. Vehicles stopped by traffic signal (westbound through vehicles, intersection G-H).

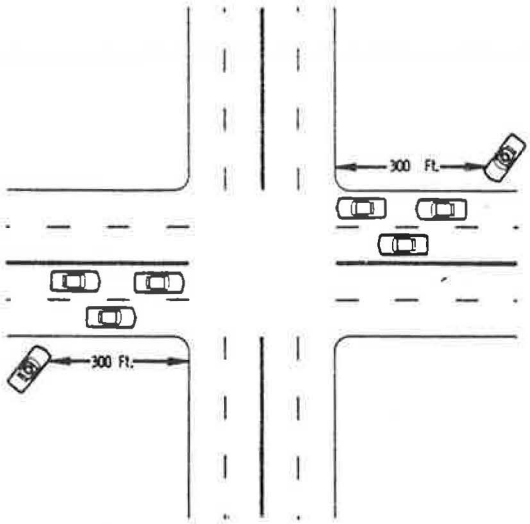

Figure 10. Brake-light criteria observation.

Typical measurements of traffic conflicts at intersections indicate that the situations vary significantly throughout the day as the traffic loads and patterns change (Fig. 9). The number of incidents that occur is high enough for detailed examination. One hundred percent stopped vehicles indicates a period of traffic saturation for the intersection.

The traffic movements of the intersection (Table 3) are recorded as the vehicles are observed entering the intersection and are counted for each approach lane and ultimate direction. Notations are made of illegal movements and improper lane usage. These counts appear to be noteworthy in that they show how the drivers are actually using the intersection.

Since brake lights play an important role in these studies, vehicles are observed as they are stopping to detect those that have operating brake lights and those that have no perceptible brake-light indication (Table 4). It will be necessary to be aware of an intersection having a disproportionate number of vehicles not having operable brake lights. In general, it has been found that 4 to 7 percent of the vehicles have nonfunctional brake lights.

OBSERVATION TECHNIQUES

The data for measuring a signalized intersection are currently taken in three 12-hr observation periods for each intersection. Observations are generally made on Tuesday, Wednesday, and Thursday from 7 a.m. to 7 p.m.

During the first two observation periods, one for each of the intersecting roads, the traffic is observed (from behind) as it approaches the intersection to view the conflicts defined by vehicle brake-light criteria (Fig. 10). During the third 12-hr observation

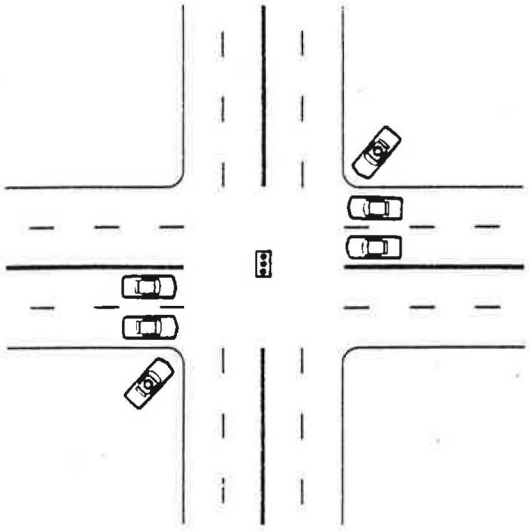

Figure 11. Traffic movement criteria observation.

period, the traffic is observed as it enters the intersection to view conflicts defined by traffic movement criteria (Fig. 11).

The data for each road are taken in 15-min counts for alternate directions: one count for northbound traffic, the next for south, the third for north, etc. Further, it should be noted that one of the purposes of counting traffic movements is to obtain denominators for the conflict counts. Taking left-turn conflicts as an example, the data can be analyzed in terms of left-turn conflicts per hour, per left-turn vehicle, per opposing through vehicle, etc.

CONFLICT DATA

Some 30 signalized and nonsignalized intersections have been counted using the conflict criteria. These intersections represent a wide variation in geometrics, environment, signalization, traffic patterns, and densities. In each case, the conflict criteria served to numerically document the way the drivers were using the facility and the frequencies of the potential accident situations. The conflict criteria proved to be objective, and yielded significant amounts of data in short observation periods.

In addition to the conflict data previously noted, complete data for two signalized and two nonsignalized intersections are given in Tables 5 through 8 to provide a better sample of conflict characteristics. These data also serve to demonstrate the ability of the conflict technique to quantitatively measure the potential accident frequencies with their initiating causes at intersections. The weave and rear-end conflicts include some 10 additional categories (e.g., turn-from-wrong-lane weave conflicts) which have not been separately noted here for brevity.

The conflict data reflect the individual geometrics, environment, and traffic controls of each road. That is, the effects of left- and right-turn flares, merging

TABLE 5

SIGNALIZED INTERSECTION H-D
7 a.m. to 7 p.m. Average Conflicts per Hour

Conflict Situation		Direction of Travel			
		North	South	East	West
Left-turn conflict		2.4	2.8	1.9	6.1[e]
Weave conflict		4.9[e]	2.1	0.9	1.2
Rear-end conflict	Amber	6.4[a]	1.2	0.5	0.9
	Through-lane	3.9[b]	12.3[d]	0.7	1.0
	Left-turn	0.5	0	0.5	1.1
	Right-turn	1.4[c]	0.2	0.5	0.7
	Conflict	2.4	2.1	2.3	0.5
Red-light violators	Through	1.5	0.7	0.7	0.4
	Left-turn	1.5	1.1	1.1	0.4
	Right-turn	0.2	0.2	0.7	1.3

Note: The north-south road at intersection H-D is a four-lane highway with a narrow median and is flared to provide both left- and right-turn lanes at the intersection. The east-west road is a two-lane road flared to four lanes at the intersection. The north-south is the major road.

[a]Freeway ¼ mile south of intersection.
[b]Primarily traffic back-up caused by slow trucks negotiating a hill north to intersection.
[c]Right-turn flare was partially filled with water; significant number of vehicles turned right from the through lane.
[d]Primarily traffic back-up caused by vehicles turning into shopping at the southwest corner of intersection.
[e]Large shopping center under construction on southeast corner of intersection.

TABLE 6

SIGNALIZED INTERSECTION AA-n
7 a.m. to 7 p.m. Average Conflicts per Hour

Conflict Situation		Direction of Travel			
		North	South	East	West
Left-turn conflict		1.2	5.5	4.3	0.3[d]
Weave conflict		1.3	0.4	6.4[f]	5.3[f]
Rear-end conflict	Stop Amber	1.0	0.2	17.3[c]	3.8
	Through-lane	0.8	0.2	3.2	11.0[e]
	Left-turn	2.3	0.9	0.8	0.3[d]
	Right-turn	9.8[a]	3.5[a]	1.1[b]	14.8[a]
	Conflict	0	0	0	0.3
Red-light violations	Through	3.3	1.8	12.0	11.5
	Left-turn	0	5.8	0.8	0
	Right-turn	7.1	1.0	0	2.0

Note: The north-south road at intersection AA-n is a four-lane undivided road. The east-west road has three lanes in each direction, a center lane for left-turns west of the intersection, and a railroad viaduct east of the intersection. The east-west road is the major road.

[a]No right-turn flare.
[b]No right-turn flare, but very few right-turn vehicles.
[c]Eastbound traffic, from nearest traffic signal ¼ mile to the west, arrived at this signal when it turned amber; note high number of through-on-red violations.
[d]Westbound left-turn prohibited.
[e]Traffic back-up from shopping west of intersection, and vehicles stopping at a viaduct 50 ft east of intersection.
[f]Primarily right-turn-from-wrong-lane weave conflicts.

TABLE 7

NONSIGNALIZED INTERSECTION H AT F
7 a.m. to 7 p.m. Average Conflicts per Hour

Conflict Situation		Direction of Travel	
		North	South
Left-turn conflict		3.1	2.0
Weave conflict		1.1	3.1
Rear-end conflict	Amber	0[a]	0[a]
	Through-lane	6.3[b]	6.9[d]
	Left-turn	8.3[c]	0.6
	Right-turn	0.9	12.3[e]
	Conflict	3.2	3.1
Cross-traffic conflict	Through-to-east	1.7	0.9
	Through-to-west	6.0	0.6
	Left-turn	2.0	1.1
	Right-turn	1.1	6.0

Note: The north-south road at intersection H-F is a four-lane highway divided by a narrow median, and is flared to provide left- and right-turn lanes for northbound traffic. The east-west road was not counted for conflicts; it has a STOP sign at the intersection. Note that 36.6 percent of the eastbound and 67.4 percent of the westbound through vehicles caused through-cross-traffic conflicts; 21.7 percent of the east and west left-turn vehicles caused left-turn cross-traffic conflicts; 10.8 percent of the east and west right-turn vehicles caused right-turn cross-traffic conflicts.

[a]Amber rear-end conflicts cannot occur at nonsignalized intersections.
[b]Primarily traffic back-up caused by slow trucks negotiating a hill north of intersection.
[c]Left-turn flare begins just after crest of hill to the south of intersection.
[d]No right-turn flare.
[e]Primarily traffic back-up caused by slow trucks negotiating a hill south of intersection.

TABLE 8

NONSIGNALIZED INTERSECTION GH-WS
7 a.m. to 7 p.m. Average Conflicts per Hour

Conflict Situation		Direction of Travel	
		East	West
Left-turn conflict		2.7[a]	19.2[b]
Weave conflict		2.1	10.9
Rear-end conflict	Amber	0	0
	Through-lane	0.3	5.9[f]
	Left-turn	4.0[c]	19.2[e]
	Right-turn	11.1[d]	6.4[d]
	Conflict	7.3	8.0
Cross-traffic conflict	Through-to-north	14.9	0[g]
	Through-to-south	0[g]	4.0
	Left-turn	1.3	14.7
	Right-turn	9.1	0.3

Note: Intersection GH-WS is actually a large shopping area immediately west of intersection H-G; the east-west road is five lanes in this area with the center lane reserved for left turns. Eastbound traffic turning left into the north shopping area uses that portion of the center lane reserved for left turns at intersection H-G, and thus shares the lane with traffic going past the shopping area. The center lane does not, therefore, serve as an effective left-turn flare for eastbound traffic. Note that, of 96.2 vehicles per hr turning left out of the shopping area, 35.2 percent experienced cross-traffic conflicts. Of 140.2 vehicles per hr turning right out of the shopping area, only 6.7 percent experienced conflicts.

[a]Eastbound left-turn vehicles averaged 20.8 per hr.
[b]Westbound left-turn vehicles averaged 197.1 per hr.
[c]No effective left-turn flare.
[d]No right-turn flare.
[e]Left-turn flare with inadequate storage (two vehicles) for demand.
[f]Primarily traffic back-up caused by the merging of two through lanes into one west of the intersection.
[g]Northbound and southbound vehicles could not proceed directly through.

lanes, hills, shopping, and traffic signal synchronization with surrounding intersections is readily apparent in the data.

ACCIDENT DATA

A preliminary analysis has been made of conflict and available accident data. It was found that the probability that a conflict situation will result in reported accidents is generally dependent upon the relative approach velocities of the conflicting vehicles, and, of course, such factors as road geometrics and environment. It is to be emphasized that the problem of unreported accidents is of considerable significance when attempting to correlate measured conflict frequencies with reported accident frequencies.

Accident data for the year 1966 have been shown in Tables 9 through 13 for the intersections discussed in this report. These data are reasonably representative of the

TABLE 9

LEFT-TURN CONFLICT–ACCIDENT DATA

Road	Direction	Conflicts per Hour	Accidents in 1966
AA-n	North	1.2	2
	South	5.5	1
	East	4.3	4
	West	0.3	1
B-s	North	5.6	6
	South	5.4	6
	East	5.1	2
	West	5.6	5
H-D	North	2.4	2
	South	2.8	2
	East	1.9	0
	West	6.1	0
H-F	North	3.1	0
	South	2.0	2
GH-WS	East	2.7	1
	West	19.2	1

TABLE 10

WEAVE CONFLICT–ACCIDENT DATA

Road	Direction	Conflicts per Hour	Accidents in 1966
AA-n	North	1.3	0
	South	0.4	2
	East	6.4	3
	West	9.1	6
B-s	North	3.2	0
	South	1.6	3
	East	0.8	1
	West	0.8	0
H-D	North	4.9	2
	South	2.1	3
	East	0.9	0
	West	1.2	0
H-F	North	1.1	1
	South	3.1	4
GH-WS	East	2.1	1
	West	10.9	2

TABLE 11

THROUGH RED-LIGHT VIOLATIONS—ACCIDENT DATA
Signalized Intersections

Road	Violator Direction	Through Red-Light Violations	Accident Direction	Accidents in 1966
AA-n	North	3.3	N/E	7
	South	1.8	N/W	4
	East	12.0	S/E	3
	West	11.5	S/W	8
B-s	North	3.5	N/E	2
	South	2.4	N/W	0
	East	0.5	S/E	2
	West	2.9	S/W	0
H-D	North	1.5	N/E	1
	South	0.7	N/W	1
	East	0.7	S/E	0
	West	0.4	S/W	1

TABLE 12

CROSS-TRAFFIC CONFLICT—ACCIDENT DATA
Nonsignalized Intersections

Conflict Situation	Road	Direction	Conflicts per Hour	Accidents in 1966
Through	H-F	North	7.7	3
		South	1.5	0
	GH-WS	East	14.9	4
		West	4.0	1
Left-Turn	H-F	North	2.0	1
		South	1.1	0
	GH-WS	East	1.3	1
		West	14.9	3
Right-Turn	H-F	North	1.1	0
		South	6.0	0
	GH-WS	East	9.1	1
		West	0.3	0

TABLE 13

REAR-END CONFLICT—ACCIDENT DATA
Conflicts per Hour

Road	Violator Direction	Total Rear-End Conflicts	Stop Amber and Through-Lane Rear-End Conflicts	Accidents in 1966
AA-n	North	13.9	1.8	0
	South	4.8	0.4	0
	East	22.4	20.5	24
	West	30.2	14.8	23
B-s	North	19.7	18.1	13
	South	28.8	8.5	6
	East	6.9	4.8	0
	West	6.2	4.8	2
H-D	North	14.6	10.3	6
	South	15.8	13.5	4
	East	4.5	1.2	1
	West	4.2	1.1	0
H-F	North	18.7	6.3	1
	South	22.9	6.9	1
GH-WS	East	22.7	0.3	1
	West	39.5	5.9	0

intersections investigated to date. Although much more data are required, a high level of association exists between the traffic conflict and reported accident frequencies. In particular, high accident frequencies are always associated with high conflict frequencies.

CONCLUSIONS

The traffic conflict technique provides a relatively quick test for determining the effectiveness of traffic engineering changes by taking "before and after" conflict counts. Changes in road design, signing, signalization, environment, and accident trade-offs can be evaluated quickly and quantitatively.

The traffic conflict technique delineates initial causes of potential accident situations. Over 10 specific categories of rear-end incidents have been defined. The technique results in accurate measures of accident potentials, provides an understanding of the basic causes of accidents, and should ultimately lead to a reduction of traffic accidents. Though embryonic, the work done to date indicates that the traffic conflict technique should prove to be a useful tool for traffic engineers.