I. History

In a very broad sense, the Traffic Conflicts Technique is not really anything new—only newly titled. For many years, highway engineers have observed problem locations in an effort to detect what operational characteristics were contributing to either safety or operational deficiencies. Over the years, it was not uncommon for experienced engineers to at least mentally note or even actually record events such as vehicle erratic maneuvers, "near-misses," and even those vehicular interactions characterized by brake-light activity. There is at least one documented brake-light study that was done in the late 1930's.

These efforts, however, were rarely documented with standard definitions or research to verify that what was being observed and counted was, in fact, indicative of either safety or operational deficiencies. "Engineering judgement" was the guide and as a result, those interruptions to the traffic stream that were the easiest to observe, such as single vehicle erratic maneuvers, were most often counted. This data was then utilized, along with actual recorded accident information, as justification for implementing engineering changes. More often than not, it was assumed that the correct solution had been determined and there was no followup after the location had been "improved."

In 1966, two engineers at the General Motors Research Laboratories were assigned the task of observing traffic at intersections to see if, by observation, it could be shown that General Motors cars performed differently than other manufacturer's cars. After months of observation, it became clear that to the untrained observer, there was no discernible difference in operational characteristics. What they did report, however, was that most drivers, regardless of their make of car, reacted to potential conflict of path conditions by either braking or weaving to avoid a possible collision course. They reasoned that it did not matter if, in fact, there was the real danger of collision. Only the perceived danger was necessary since the braking or weaving maneuver itself could cause an accident.

A set of definitions and procedures was developed, and it was envisioned that the scheme, termed the Traffic Conflicts Technique, was to be used primarily as a tool for measuring the traffic accident potential at intersections. In fact, in the years to follow, the Traffic Conflicts Technique was to be used mostly as a diagnostic tool as opposed to a predictive tool.

According to the very broad General Motors definition, a Traffic Conflict occurs when one driver takes evasive action by braking or weaving to avoid what he believes to be an impending collision with another vehicle. The objective evidence of a Traffic Conflict is a brake-light indication or a lane change effected by the offended driver. The brake-light indication or the lane change, as well as the offending vehicle, must be observed before a Conflict can be recorded. Criteria were defined for over 20 specific Conflict situations at intersections and are described in GMR Traffic Conflicts Technique - Procedures Manual.¹

According to the Procedures Manual, when a Traffic Conflicts count is taken, observations from two opposite intersection approach legs are recorded in 1 day by a two-man team using a single vehicle. One observer is responsible for counting Conflicts, while the other is responsible for recording volume data. Fifteen minute data samples are taken alternately on each intersection approach.
leg from the observation vehicle, which is parked on the side of the roadway about 100 to 300 feet back from the intersection. The team is allowed 15 minutes after each sample count to record the data and move to the opposite approach. The team alternately surveys the two approach legs throughout the day.

It should be noted at this point that the General Motors counting procedures and definitions were not the result of extensive research. Very little effort was expended in determining reliability (i.e., consistency among observers for the same locations and traffic conditions), repeatability (i.e., consistency with time at a given location under similar traffic conditions), and sample size.

Although the General Motors work was subsequently presented at the annual Highway Research Board (now the Transportation Research Board) meeting in 1968, it was evident that highway agencies were reluctant to undertake programs to test the applicability of the Traffic Conflicts Technique as an operational tool. Therefore, the U.S. Department of Transportation, Federal Highway Administration, contracted with three States to conduct a Traffic Conflicts demonstration study. The contracts provided funds for the counting of Conflicts at a minimum of 400 intersection approach legs in each State. In addition, the counts were to be made both before and after a "spot improvement" type of engineering change had been made. Special training was provided by one of the General Motors engineers who developed the Technique.

The States' role in the overall evaluation of the Traffic Conflicts Technique was to determine whether Conflicts data provided the kind of information from which the need for safety improvements could be determined. The States were responsible for making the counts, comparing them to actual accident data, and determining whether the Traffic Conflicts Technique was advantageous to them.

It was beyond the scope of the studies to require that the improvements be made only on the basis of Conflicts counts because this would have necessitated the funding of the improvements themselves. Instead, each State was to make counts at intersections that were already scheduled for improvement as the result of analyses based on accident experience. Because the Traffic Conflicts Technique was developed as a tool for measuring traffic accident potential, it was hoped that the Conflicts counts would reveal the same safety deficiencies as did the conventional accident analysis.

II. Current Activity

Primarily because of the three-State demonstration project, which was completed in 1971, the Traffic Conflicts Technique has gained popularity as a diagnostic tool. In two of the three States involved in the demonstration project, the Traffic Conflicts Technique is employed as a diagnostic tool in day-to-day operational procedures. In addition to diagnostic applications at both at-grade intersections and freeway spot locations such as gore areas and weaving sections, it is being used as warrants for justifying special signalization projects and in some cases as a traffic control device evaluation tool in research studies.

Currently, there are four States that use the Traffic Conflicts Technique on a regular basis. The use in these States varies from extensive to occasional. A number of other States continue to experiment with Conflicts and occasionally find applications as an evaluation tool on research projects or as a supplement to accident data in justifying certain expenditures of safety funds.
While the General Motors definitions and procedures are utilized exclusively, certain variations have been introduced by some of the users. Specifically, as a result of work by the Transport & Road Research Laboratory in Great Britain, the regular users of Traffic Conflicts data in this country have included a severity scale in their procedures. In addition, the Conflict count time has been reduced to as little as 3 hours per day for certain types of locations. One State has developed its own normalizing data so that determinations can be made as to what constitutes a "good" or "bad" number of Traffic Conflicts at a particular location with specific design and operational characteristics.

The introduction of severity measures into the procedures has resulted in Traffic Conflict counts being more judgemental in nature and has served, in part, to focus attention on the issues of reliability and repeatability. This problem, together with variations in the Traffic Conflict definitions has rendered the data incompatible from one user to another.

Other forces at work that tend to inhibit the use of the Traffic Conflicts Technique include the requirement by the Federal agencies that all transportation safety projects be justified on the basis of reported accident experience. As a result, the State highway agencies have developed, with Federal funding, extensive accident record systems and rely heavily on computer generated accident data to diagnose and evaluate safety problems. The interest in the use of techniques such as Traffic Conflicts, however, remains high because of the obvious problems in using reported accident data.

As can be seen from a review of the published reports on the Traffic Conflicts Technique, a number of attempts have been made to model the relationship between Traffic Conflicts and accidents. The results of most of these efforts were the subject of a report entitled "Evaluation of the Traffic Conflicts Technique" by Glennon and Thorson of the Midwest Research Institute. This study was the first to critically evaluate the Traffic Conflicts literature in an exhaustive manner and concluded that the current reliability of the Traffic Conflicts Technique for estimating accident potential is highly questionable. Further, for all of the potential uses of Conflict counts, including the diagnostic applications, existing relationships do not allow practical sample sizes. Thorson and Glennon attribute this to the fact that existing Conflicts data "... have not been adequately stratified and analyzed accordingly for significant conditional parameters such as highway ADT, crossroad ADT, number of approach legs, number of lanes, type of traffic control, etc."

While this study added significantly to what is known about the uses of Traffic Conflicts, it is not without its critics as well. Several papers that will be formally presented at the January 1978 meeting of the Transportation Research Board offer some evidence that tends to refute some of Thorson's and Glennon's conclusions.

The Transportation Research Board Subcommittee on Traffic Conflicts has served for the last 3 years as a forum for activities in the United States related to the Traffic Conflicts Technique. Through this Subcommittee, a mailing list is maintained of those who are active or interested in the application of the Technique. A meeting is held during the annual Transportation Research Board meeting and formal papers are generated through the 25 members of the Subcommittee.
III. Proposed Research

Because of the focus of the Traffic Conflicts Subcommittee, increased interest among highway agencies, and the discussions evolving from the Thorson-Glennon paper, a major research project entitled "Application of Traffic Conflicts Analysis at Intersections" was generated through the National Cooperative Highway Research Program (the National Cooperative Highway Research Program is a part of the Transportation Research Board that administers a national, State-funded research program).

The objective of the project is to develop a standardized set of definitions and procedures that will provide a cost-effective method for measuring Traffic Conflicts. Required is a Traffic Conflicts Technique method that is both reliable and repeatable for diagnosing safety and operational deficiencies and evaluating the effectiveness of improvements at intersections; and yet be capable of use by personnel without extensive training or expensive equipment. The product of the research will be a readily usable procedures manual that clearly and concisely describes the recommended training procedures, data collection methodology, analysis techniques, and evaluation methods.

Although the relationship between Conflicts and accidents is a valid and important research area, it is not the major thrust of this project. Rather, the major question to be addressed is how well can Traffic Conflicts predict Traffic Conflicts. There are two major parts to this question: (1) At a given site under specific traffic and environmental conditions, how much variability in the recorded number of Conflicts is expected from one observation period to another? (i.e., are Traffic Conflicts repeatable?); and (2) for a given set of observed Conflicts, how much variability in the observations is expected between trained observers (i.e., are Traffic Conflict counts reliable?).

The research plan consists of five logically sequenced tasks.

In Task 1, all information on the state-of-the-art and the extent of current practice on Traffic Conflict analysis will be drawn together. This activity will help define the scope of the remaining research.

Task 2 involves using the information gained in Task 1 to select candidate Traffic Conflicts Technique definitions and procedures to be tested in the Task 3 field studies. This will be done by weighing data and estimates of the efficiency, cost, practicality, accuracy, reliability, repeatability, and applicational needs of each candidate.

Task 3 will consist of comprehensive field studies testing the candidate definitions and procedures to determine their reliability (observer variance) and repeatability (site variance) for a variety of intersection conditions and characteristics. Task 3 includes seven subtasks to (1) develop a general work plan, (2) select field sites, (3) develop field study procedures, (4) design experiments, (5) recruit observers, (6) train observers, and (7) conduct the field studies.

Task 4 involves the exhaustive analysis of the field data, and the application of the findings in generating final recommendations on Traffic Conflicts Technique definitions and procedures. The task will include (1) encoding the field data, (2) statistically analyzing the data to determine for each candidate Traffic Conflicts Technique procedure, its repeatability, reliability, and applicability for a range of site configurations, and (3) selecting those highly rated definitions from the standpoint of both reliability and repeatability and also practicality and economic efficiency.
In Task 5, three separate documents will be prepared as a result of this research. These include a final research report, a Traffic Conflicts Technique procedures manual, and an instructor's guide for training Traffic Conflicts Technique observers.

The $180,000, 21-month project is scheduled for formal initiation on about December 1, 1977, and should be completed by September 1, 1979.

References

