Traffic Conflict Techniques for Safety and Operations--

Observers Manual

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FOREWORD

This observer's manual provides basic background information for persons who are assigned to observe traffic conflicts in the field. The manual contains definitions of traffic conflicts which typically occur at intersections as well as step-by-step instructions for conducting the survey.

Experienced observers and engineers will find the manual to be a handy reference source and an aid in training new personnel. Persons who have not previously conducted a traffic conflict survey should read this manual carefully as a first step in learning how to accurately observe and record traffic conflicts.

Stanley Byington

Stanley R. Byington, Director
Office of Implementation

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16. Abstract

This manual provides basic background information and step-by-step procedures for conducting traffic conflict surveys at signalized and unsignalized intersections. The manual was prepared as a training aid and reference source for persons who are assigned the responsibility of conducting traffic conflict observations at intersections.

Based on previous research and experiences, the survey techniques described in this manual provide a standard, cost-effective method for accurately observing and recording traffic conflicts. The manual contains definitions with illustrations and examples of conflict types, and instructions for conducting the field activities, including time schedules, forms, and other details.

The results of traffic conflict observations are used to diagnose safety and operational problems and to evaluate the effectiveness of treatments. Observer training techniques, as well as procedures for analyzing and interpreting the results of conflict surveys, are presented in the engineer's guide (FHWA-IP-88-026).

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METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	2.54	millimetres	mm
ft	feet	0.3048	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
AREA				
in^2	square inches	645.2	millimetres squared	mm^2
ft^2	square feet	0.0929	metres squared	m^2
yd^2	square yards	0.836	metres squared	m^2
mi^2	square miles	2.59	kilometres squared	km^2
ac	acres	0.395	hectares	ha
MASS (weight)				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
VOLUME				
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft^3	cubic feet	0.0328	metres cubed	m^3
yd^3	cubic yards	0.0765	metres cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

TEMPERATURE (exact)

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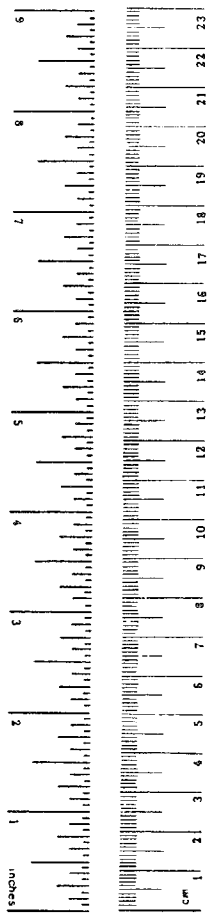

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
AREA				
mm^2	millimetres squared	0.0016	square inches	in^2
m^2	metres squared	10.764	square feet	ft^2
km^2	kilometres squared	0.39	square miles	mi^2
ha	hectores (10 000 m^2)	2.53	acres	ac
MASS (weight)				
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1 000 kg)	1.103	short tons	T
VOLUME				
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m^3	metres cubed	35.315	cubic feet	ft^3
m^3	metres cubed	1.308	cubic yards	yd^3

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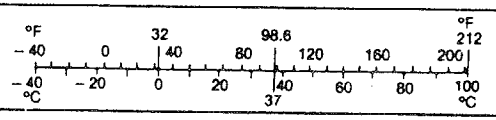

These factors conform to the requirement of FHWA Order 5190.1A.

* SI is the symbol for the International System of Measurements

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OBSERVER'S MANUAL

CHAPTER 1 - INTRODUCTION

A traffic conflict is a traffic event involving the interaction of two or more road users, usually motor vehicles, where one or both drivers take evasive action such as braking or swerving to avoid a collision. A traffic conflict survey is a systematic method of observing and recording traffic conflicts and other events associated with safety and operations. A person who conducts the field survey is known as a traffic conflict observer.

This manual provides basic background information and standard procedures for traffic conflict observers. The manual contains definitions of traffic conflicts which typically occur at intersections as well as step-by-step instructions for conducting the survey.

Experienced observers and engineers will find the manual to be a handy reference source and an aid in training new personnel. Persons who have not previously conducted a traffic conflict survey should carefully read this manual as a first step in learning how to observe and record conflicts.

Because the results of a traffic conflict survey are used to make important decisions concerning traffic safety and operations, it is imperative that conflicts be recorded in a uniform or standard manner. Observers must participate in a formal training program to help them recognize conflicts under a variety of traffic and roadway conditions. One should not be expected to count conflicts based on reading this manual alone. The training program, conducted by the engineer, is essential to assure uniform and accurate data collection. Training procedures, as well as methods for analyzing and interpreting conflict data are described in the engineer's guide.[1]

The survey techniques described in this manual provide a cost-effective method for accurately measuring traffic conflicts at signalized and unsignalized intersections. The definitions and procedures are based on the results of years of extensive research, experimentation, and practice. In the future it is anticipated that standardized procedures will be developed for other roadway situations such as freeway entrances and exits, weaving areas, midblock locations, and construction zones.

Background

For many years traffic accidents have been used as a direct measure of highway safety. If an unusually high number of accidents occur at a location, it is probable that something associated with the roadway design or traffic operation is unsafe. Traffic engineers, therefore, use accident data to determine:

- Which locations are most hazardous.
- What kinds of hazards are present.
- Whether a change in the design or operation has been effective.

But, there are many problems with accident data. All accidents are not reported. Due to manpower and budget limitations in recent years, there is a growing trend nationwide by police agencies not to report property damage only accidents. For example, in 1982 in Maryland, reduced accident reporting resulted in a loss of 40 percent of the total number of accidents previously reported.[2] Incomplete accident data makes the identification of roadway hazards less accurate.

Sometimes data errors and incomplete information are found in accident records. Also, accidents are fairly infrequent and happen sporadically, so a long time is needed to collect enough accident data to be useful. For example, the numbers of accidents at one intersection from year to year are 10, 24, 12, 20, 18, 14, 20, 10, 14. If one looked at only one or two years, one would not know what is typical. Is it 10 to 14 per year, or is it 14 to 20 per year? This is a statistical problem that many people do not appreciate. People often overreact to a rash of accidents or a severe accident that may be just a normal statistical fluctuation. Additionally, accident records sometimes are not helpful in pinpointing specific hazards.

For these reasons, other traffic indicators are useful. The Traffic Conflict Technique is one important way to measure the accident potential of highway intersections without having to wait for accidents to happen.

For many years traffic engineers have made observations of traffic operations to obtain clues that are useful in identifying unsafe conditions and operational problems, but the procedures were based on opinion and judgment. In 1967, two researchers with the General Motors Research Laboratories developed a set of formal definitions and procedures for observing traffic conflicts at intersections.[3] The researchers identified traffic conflict patterns for over 20 corresponding accident patterns at intersections. The procedure became known as the Traffic Conflict Technique. Because each traffic conflict was based on a particular accident type, the technique was considered to be a measure of accident potential.

Conflicts were defined as the occurrence of evasive vehicular actions and were recognizable by braking and/or weaving maneuvers. Figures 1 and 2 show two traffic conflicts. In figure 1, the driver in the pickup is making a left turn onto the cross street causing the driver of the through car to brake to avoid collision. In figure 2, the driver in the pickup on the cross street is making a right turn onto the main street causing the driver of the car to weave to the left to avoid a collision. These are just two examples, but they show that traffic conflicts are situations where a driver brakes or swerves to avoid a collision.

In 1979 additional extensive field testing was conducted to develop standard definitions and refine the data collection procedure to ensure that trained observers could provide accurate results.[4] The definitions and procedures presented in this manual were taken from that research study.

Another major study, completed in 1985, provided proof that some traffic conflicts and accidents at intersections were related.[5] In fact, the researchers found that traffic conflicts are good surrogates for accidents. This means that conflict data may be used as a substitute for accident data.

Figure 1. A traffic conflict with an oncoming left-turn vehicle.

Figure 2. A traffic conflict with a cross-street vehicle.

Traffic Conflict Survey

A traffic conflict study is usually conducted under the direction of a traffic engineer who determines that the study is needed, schedules the activities, supervises data collection, and performs or supervises the analysis. The engineer also interprets the findings and makes decisions and recommendations concerning intersection improvements. Field data collection is normally the function of traffic technicians, and/or planning personnel. An engineer's guide is available for the engineer who will make the decisions about where and when to conduct a conflict study, and how to analyze and interpret the results.[1]

A traffic conflict survey usually takes from several hours to several days of careful manual observation of traffic at an intersection. Specific procedures are used to assure uniform data collection so that valid comparisons and judgments can be made. A survey requires one or more observers who follow a set schedule and perform a number of separate but related tasks. These tasks include recording dimensions and other details about the intersection such as the type of traffic control devices in place. The observer is also required to make judgments about the traffic flow problems and their causes, and most importantly, to observe and record traffic events. No sophisticated equipment is needed to make a conflict survey. In the past some agencies have used motion picture or video equipment to record conflict data, however, to improve accuracy and reduce data collection costs, manual observations of conflicts in the field are recommended.

Chapter 2 of this manual provides detailed definitions of the types of traffic conflicts that are observed and recorded in a conflict survey. In chapter 3, examples of several traffic situations are given along with an interpretation of how these events should be handled using the traffic conflict definitions. Chapter 4 describes how to prepare for a traffic conflict survey, including instructions and suggestions for getting started. Chapter 5 tells how to conduct the survey, and includes time schedules, forms to be completed, and other details.

CHAPTER 2 - TRAFFIC CONFLICT DEFINITIONS

In this section the general concept of a traffic conflict is discussed followed by the definitions of specific types of conflicts for intersections.

General Definition

> A traffic conflict is an event involving two or more road users, in which the action of one user causes the other user to make an evasive maneuver to avoid a collision.

Generally, the road users are motorists, but the definition also includes pedestrians and cyclists. The action of the first user includes a variety of maneuvers such as turning left across the path of a through vehicle just as the through vehicle is entering the intersection area; turning from the cross street into the path of a through vehicle; and slowing to turn at the cross street placing a following vehicle in danger of a rear-end collision. The

general definition, however, does rule out actions that nearly all drivers take under the same conditions such as normal stopping for a STOP sign or red traffic signal.

Conflicts are vehicle interactions which can lead to accidents. For a conflict to occur, the road users must be on a collision course; i.e., the users must be attempting to occupy the same space at the same time. The primary requirement of a traffic conflict is that the action of the first user places the other user on a collision path unless evasive action is taken by the other user to avoid the accident. Sometimes the other user is either unaware of the collision potential or has poor judgment in estimating time intervals and clearances and does not make an evasive maneuver. Collisions and near miss situations that occur without evasive maneuvers, or when the evasive action is inadequate or inappropriate for conditions, are also recorded as conflicts under the general definition.

An intersection traffic conflict is described as an event involving the following stages.

Stage 1. The first vehicle makes a maneuver; e.g., pulling out from the cross street.

Stage 2. A second vehicle is placed in danger of a collision.

Stage 3. The driver of the second vehicle reacts by braking or swerving.

Stage 4. The second vehicle then continues to proceed through the intersection area.

The last stage is necessary to convince the observer that the second vehicle was actually responding to the maneuver of the first vehicle and not, for example, to a traffic control device or nearby driveway or median opening.

The evasive maneuver taken by the second vehicle is evidenced by obvious braking or swerving. Braking is usually observed as brake-light indications, however, some vehicles are driven with inoperative brake lights. A noticeable diving of the vehicle or squealing of tires in the absence of brake lights is acceptable evidence of an evasive maneuver.

Operational Definitions

Within this general framework, a basic set of conflict definitions were developed for intersections, corresponding to the different types of maneuvers and related accident patterns. Similar to the manner in which accidents are grouped by type of collision, traffic conflicts are categorized by type of maneuver. The primary types of intersection conflicts are:

- Same direction.
- Opposing left turn.
- Cross traffic.
- Right-turn-on-red.
- Pedestrian.
- Secondary.

Overall, 14 basic intersection conflict situations are useful in pinpointing safety and operational problems, and several other events may be important in special situations. The conflict definitions are presented in the following paragraphs along with figures illustrating the event.

To view conflicts, an observer is stationed on one intersection approach for a specified time period. All conflicts observed from that vantage point are recorded. Conflicts that occur on the other approaches are recorded by other persons or during different time periods when one observer is used. The conflict definitions were developed to give the observer a clear view of the evasive action; i.e., braking or swerving, taken by the second road user. While the observer can see the action taken by the first road user, the primary focus is on the reaction of the driver in the second vehicle. To aid in learning the various conflict patterns, the position of the observer is marked on each of the following conflict diagrams.

Same-Direction Conflicts

A same-direction conflict occurs when the first vehicle slows and/or changes direction and places the following vehicle in danger of a rear-end collision. The second vehicle brakes or swerves to avoid the collision, then continues to proceed through the intersection area. The four basic types of same-direction conflicts are described below. It should be noted, however, that all secondary conflicts (described later in a separate category) are also same-direction conflicts.

Left-turn, Same-Direction Conflict

A left-turn, same-direction conflict occurs when the first vehicle slows to make a left turn, thus placing a second, following vehicle in danger of a rear-end collision (see figure 3).

Right-Turn, Same-Direction Conflict

A right-turn, same-direction conflict occurs when the first vehicle slows to make a right turn, thus placing a second, following vehicle in danger of a rear-end collision (see figure 4).

Slow-Vehicle, Same-Direction Conflict

A slow-vehicle, same-direction conflict occurs when the first vehicle slows while approaching or passing through the intersection, placing a second, following vehicle in danger of a rear-end collision (see figure 5).

The reason the driver of the first vehicle slows down may not be evident, but it could simply be a precautionary action, or a result of congestion or some other cause beyond the intersection. When the cause of the slow-vehicle conflict is seen by the observer, it should be noted on the conflict form.

Lane-Change Conflict

As shown in figure 6, a lane-change conflict occurs when the first vehicle changes from one lane to another, thus placing a second, following

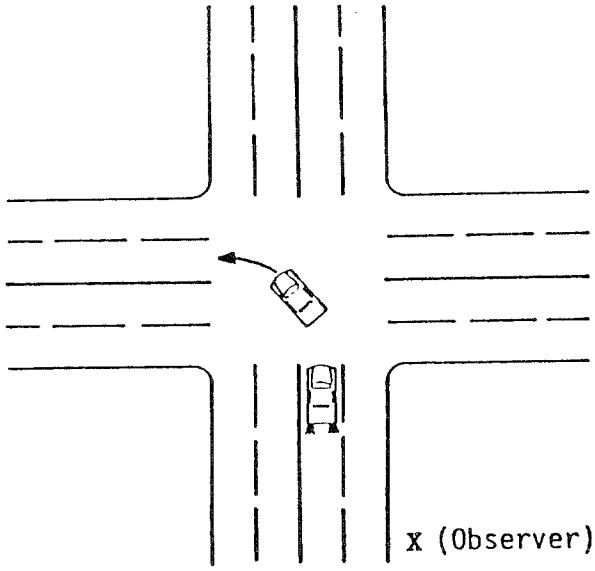


Figure 3. Left-turn, same-direction conflict.

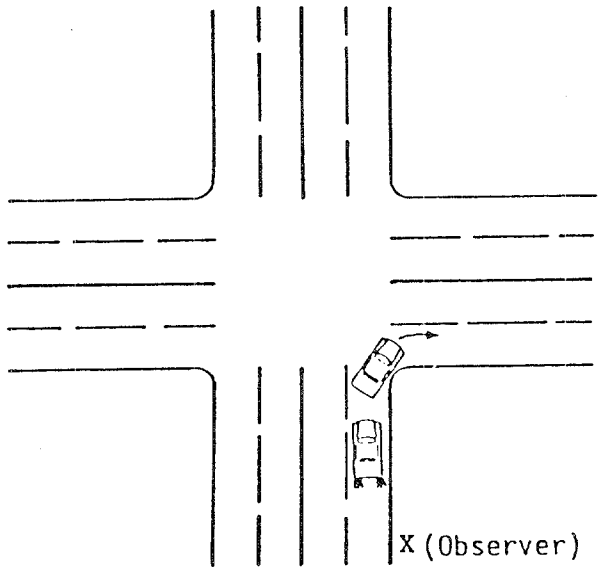


Figure 4. Right-turn, same-direction conflict.

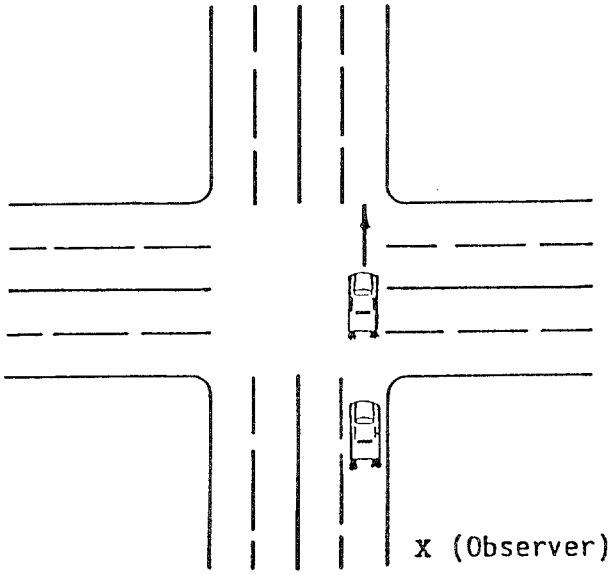


Figure 5. Slow-vehicle, same-direction conflict.

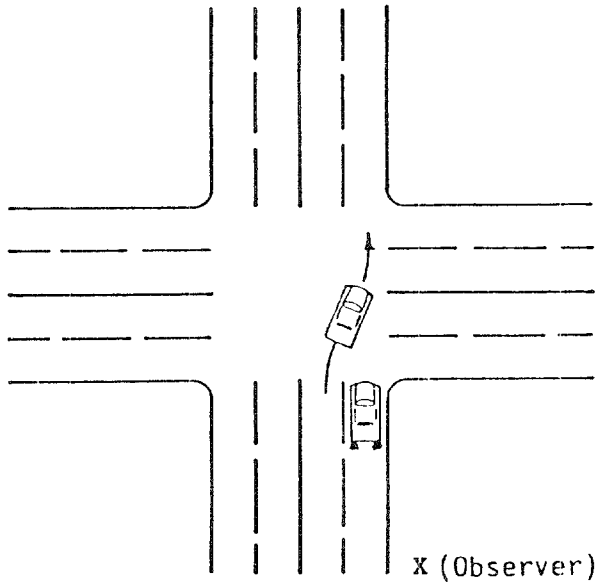


Figure 6. Lane-change conflict.

vehicle in the new lane in danger of a rear-end or sideswipe collision. However, if the lane change is made by a vehicle because it is in danger, itself, of a rear-end collision with another vehicle, the following vehicle in the next lane is said to be faced not with a lane-change conflict situation, but with a secondary conflict situation. (Secondary conflicts are described in a subsequent category.)

Opposing Left-Turn Conflict

An opposing left-turn conflict occurs when an oncoming vehicle makes a left turn, thus placing a second vehicle, going in the other direction, in danger of a head-on or broadside collision (see figure 7).

In this and in the following conflict situations, the second vehicle is presumed to have the right-of-way, and this right-of-way is threatened by the first road user. Situations such as a second vehicle placed in danger of a collision because the driver of the second vehicle is running a red light, for example, are not treated as traffic conflicts. These situations are described in the section on other types of traffic events.

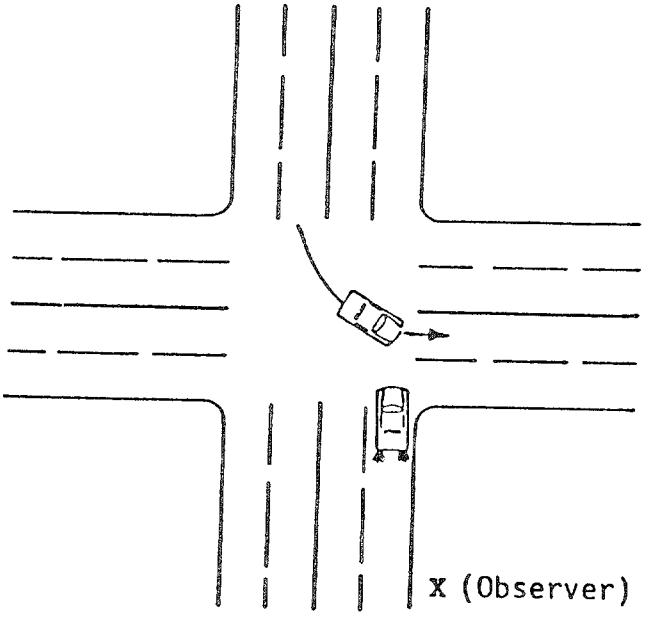


Figure 7. Opposing left-turn conflict.

Cross-Traffic Conflicts

A cross-traffic conflict occurs when a vehicle on the cross street turns or crosses into the path of a second vehicle on the main street who has the right-of-way and places the second vehicle in danger of a rear-end, sideswipe, or broadside collision. The second vehicle brakes or swerves to avoid the collision, then proceeds through the intersection area.

Cross-traffic conflicts can occur from vehicle maneuvers on the right-hand and/or left-hand cross street approach.

Cross-Traffic Conflicts From the Right Cross Street Approach

Right-Turn, Cross-Traffic-From-Right Conflict

A right-turn, cross-traffic-from-right conflict occurs when a vehicle on the right-hand cross street makes a right turn, thus placing a second vehicle on the main street in jeopardy of a broadside or rear-end collision. See figure 8 for the directions of the two vehicles.

At signalized intersections where right turns on red are permitted, it is sometimes desirable to further subdivide the right turn category to identify conflicts related to right-turn-on-red (RTOR) maneuvers.

Left-Turn, Cross-Traffic-From-Right Conflict

A left-turn, cross-traffic-from-right conflict occurs when a vehicle on the right-hand cross street makes a left turn, thus placing a second vehicle on the main street in danger of a broadside collision (see figure 9).

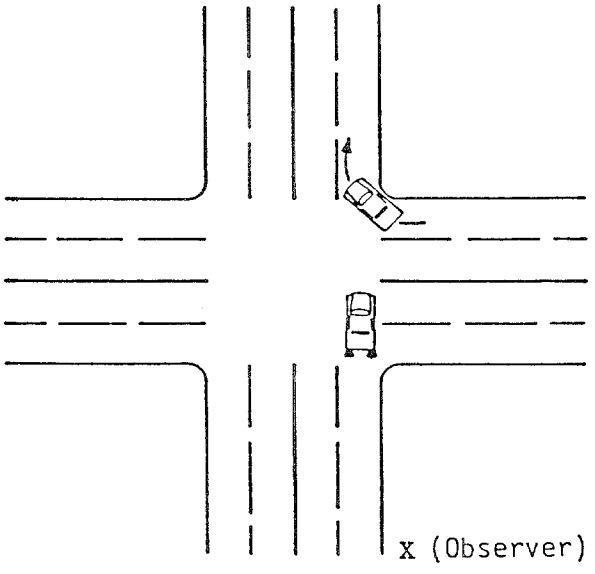


Figure 8. Right-turn, cross-traffic-from-right conflict.

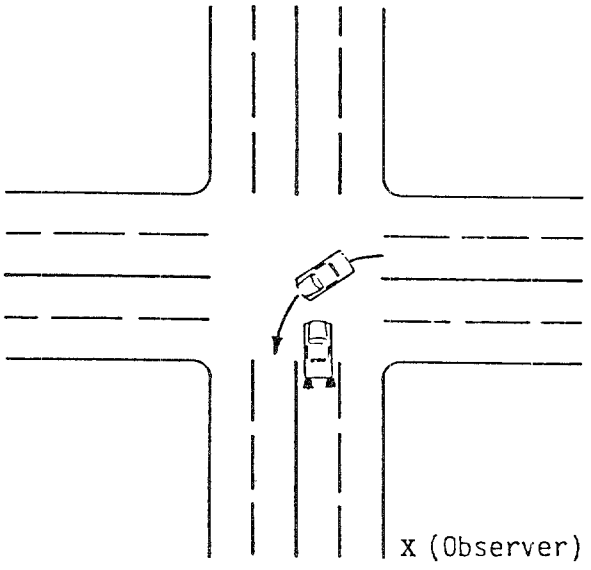


Figure 9. Left-turn, cross-traffic-from-right conflict.

Through, Cross-Traffic-From-Right Conflict

A through, cross-traffic-from-right conflict occurs when a vehicle on the right-hand cross street crosses in front of a second vehicle on the main street, placing it in danger of a broadside collision (see figure 10).

Cross-Traffic Conflicts From the Left Cross Street Approach

Right-Turn, Cross-Traffic-From-Left Conflict

A right-turn, cross-traffic-from-left conflict occurs when a vehicle on the left-hand cross street makes a right turn across the center of the main street roadway and into an opposing lane, thus placing a vehicle in that lane in danger of a head-on collision (see figure 11). This conflict is sometimes observed when the cross street is narrow, or when large trucks or buses make wide right turns. Note that the first vehicle must cross the center line for there to be a conflict.

Left-Turn, Cross-Traffic-From-Left Conflict

A left-turn, cross-traffic-from-left conflict occurs when a vehicle on the left-hand cross street makes a left turn, thus placing a second vehicle on the main street in danger of a broadside or rear-end collision (see figure 12).

Through, Cross-Traffic-From-Left Conflict

A through, cross-traffic-from-left conflict occurs when a vehicle on the left-hand cross street crosses in front of a second vehicle on the main street placing it in danger of a broadside collision (see figure 13).

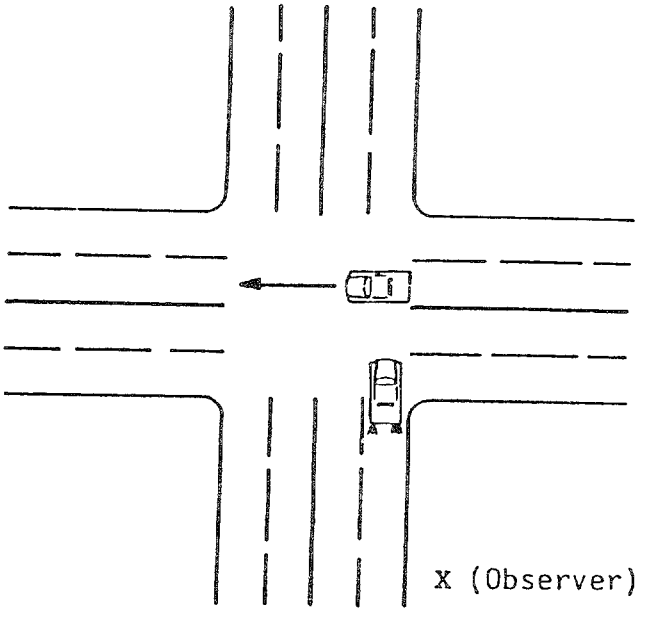


Figure 10. Through, cross-traffic-from-right conflict.

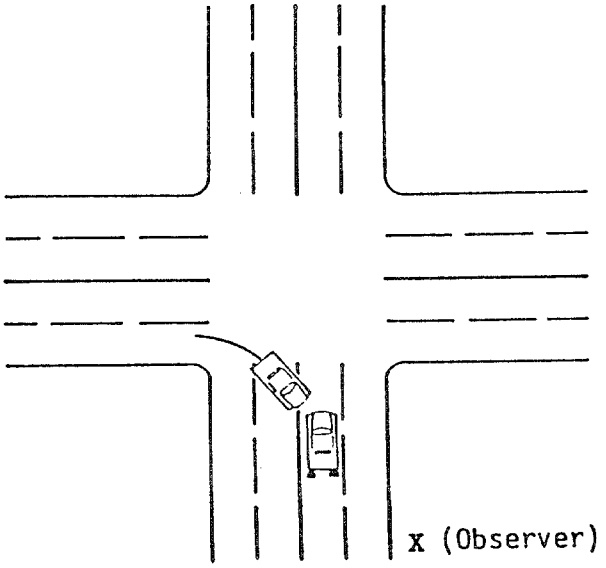


Figure 11. Right-turn, cross-traffic-from-left conflict.

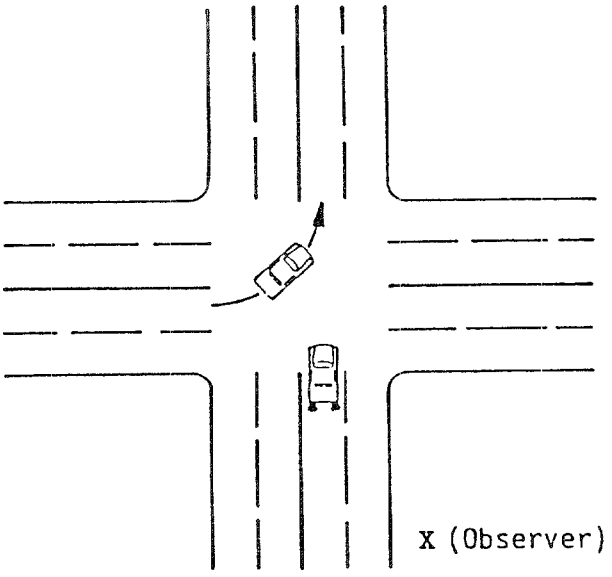


Figure 12. Left-turn, cross-traffic-from-left conflict.

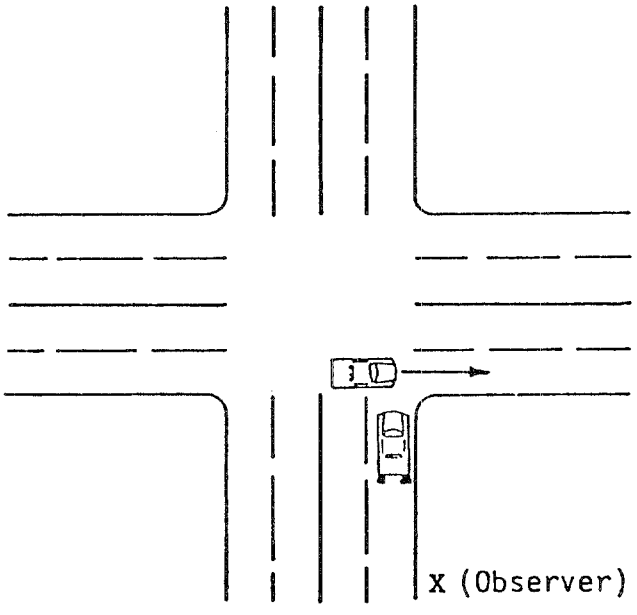


Figure 13. Through, cross-traffic-from-left conflict.

Right-Turn-On-Red Conflicts

Right-turn-on-red conflicts occur when a RTOR vehicle makes a turn and crosses into the lane of a second vehicle which has the right-of-way. The driver of the second vehicle brakes or swerves to avoid a broadside, sideswipe, or rear-end collision, then proceeds through the intersection area.

Opposing Right-Turn-On-Red Conflict

An opposing right-turn-on-red conflict can only occur at a signalized intersection with a protected left-turn phase. It happens when an oncoming vehicle makes a right-turn-on-red during the protected left-turn phase, thus placing a left turning, second vehicle (which has the right-of-way) in danger of a broadside or rear-end collision (see figure 14).

Right-Turn-On-Red-From-Right Conflict

A right-turn-on-red-from-right conflict is a special category of the right-turn, cross-traffic-from-right conflict (see figure 8). The right-turn-on-red conflict occurs only at signalized intersections when a RTOR vehicle on the right-hand cross street makes a RTOR maneuver and places a second vehicle on the main street in danger of a sideswipe, broadside, or rear-end collision.

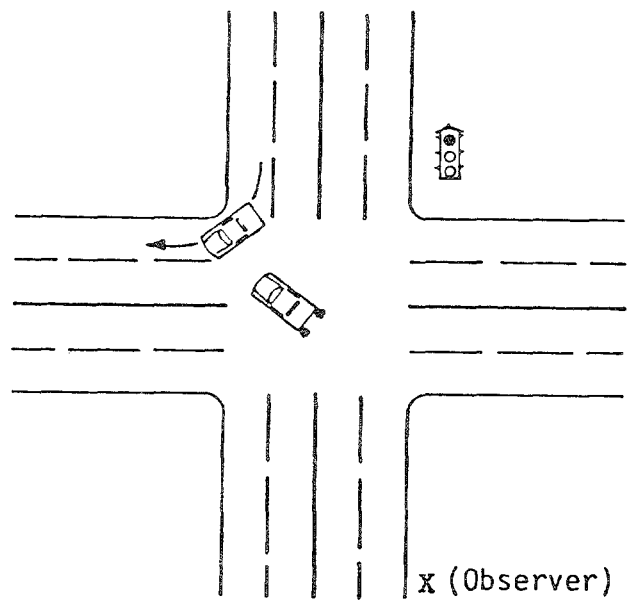


Figure 14. Opposing right-turn-on-red conflict.

Pedestrian Conflicts

There can also be pedestrian conflicts. They occur when a pedestrian (the road user causing the conflict) crosses in front of a vehicle that has the right-of-way, thus creating a possible collision situation. The vehicle brakes or swerves, then continues through the intersection area. Any such crossing on the near side or far side of the intersection (see figures 15 and 16) is liable to be a conflict situation. However, the pedestrian movements on the right and left sides of the intersection are generally not considered to create conflict situations if the movements have the right-of-way, such as during a WALK phase.

In some cases, the observer may be asked to count bicycle conflicts. These conflicts are similar to the pedestrian conflicts described above except the road user causing the conflict is a bicyclist.

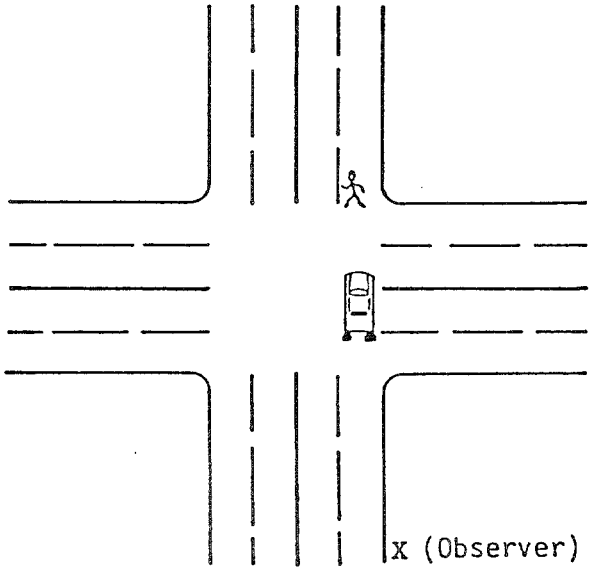


Figure 15. Pedestrian, far-side conflict.

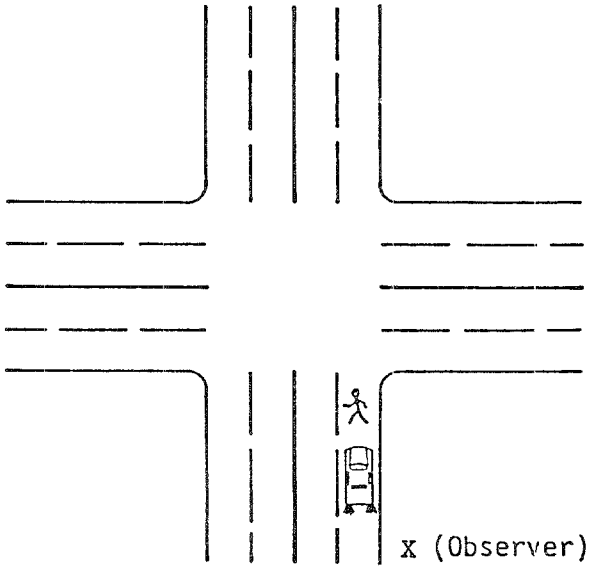


Figure 16. Pedestrian, near-side conflict.

Secondary Conflicts

In all of the foregoing conflict situations, when the second vehicle makes an evasive maneuver, it may place another road user (a third vehicle) in danger of a collision. This type of event is called a secondary conflict. Nearly always, the secondary conflict will look much like a slow-vehicle, same-direction conflict or a lane-change conflict. The difference is that, in a secondary conflict, the third vehicle is responding to a second vehicle that, itself, is in a conflict situation. Some examples are shown in figures 17 and 18.

By definition, only one secondary conflict for any initial conflict should be counted. Even if a whole line of cars stops because the first vehicle turns left, the event would be recorded as one left-turn, same-direction conflict and one secondary conflict.

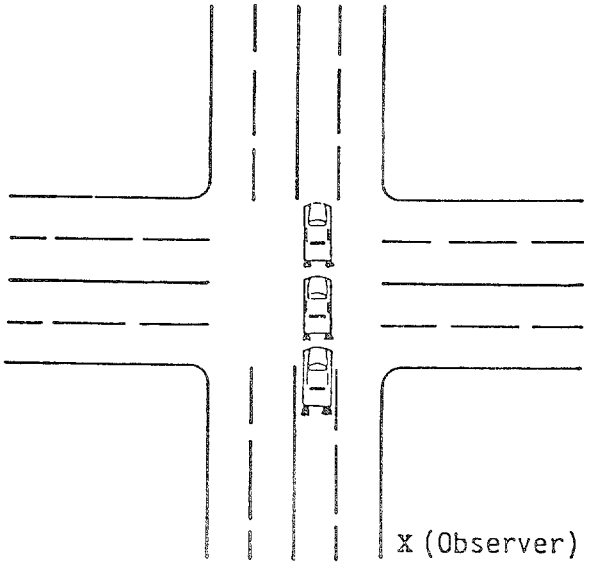


Figure 17. Slow-vehicle, same-direction secondary conflict.

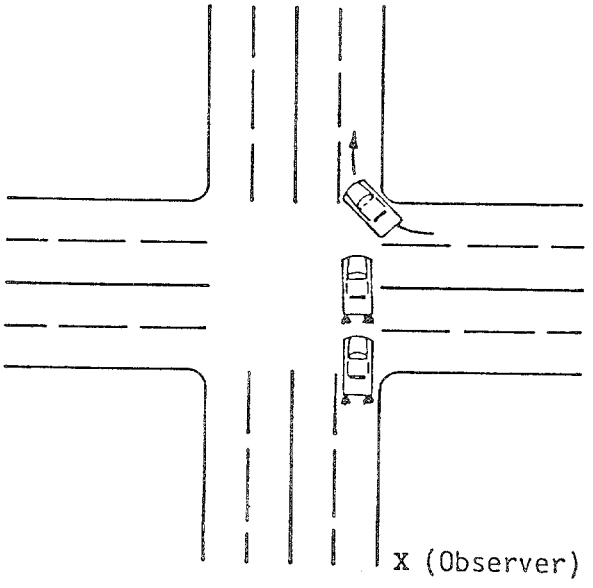


Figure 18. Right-turn, cross-traffic-from-right secondary conflict.

Other Types of Traffic Events

For some studies, the engineer may request the observer to count other types of traffic events, which are not defined in this manual. For example, to examine the effectiveness of a new traffic signal display, the observer may be asked to collect the number of red-light violations (a driver who crosses the stop line after the light has turned red), and the number of red-light violations that resulted in a conflict with other road users. Note that neither a red-light violation nor the resulting violation conflict is a traffic conflict under the conditions outlined in the general definition. In any case, the two events may be appropriate measures for some studies. In these special situations, the engineer will define the events to be counted and provide observer training prior to data collection.

Observers should always record any unusual or unexpected events during a conflict survey. Even if the event is rare or not described in this manual or during training, it may have important implications concerning safety and operations at the intersection. These events should be recorded in the comments section on the conflict data form.

CHAPTER 3 - RECOGNIZING TRAFFIC CONFLICTS

A traffic conflict survey requires the observer to recognize specific conflict types from a wide variety of traffic events.

It is not possible to describe in this manual every possible traffic event and classify it into one of the conflict categories. The observer will have to judge most situations using experience, and by applying the basic principles presented earlier. To aid in recognizing and classifying conflicts, the following examples of traffic situations are offered. Studying the selected examples will help in making these judgments.

Examples

In all of these examples, assume the conflict observer is on the south leg, as shown in figure 19, viewing northbound traffic as it approaches the signalized intersection. In each case, the traffic situation is first described and then interpreted.

1. **The signal turns red for northbound traffic, but a driver apparently does not notice it until the last minute, then slams on the brakes.** The interpretation depends on the other traffic. If, as would normally be the case, the intersection is empty when braking begins, there is no conflict. The driver is just responding to the signal. But if a westbound vehicle is in the intersection, classify the event as a through, cross-traffic-from-right conflict. This would probably be rare, and the observer should make a special note about it on the conflict data form.

2. **A car on the right (east) approach stops, starts to pull out to make a right turn, then stops abruptly because the driver sees a northbound vehicle that just passed the observer position.** This is not a conflict from the observer perspective. Only when a northbound vehicle reacts to an impending

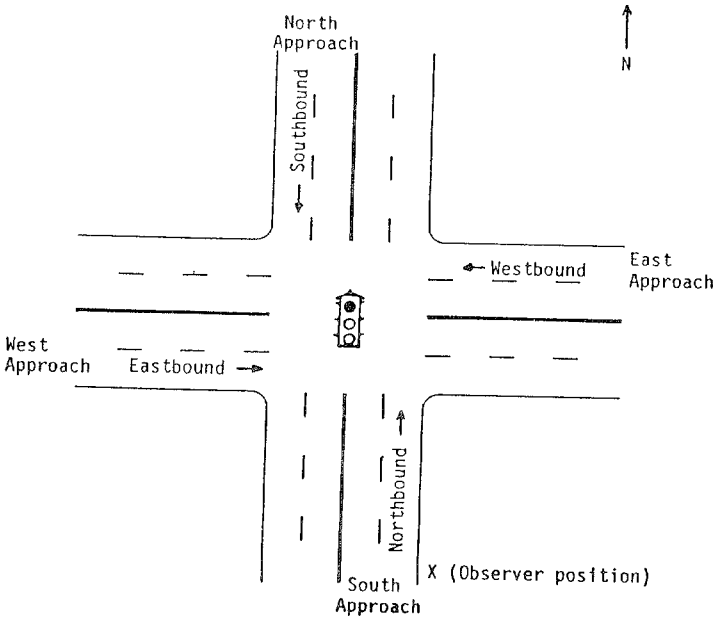


Figure 19. Intersection layout for the example traffic situations.

collision is there a conflict. If, however, the northbound vehicle also braked or swerved and the car from the right had pulled far enough forward to be in his path, then a right-turn, cross-traffic-from-right conflict would be recorded.

3. **A northbound car slows and turns right. Another car, right behind it, brakes severely and then it, too, turns right.** Although this could be debated, the event should be considered to be a right-turn, same-direction conflict. If the second vehicle, however, turns into a driveway or makes a left turn, it should not be recorded as a conflict because you do not know if the second vehicle braked because of the first vehicle or because the driver was going to turn. If the second vehicle proceeds through the intersection instead of turning right, always record the event as a conflict. When in doubt about any conflict situation, make a note on the conflicts form.

4. **While the signal is green for north and southbound traffic, a northbound driver begins a left turn, then stops abruptly to avoid a southbound vehicle which he did not see until the last minute.** This is not a conflict. This common situation often leads to accidents, however. Especially on four-lane roads, the oncoming southbound center-lane vehicles may be stopped waiting to turn left, hiding southbound through-vehicles in the outside lane. But unless there is a left-turn phase, the through-vehicles have the right-of-way. If the left-turn vehicle does not have the right-of-way, it is not classified as a conflict. However, if this situation is observed often at an intersection, make a note on the data form.

If the observer was on the north approach and the southbound driver took evasive action to avoid a collision with the left-turning vehicle, the event would be recorded as an opposing left-turn conflict.

5. **During the green cycle on a four-lane street, an oncoming southbound vehicle makes a left turn, causing drivers in both northbound lanes to brake.** Although this could be debated, it appears most logical to count this as two opposing left-turn conflicts. Although there is only one instigating vehicle, an accident could have occurred with either northbound vehicle if the drivers had not reacted. Also, this is not a secondary conflict situation, because the two northbound vehicles reacted independently to the left turner, not to each other.

6. **A car is stopped with a flat tire on the north side of the intersection, blocking the right northbound lane for half an hour. Meanwhile, northbound traffic is slowed considerably because it is forced to maneuver around the disabled vehicle. Frequent slow-vehicle and secondary conflicts are noted.** The conflicts should be recorded unless traffic backs up (stop and go condition) through the intersection. Make prominent notes about the situation and, if possible, explain it personally to the engineer. He may decide not to use the data, but it is better to record the data, even if they will not be used, than to miss important insights about the traffic operations.

7. **Same situation as noted in example 6, except traffic flow is reduced to stop and go conditions during the green phase, and nearly every northbound vehicle brakes one or more times approaching or going through the intersection.** The Traffic Conflict Technique does not appear suitable during periods of congestion. However, the existence of traffic congestion is possibly indicative of operational deficiencies. During such times, cease making formal conflict counts, but carefully note any apparent causes for the congestion (it could be simply heavy traffic) and how long it lasts.

8. **Every 10 minutes or so, a city bus slows and stops just north of the intersection to discharge passengers. Cars behind the bus are forced to brake or swerve.** Record these events as slow-vehicle conflicts. But it is extremely important to note the cause. This may or may not be judged a hazardous situation--that is for the traffic engineer to decide--but make sure to record the information.

9. **The observer hears the squeal of brakes behind (south of) his position. Turning, he sees a heavy, slow-moving truck and, behind it, the car that had just braked.** This is not a conflict. The observer is counting only the events between him and the intersection. The purpose of the study is to learn more about the intersection. Chances are that events behind the observer (such as the slow-moving truck) have little to do with the intersection itself. But, if the observer believes the braking was due to the intersection (for example, the truck was moving slowly because the signal was going to change), a special note should be made on the data form.

10. **There is a fast-food restaurant 200 feet north of the intersection, and many vehicles slow to turn right and enter the driveway. Often, other northbound vehicles are forced to slow during, or after, the time they cross the intersection.** These incidents should be recorded as slow-vehicle conflicts if the braking vehicle is on the observer side of or in the intersection. If the braking vehicle is north of the intersection, this is not an intersection conflict and should not be recorded. In either case, if it

happens frequently, make notes about it. Although there may not be an intersection problem, the observer may have located a driveway problem that bears on how the intersection operates.

11. **A car, parked at a meter ahead of the observer, pulls in front of another vehicle, causing it to brake.** This is a conflict; the question is, what kind? Arguments could be made for calling it a slow-vehicle conflict, a lane-change conflict, or even a right-turn, cross-traffic-from-right conflict. If this does not happen very often, the classification probably does not matter very much. It is preferred practice to record it as a slow-vehicle conflict, then to note the cause.

12. **A southbound cab enters the intersection, then makes a U-turn and heads north. The driver of a northbound vehicle applies brakes to avoid a collision with the cab.** If this happens very often, make up a separate column, define these as U-turn conflicts, and count them. Otherwise, record them as slow-vehicle conflicts and note the cause.

13. **A southbound vehicle makes a left turn at the intersection crossing in the path of a through northbound vehicle. The observer hears the tires squeal an can see the front of the northbound vehicle dip forward indicating sudden deceleration, but there are no brake light indications and the northbound driver did not attempt to swerve to avoid the impending collision.** This is definitely an opposing left-turn conflict. A small percentage of vehicles have brake lights that are inoperative. To record a conflict, however, there must be some visual and/or audible evidence such as the squealing of tires to convince the observer that the driver was attempting evasive action.

14. **The signal turns red for northbound traffic causing a northbound vehicle to slow, then come to a full stop. At the last second a following northbound driver slams on the brakes, the vehicle skids, and finally comes to a stop just before reaching the lead vehicle stopped on the approach.** By definition, this is not a conflict because the lead vehicle stopped legally for a red signal. For a same-direction conflict to occur, the signal phase must be green. However, as accidents related to this maneuver occur at intersections, the observer should note the event on the conflict form. Sudden braking or swerving by a following vehicle may indicate a signal visibility, sunglare, or related problem, especially if the event is repeated a number of times during the survey. These events, along with any unusual circumstances, should always be recorded.

Unusual Intersection Geometrics

The basic operational definitions previously described refer to relatively standard intersection geometrics. Certain modifications will be required for other geometrics. Suggestions are given here for some of the more common departures from normality that may be encountered.

Right-Turn and Left-Turn Lanes

If an approach leg contains a right-turn and/or a left-turn lane, more lane changing than usual will be observed. The observer should not mistakenly

record these swerves as rear-end conflict situations. However, the observer should be alert for lane-change conflicts, which are otherwise rare at most intersections.

Driveways at Three-Leg Intersections

Many three-leg intersections have a driveway where a fourth leg would normally be. Unusual conflict situations may occur, especially if the intersection is signalized and there is appreciable driveway traffic (which is not signal controlled). Observers should be alert for such movements, and record them as notes or under appropriate column headings on the conflict data form.

One-Way Streets

If the street under study carries one-way traffic, observation is simplified because only the approach leg needs to be monitored. Also, there will be no opposing left-turn conflicts. On the other hand, if the cross street is one-way, the observer obviously needs to watch for cross traffic from only one direction--again, a simplification.

Traffic Circles

Each approach to a traffic circle is similar to an approach to a one-way street. Likewise, traffic within the circle is somewhat like traffic on a one-way street with frequent intersections. It differs, however, in that there is more frequent lane changing. In this respect, it is like a series of weaving sections. Thus, lane-change conflicts will be seen frequently.

Five-Leg Intersections

Intersections with more than four approaches are more complicated, but no new concepts are required. Cross-traffic conflicts will have to be clearly labeled according to the approach leg used by the cross traffic. If the intersection is one with major merging/diverging movements (i.e., where traffic on one approach splits fairly evenly between other legs and vice versa), three observers will be required. Also, the engineer should define for the observers the straight-through path, as opposed to right- and left-turn movements, even though a straight-through movement may require a slight turn.

Offset-Intersections

The major difficulty with offset-intersections is whether to consider them as two three-leg intersections separated by a short weaving section or as a single four-leg intersection with a longer than normal clearance interval. In the latter case, observation of opposing left-turn conflicts involving vehicles on the offset legs may be difficult for the observers to see from their normal vantage points. If so, rather than observing from the right side of the approach leg, using the left side may be advantageous.

CHAPTER 4 - STARTING THE TRAFFIC CONFLICT SURVEY

A traffic conflict survey includes making conflict counts along with collecting other data needed to make a complete study of the location. The collected data can be used to answer questions about safety and operational problems; to recommend corrective treatments; or to show the effectiveness of improvements already implemented, as in a before-and-after study. The traffic conflict survey can also be a portion of a larger study within a safety upgrading program. In this case, traffic conflict data are used along with traffic accident data, signal warrants, capacity analysis, and other engineering data needed to identify problems and recommend improvements.

Preparing for the Survey

Before leaving for the study location, assemble the engineer's instructions, equipment, and materials needed for the survey. These include:

- Observation procedures as discussed with the engineer.
- Schedule of survey locations.
- Map showing location of study sites.
- Supervisor's telephone number.
- Personal identification card.
- Mechanical count board.
- Tablet.
- Pencils.
- Watch.
- Stop watch.
- Camera with film (at least 20 exposures for a four-leg intersection).
- Folding chair (optional).
- Water.
- Data collection forms.
- Safety vests.
- Copy of the Observer's Manual for reference purposes.

The observation procedures include the number of personnel needed; approach legs to be studied, special conflict types, if any, and other data to be collected; and hours of observation needed. This information will be provided by the engineer. These procedures are described in the engineer's guide.[1]

The schedule of survey locations should list future study sites, which could also be used in emergency situations--that is, if for some reason data cannot be collected at the scheduled site. If the observer is not familiar with the other locations, they should be noted on a map.

The engineer should be telephoned whenever the observer is unsure of the procedures or something unusual occurs. Also, observers should always carry valid identification in case property owners or the police are concerned by their presence. Questions should be answered courteously but quickly so that one can maintain concentration on the study.

The count board should have enough mechanical counters to record traffic volumes on all approaches of a standard four-leg intersection (i.e., three

counters per approach). This will be more than enough to record the most common traffic conflicts. Any additional counts can easily be recorded by hand. The count board can also be used to do traffic volume counts, if requested by the engineer. It should be noted that only a few conflict types occur at any given location, thus, having additional mechanical counters is not necessary.

Spare pencils and a tablet for additional notes are a necessity. A watch is needed to note count start times, and a stop watch is needed to accurately determine signal timing. To adequately record the physical features of the study location, about five photographs per approach are needed.

A folding chair should be included as part of the observer's equipment in case he is unable to use his car or if the temperature makes observations from the car uncomfortable. Drinking water is highly desirable, especially on hot days. A safety vest or other safety equipment required by the agency should be worn when the observer is collecting other data near the roadway. Safety considerations are discussed later in this manual.

Finally, a complete set of data collection forms, including extras, are needed as follows: Physical Inventory, On-Site Observation Report, Traffic Volume Counts, and Intersection Conflicts. The purpose and use of these forms are discussed in the next section.

Arriving at the Study Location

When the observer arrives at the study location, he should familiarize himself with it. Is this the intersection to be studied? Which approach legs are to be used for conflict observations? How many lanes are there?

Observation points are selected next. The main objective is to select locations that offer the observer a clear view of the intersection and traffic movements. For conflict observations, a location approximately 100 to 300 feet from the intersection and on the right side of the approach is usually best. The location depends on vehicle speeds and approach geometry. Shown in figure 20 is an example of an intersection with the observer locations marked. In this example, the engineer had requested conflict counts be taken on the two nonstop sign approaches. At high-speed locations, a location should be picked farther away (300 feet or more) from the intersection so that all actions and maneuvers relating to the intersection can be observed. In urban areas where operating speeds are typically 25 mi/h, a shorter distance (100 feet or more) may be appropriate. The location of the observer position should be noted on the conflict form, especially if a before and after study is planned for the intersection.

To obtain accurate conflict counts, it is essential that the observer not influence passing motorists. Ideally, the observer and equipment should be invisible. The best practice is to blend into the natural background to become inconspicuous. Several suggestions are offered below.

Often conflict observations can be made from the observer's vehicle. The observer should always park his vehicle off the roadway unless on-street parking is permitted. Figure 21 shows a typical situation where the

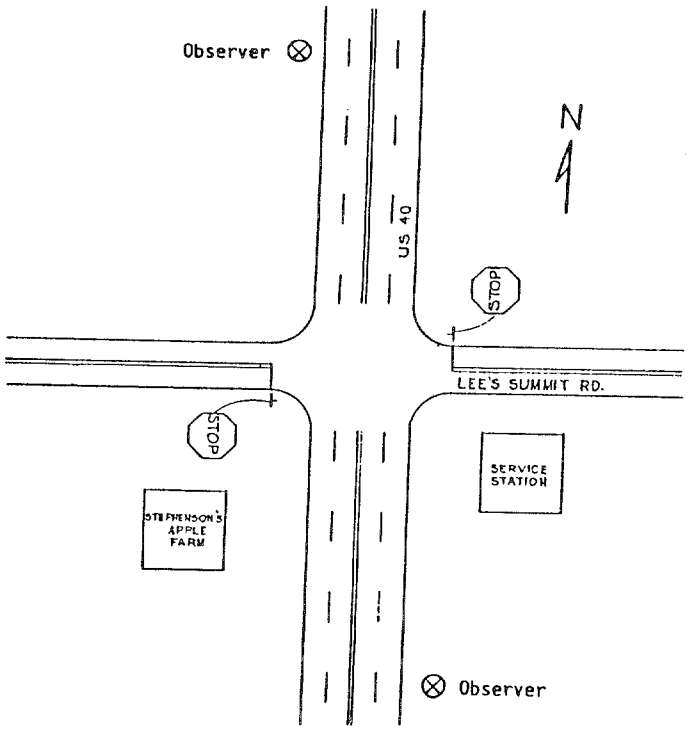


Figure 20. Typical intersection diagram showing observer positions.

Figure 21. Conflict observer in pickup parked on the intersection approach.

observer's car is parked on the street in front of the van. One should never use a vehicle that could be mistaken for a police or other official car that would affect traffic behavior. Where on-street parking is permitted, a corner parking spot is usually adequate provided that other vehicles are parked in the area. In rural areas it may be necessary to park near driveways or next to trees to blend into the surroundings.

If an adequate parking place is not available, the observer will have to perform the study outside of the vehicle. For this reason, he should have a folding chair. Without a comfortable seat, fatigue will soon make concentration difficult. Whenever possible, the observer should be hidden or inconspicuous from the traffic on the study approach. In figure 22, the observer is behind the tree. When a suitable location is not available along the right side of the approach, he will have to observe conflicts from the left side. Observer comfort and, of course, safety are also deciding factors. When summer temperatures exceeds 90^{o} F, the heat and sun can create health hazards. For this reason, one may wish to find a shady place from which to observe.

Figure 22. Conflict observer in chair.

Observation positions are not as critical during a standard traffic volume count, if one is requested by the engineer. Such counts usually include recording all turning movements on all approaches at the same time. The observer will then usually need an observation position much closer to the intersection. He may even be able to record volumes from a corner of the intersection. However, if conflicts and volumes are counted at the same time by two observers, the volume observer should remain inconspicuous also.

Once the observation positions are determined, the required number of data collection forms (this depends on the amount and type of data to be collected) should be prepared. All heading information should be completed and double checked before any data are collected. The count board has to be "zeroed." If there is more than one observer, watches will have to be synchronized. Make sure that watches and stop watches are wound.

For uniformity in the field study, observations should always start at the prescribed times, and count periods should always be of the prescribed length. To start on time, the observer will have to arrive at the test site at least 30 minutes before starting to count. This is the minimum time required to become familiar with the intersection and prepare for data collection. If there is much other data to be collected, the observer might have to arrive 1 hour before the count start time.

A very important preliminary activity is to watch the traffic for 5 minutes or more, and become familiar with the major traffic movements, the signalization or traffic control characteristics, and any unusual activities. Also, locations of nearby driveways, parked vehicles, or other features that may cause traffic problems should be noted. This activity provides the observer with a feel for the major vehicle interactions and likely conflict situations.

CHAPTER 5 - CONDUCTING THE SURVEY

After arriving at the site, selecting observation points and checking basic traffic patterns, the observer should then be ready to conduct the survey. The following section presents the time schedule for conflict counting, how to use the count board, the forms to use and how to use them, how to deal with special problems, and safety precautions.

Time Scheduling

Whether the survey lasts for several hours or several days, the observation process is conveniently thought of as being in 1-hour blocks. The traffic engineer in charge will determine how many, and which hours are to be used for conflict counting.

The time schedule and related observer activities are dependent upon the number of approaches to be studied and the number of observers available. For a four-leg stop-sign controlled intersection, such as the one shown in figure 20, conflict counts are usually made only on the two approaches with right-of-way. One observer could count conflicts for both approaches by periodically alternating his recording periods as suggested in table 1. For signalized

intersections, conflict data are usually recorded for all approaches as shown in figure 23. Typically, two observers are used to obtain conflict data at signalized intersections.

For illustration, suppose a 1-hour block begins at 0800 (8:00 a.m.). Table 1 shows how the 1 hour is split up into several activities. During the first 20 minutes (or other period designated by the engineer), the observer should observe and count traffic conflicts from one of the designated approach legs of the intersection. For example, assume the observer begins at location number 1 as shown in figure 23. After 20 minutes, he should stop and record his counts on the conflict form and then move to the opposite approach (location number 2, figure 23) and prepare for a second count starting on the half-hour. The same procedure should be followed on this approach. (If there are two observers, one will be alternating between the adjacent approaches every half-hour, for example, between approaches 3 and 4 as shown in figure 23.) Then, the process should be repeated during succeeding hours, as required. Usually, after every 2 or 3 hours of a survey, a break will be scheduled.

For consistency, it is best to start counting exactly at the hour and half-hour marks. An exception can be made for signalized intersections, where the signal cycle may not be in phase with the observer's watch. In such cases, one should start observing after the hour or half-hour marks the first time the signal turns red for his approach. Then, a stop watch should be used in order to observe for just 20 minutes after the start. This should be coordinated with the other observer (if any), so both are counting at the same time.

Table 1. Typical 1-hour time schedule.

Time	Activity
0800	Start observing conflicts.
0820	Stop observing conflicts, and record counts on data form. Zero counters. Move to opposite approach leg.
0830	Start observing conflicts.
0850	Stop observing conflicts, and record counts on data form. Zero counters. Move to opposite approach leg.
0900	Start observing conflicts.

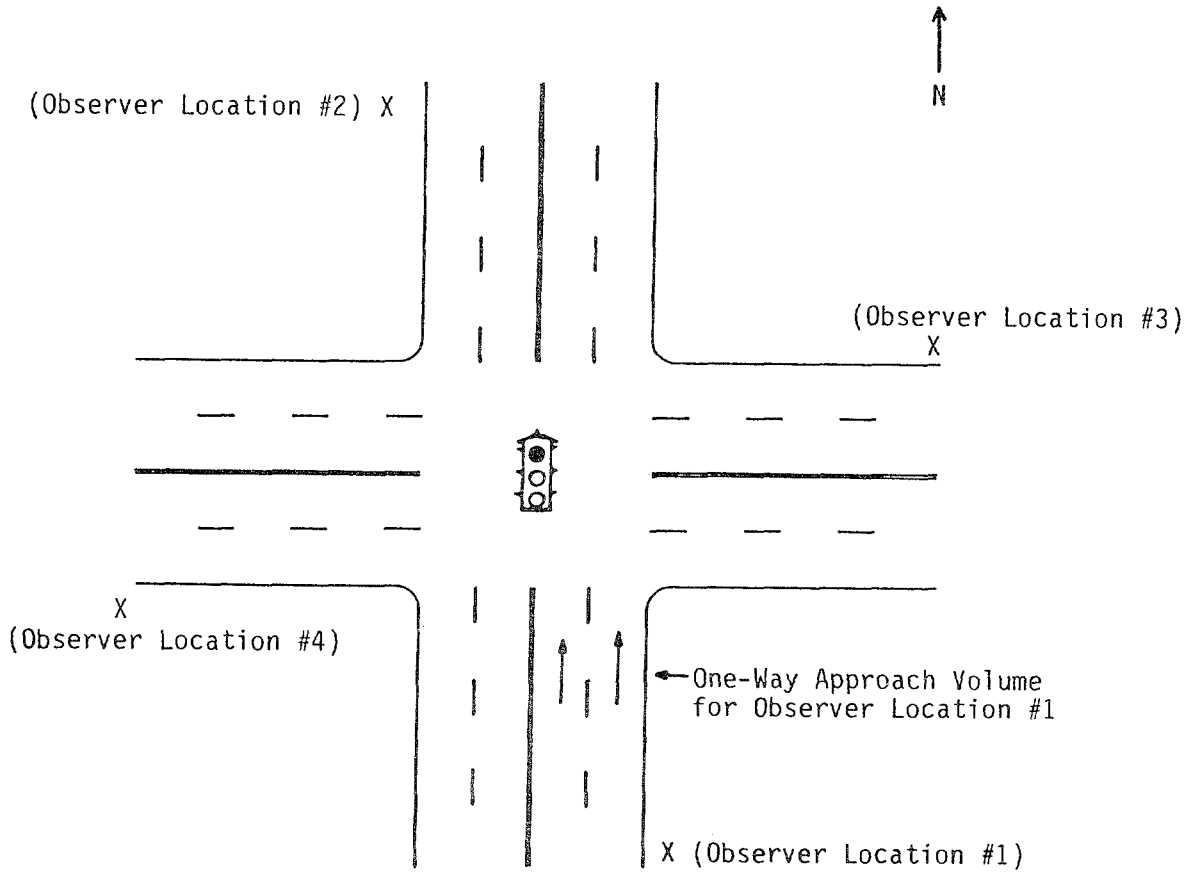


Figure 23. Site diagram showing observation locations and approach volume.

Using the Count Board

At nearly all intersections a mechanical count board is necessary to record conflict counts. Some traffic events, such as conflicts, occur very rapidly, so the observer's attention must be focused on the road and vehicles rather than on pencil and paper. After some practice, the count board allows one to record the events by touch, without looking down.

The type of count board is not important. One designed for making traffic volume counts is very acceptable; another is shown in figure 24.

The mechanical counters should be used to record the most common traffic occurrences (the ones with the highest counts). The one that is most frequent is the traffic volume count (if required by the engineer) on the approach leg. The counter used for this event should be positioned in the most convenient place--usually the lower right corner.

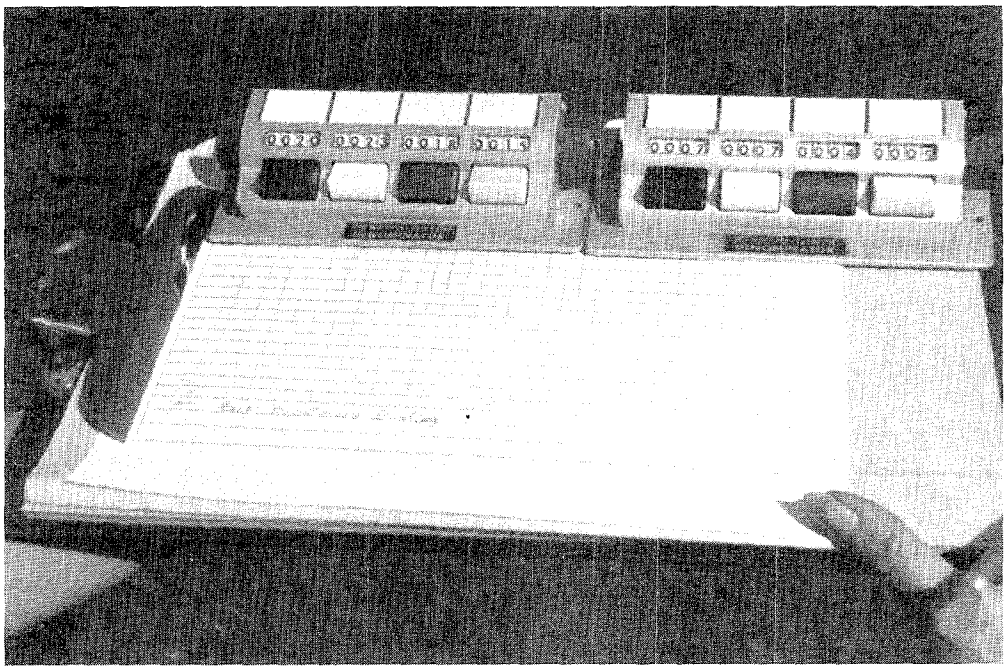


Figure 24. Traffic conflict count board.

Based on conflict studies conducted at many intersections, rear-end or same-direction type conflicts occur more frequently than other conflict types. The conflict types that occur, listed in order of decreasing frequency, are as follows:

1. Most frequent conflicts:

   Left-turn, same-direction.
   Slow-vehicle, same-direction.
   Right-turn, same-direction.

2. Less frequent conflicts:

   Opposing left-turn.
   Right-turn, cross-traffic-from-right.
   Left-turn, cross-traffic-from-right.
   Through, cross-traffic-from-right.
   Left-turn, cross-traffic-from-left.
   Through, cross-traffic-from-left.

3. Least frequent conflicts:

   Lane-change.
   Right-turn, cross-traffic-from-left.
   RTOR conflicts.
   All secondary conflicts.
   All special conflicts.

It should be noted that not all of the conflict types will occur at any given location. In fact, at most intersections, usually only 2 or 3 types occur with any regularity. It is recommended that the count board be used for the most frequent events. The least frequent events can be written directly on the forms when they occur.

Before a 20-minute count (or other period specified by the engineer) is begun, the observer should make sure that all counters are reset to zero. After the count is completed, all figures should be recorded from the counters to the form, and double checked. A common error is to reset the counters before recording the results, which obviously erases all the hard work.

The Conflict Form

A recommended, general-purpose form for recording traffic conflict counts is shown in figure 25. The heading information, which is self-explanatory, should be filled out in advance. The diagram in the upper right corner indicates the approach-leg numbering system. That is, traffic approaching from the north is on leg 1, etc. A separate traffic conflict form should be used for each approach leg.

The recording period, a 20-minute or other period specified by the engineer, must be recorded at the top of the form. The start time, using Military time, should be recorded for each 20-minute count (or other period specified by the engineer) in the first column. **If, for any reason, the count was for other than the prescribed count period, record the actual time in the left margin.** The results should be copied from the count board into the proper columns of the form, making sure all marks are legible.

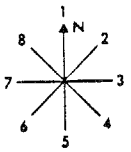
In many cases the engineer requests that the one-way approach volume be recorded along with the conflict counts. A column has been provided for this purpose. The one-way approach volume is the total number of vehicles that pass the observer and approach the intersection during the observation period. This volume is shown in figure 23 for observer location number 1.

The common types of conflicts each have separate columns for recording. (Note, however, that at signalized intersections the cross-traffic conflicts may not be very common.) If any special types of conflicts are observed very often, or if the traffic engineer requests any special type of counts, additional columns are provided for their recording. These columns should be clearly labeled by the observer.

Sometimes, conflicts of a severe nature will be observed, such as obvious diving of the front end of a vehicle, squealing of brakes, rubber skid marks, violent swerves, honking of horns, shaking of fists, and even collisions. Special note should be made of such conflicts. These notes are very important, especially if severe conflicts occur very often.

If possible, the observer should note the causes for same-direction conflicts. Is the problem just past the intersection (a driveway, shopping center, or traffic back-up), a blind spot, unclear or missing pavement markings, the absence of turn lanes, or what? Based on the observations,

INTERSECTION TRAFFIC CONFLICTS



Location _____ Leg Number _____

Day _____ Date _____ Observer _____ Length of Recording Period _____

C = Conflict SC = Secondary Conflict

Count Start Time (Military)	Time Period	Approach Volume	Left-Turn Same Direction		Right-Turn Same Direction		Slow Vehicle		Lane Change		Opposing Left-Turn		Right-Turn From-Right		Left-Turn From-Right		Through From-Right		Right-Turn From-Left		Left-Turn From-Left		Through From-Left		Right-Turn On-Red						Other
			C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	C	SC	
Total																															
C + SC																															
Comments																															

Figure 25. Traffic conflict recording form.

comments should be added about what factors are influencing traffic conflicts at the intersection and how conflicts can be reduced.

On completion of a survey day or portion thereof, the counts should be added in each column. If one is working with a partner, data sheets should be exchanged and each others forms checked for completeness and accuracy. Otherwise, the observer should doublecheck his forms making sure all the information is correct, all blanks are filled out, and all entries are legible.

Collecting Other Data

Traffic conflict counts are not meaningful unless they can be related to the existing site conditions. The site data needed may include: physical inventory, intersection diagram, signal timings, photographs, on-site observation report, and traffic volumes. Occasionally some or all of these data have been previously collected. In preparing for the conflict survey, the engineer will provide a list of information that is needed. In all cases, however, the conflict observer should complete the on-site observation report.

Each agency has standardized procedures for collecting most of these data, but general guidelines are given here, using example forms.

Physical Inventory

The signs, signals, pavement markings, type of intersection, and other useful information are noted in the physical inventory. One also needs to include the posted speed limits on all approaches. This information creates a permanent record and is especially useful for before and after studies. In many cases, the basic inventory information is available on as-built plans which should be updated at the time of the conflict survey. An example of updating an existing plan is shown in figure 26.

Intersection Diagram

When as-built plans or a previous sketch of the intersection is not available, a sketch (intersection diagram) should be made of the study site. This should be drawn on ruled paper in order to include the intersection geometrics along with all signs, signals, pavement markings, channelization, driveways, houses, businesses, utility poles, trees, shrubbery, and any other physical objects of interest. The diagram should include a north arrow, street names, and route numbers. A sample intersection diagram is shown in figure 20.

If the intersection diagram might be used to redesign the intersection, an accurate drawing is needed. The best method is to have the intersection surveyed. This, of course, is costly and time-consuming. A good scale drawing can usually be made from data collected by using a device to make accurate measurements. For a typical intersection this may take as much as 2 to 3 hours using a measuring device such as a steel tape (if assisted by a partner) or a measuring wheel. However, it is preferable to record all traffic control devices, roadway, and roadside development changes on an existing drawing such as a construction drawing. If the intersection is signalized, a good scale drawing can usually be obtained from the traffic department.

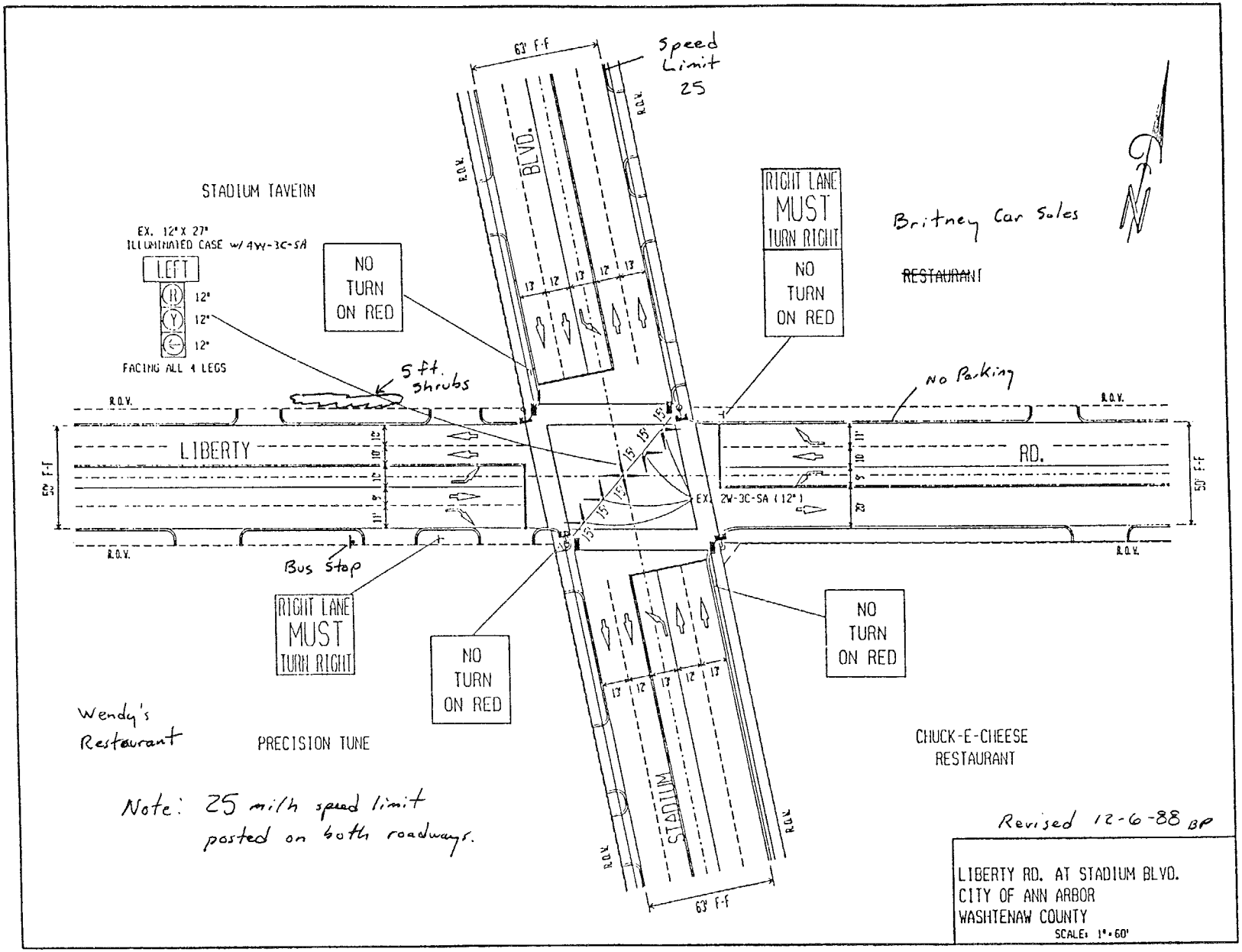


Figure 26. Example of updating an inventory of existing highway features.

Signal Timing

At signalized intersections, the signal timing should be provided by the engineer. This includes cycle length and green, amber, and red times for all approaches. Any separate phases, such as a left-turn phase, should also be given. The observer should confirm that the signal is operating in accordance with the plan. Differences in signal timing, if any, should be recorded.

Photographs

Photographs should also be taken of the intersection. Usually this should include five pictures per approach, taken from the driver's viewpoint. Three pictures should be taken from positions 200 feet, 600 feet, and 1,000 feet from the intersection. Two cross-corner photographs should be made from the stop line as though a driver were looking left and right at the approaching cross traffic. Photographs are the only means to ensure that no physical devices or their details are overlooked. They also help decision-makers, who may never see the intersection, gain a better understanding of the physical and operational characteristics.

On-Site Observation Report

During the course of the day, the observer should note any apparent operational and safety deficiencies of the intersection. This includes both causes of problems as well as possible solutions. A formalized procedure for recording these observations is shown in figure 27. With experience, a conflict observer will become fairly good at recognizing these deficiencies. By formalizing the procedure, full advantage can be taken of his expertise.

Traffic Volumes

If a total traffic volume count is to be used with the traffic conflict counts, it is best performed at the same time. Total volume or turning movement counts cannot be done by a traffic conflict observer when he is making the traffic conflict counts. They are done either by another person or by the same person before or after the traffic conflict observations. Generally one person can collect the volume data. If volumes are high or pedestrian data are needed, two people may be required. A typical traffic volume count form is shown in figure 28. It is important that the correct approach leg names and numbers are recorded.

One kind of traffic volume is usually observed and recorded along with the conflict counts. The one-way approach volume (if requested by the engineer), as defined in the section describing the conflict form, is recorded by the observer typically when no other volume information is available for the study location.

Time Schedule for Collecting Other Data

The physical inventory, intersection diagram, signal timing, and photographs can all be completed before conflict observations begin. This information takes at least an hour to collect. If this information cannot be collected beforehand, it can be obtained during a break from counting or at

ON-SITE OBSERVATION REPORT

LOCATION _____

DATE _____ TIME _____

OPERATIONAL CHECKLIST:

	No	Yes	Comments
1. Do obstructions block the drivers view of opposing vehicles?	___	___	
2. Do drivers respond incorrectly to signals, signs, or other traffic control devices?	___	___	
3. Do drivers have trouble finding the correct path through the location?	___	___	
4. Are vehicle speeds too high? Too low?	___	___	
5. Are there violations of parking or other traffic regulations?	___	___	
6. Are drivers confused about routes, street names, or other guidance information?	___	___	
7. Can vehicle delay be reduced?	___	___	
8. Are there traffic flow deficiencies or traffic conflict patterns associated with turning movements?	___	___	
9. Would one-way operation make the location safer?	___	___	
10. Is this volume of traffic causing problems?	___	___	
11. Do pedestrian movements through the location cause conflicts?	___	___	
12. Are there other traffic flow deficiencies or traffic conflict patterns?	___	___	

PHYSICAL CHECKLIST:

	No	Yes	Comments
1. Can sight obstructions be removed or lessen?	___	___	
2. Are the street alignment or widths inadequate?	___	___	
3. Are curb radii too small?	___	___	
4. Should pedestrian crosswalks be relocated? Repainted?	___	___	
5. Are signs inadequate as to usefulness, message, size, conformity and placement? (see MUTCD)	___	___	
6. Are signals inadequate as to placement, conformity, number of signal heads, or timing? (see MUTCD)	___	___	
7. Are pavement markings inadequate as to their clearness or location?	___	___	
8. Is channelization (islands or paint markings) inadequate for reducing conflict areas, separating traffic flows, and defining movements?	___	___	
9. Does the legal parking layout affect sight distance, through or turning vehicle paths, or traffic flow?	___	___	
10. Do speed limits appear to be unsafe or unreasonable?	___	___	
11. Is the number of lanes insufficient?	___	___	
12. Is street lighting inadequate?	___	___	
13. Are driveways inadequately designed or located?	___	___	
14. Does the pavement condition (potholes, washboard, or slick surface) contribute to accidents?	___	___	

COMMENTS:

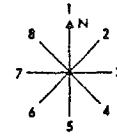
Figure 27. On-site observation report.

TRAFFIC VOLUME COUNTS

Location _____

Day _____ Date _____ Time Period _____

Observer _____



COUNT START TIME (MILITARY)	Leg No. _____			Leg No. _____			Leg No. _____			Leg No. _____		
	↱	→	↘	↰	↑	↱	↲	↓	↳	↖	←	↙
TOTAL												

NOTES AND COMMENTS:

Figure 28. Traffic volume count recording form.

the end of the day. The On-Site Observation Report should be completed only after the conflict count is finished. At this time, the observer should have a good understanding of how the intersection operates and some of the problems associated with it.

Special Problems

Changes in the weather may interrupt or postpone the conflict study. Normally, observations are not performed during inclement weather, such as rain, snow, or fog. If the roadways are completely wet or visibility is reduced, observation should be stopped. The observer should do other tasks, such as collecting the inventory data, until roads are in a near-normal condition or until conditions dictate postponing data collection for the day. The traffic engineer should be contacted if there is any doubt.

Other problems may also occur. Before a site is scheduled for study, it should be determined if any construction is planned that could alter the normal traffic-flow patterns. Unscheduled or emergency repairs by the street department or utility companies will also disrupt flow. If this occurs, the observer should speak with the person in charge to learn the extent of the work and how long it will take. Other disruptive events such as accidents, stalled vehicles, or police arrests, will also occur from time to time. The observer should always have a contingency plan that can be adopted when problems occur. When in doubt, the engineer should be contacted.

Safety Considerations

An important item that should not be overlooked in any field survey is safety. Any time a person is working near moving traffic there will be some drivers that will not see him. Of course, when collecting conflict data, the observer should be hidden. But when walking along the roadway or taking pictures from the middle of a lane, the observer must be seen. He should always wear clothing that will attract attention. All street and highway agencies maintain a supply of fluorescent orange vests for this purpose. If the observer is to enter the roadway, he should do it during a gap in the flow of traffic. He should never try to stop or direct traffic. All safety equipment and procedures required by the highway agency should be strictly followed.

Completing the Survey

After completing the field work, the observer should provide the data to the engineer or supervisor for analysis and interpretation. Unusual problems or special conflict situations should be discussed personally with the engineer whenever possible. Procedures for analyzing and interpreting the conflict data are provided in the engineer's guide.[1]

REFERENCES

[1] M.R. Parker, Jr. and C.V. Zegeer, "Traffic Conflict Techniques for Safety and Operations - Engineer's Guide," FHWA-IP-88-026, Federal Highway Administration, Washington, D.C., June 1988.

[2] Institute of Transportation Engineers, "The Problems of Reduced Accident Reporting" Issue Paper, Washington, D.C., July 1983.

[3] Stuart R. Perkins, "GMR Traffic Conflicts Technique - Procedures Manual," General Motors Research Laboratories, Warren, Michigan, August 11, 1969.

[4] William D. Glauz and Donald J. Migletz, "Application of Traffic Conflict Analysis at Intersections," NCHRP Report 219, Transportation Research Board, Washington, D.C., February 1980.

[5] D.J. Migletz, W.D. Glauz, and K.M. Bauer, "Relationships Between Traffic Conflicts and Accidents," Report No. FHWA/RD-84/042, Federal Highway Administration, Washington, D.C., July 1985.

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