DEPARTMENTAL INFORMATION EXCHANGE

Summary Report 1297-2S
June 1994

GUIDELINES FOR IMPLEMENTING FLASHING SIGNAL OPERATION

PROBLEM STATEMENT

When traffic volumes at a signalized intersection do not reach the minimum required by the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD), operating the signals in a flashing mode is one alternative to continuing normal operation. A flashing yellow signal tells vehicles to proceed through the intersection with caution; a flashing red operates the same as a STOP sign. Flashing signals have the potential to significantly reduce vehicular delay in certain situations because of the reduced number and length of stops.

In general, a flashing operation deserves consideration when traffic volumes decrease to the point that the minor street traffic can complete the desired maneuver almost immediately upon arriving at the intersection. The decision to utilize flashing operation is one that relies heavily on engineering judgement to evaluate the various factors which impact its use. State and local transportation officials have a need for written guidelines describing when flashing operation is a feasible alternative to normal operation. This information will improve consistency in the use of flashing operation and help to reduce delay.

OBJECTIVES

The Texas Transportation Institute (TTI) conducted study 0-1297, *Guidelines for Flashing Traffic Signal Operation,* in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA) to answer two basic questions:

1) When should signals be placed in a flashing operation?
2) When in flashing operation, what mode should be used—red/yellow or red/red?

Researchers performed the following research activities toward the ultimate development of guidelines for implementing flashing signal operation:

- a review of pertinent literature,
- a survey of current flashing signal operation,
- an operational analysis comparing flashing signal operation to other types of signal operation,
- an analysis of the accident impacts associated with flashing operation,
- an evaluation of power savings resulting from flashing operation,
- an evaluation of driver behavior at intersections with flashing operation, and
- an analysis of the relationships between 24-hour and nighttime hourly traffic volumes.

FINDINGS

The key findings of each research activity are described below:

Literature Review – Most of the numerous studies of flashing signal operation have focused upon the relationship between flashing operation and accidents. Most have found that right-angle accidents are more frequent during flashing operation. The potential for accidents during yellow/red flashing operation seems to be greater when the volume ratio is less than 3 or 4.

Current Practice – Flashing operation is widely used in many agencies, although there are few written guidelines for implementation. The most common uses

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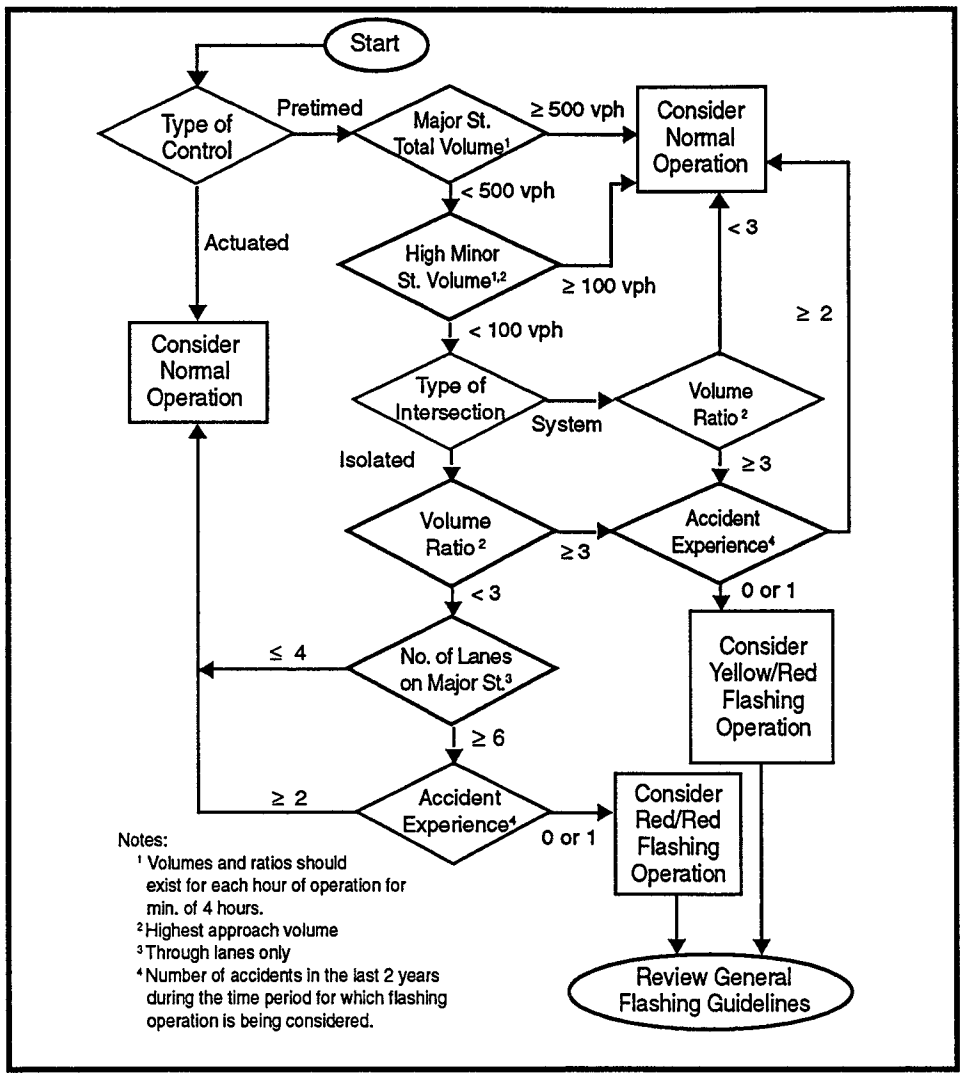

Figure 1. Flowchart for Implementing Flashing Operation during Low-Volume Conditions.

of flashing operation are for emergency flashing, signal installation and removal, railroad preemption, and during low-volume conditions.

Operational Analysis – The use of a yellow/red flashing operation can reduce vehicular delay by as much as two-thirds over normally operating signals. However, the traffic conditions which are present during low-volume conditions typically mean that the actual delay savings is less than 10 seconds per vehicle.

Accident Analysis – The analysis did not identify a clear relationship between accidents and nighttime flashing operation. However, intersections with no daytime accidents in a two-year period were found to have no accidents when converted to nighttime flashing operation.

Power Savings Analysis – The analysis indicated that about $150 of electrical power could be saved each year by operating a typical traffic signal in the flashing mode for six hours a day.

Driver Behavior – Observations of driver behavior found low compliance rates during nighttime flashing operation.

Traffic Volumes – The volume relationships shown in chapter 6 of the final report can be used to estimate hourly volumes during nighttime periods.

Some of the circumstances in which flashing operation may be more advantageous than normal operation are:

- during preemption at railroad-highway grade crossings,
- prior to initial installation or signal removal,
- as the result of the conflict monitor being activated or signal maintenance activities,
- in a school zone,
- during adverse weather conditions,
- during certain low-volume conditions.

For each of these areas, the final report contains detailed guidelines and explanations of why flashing signal operation should be considered. In general, the findings of this research indicate that flashing operation should not be used in low-volume conditions unless an engineering study indicates that it would be of greater benefit than normal operation. Figure 1 illustrates the thought processes for considering the use of flashing operation during low-volume conditions.

IMPLEMENTATION

Guidelines provided in the report should be considered only *along with* a great deal of engineering judgement. Except with conditions where a flashing signal is the only practical solution (railroad crossing or school zone), their successful use is highly dependent upon specific circumstances, especially with low-volume, nighttime conditions.

It should be noted that the Texas MUTCD in use at the time the guidelines were developed was the 1980 edition with revisions 1 through 4. Future revisions could affect the manner in which these guidelines are used.

Despite limitations, the written guidelines developed in this study should be a useful and consistent starting point as traffic engineers enter the process of deciding whether or not a flashing signal operation is a feasible and safe solution for an intersection.

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The contents of this summary are reported in detail in TTI Research Report 1297-2F, "Evaluation of Flashing Traffic Signal Operation," by Kent C. Kacir, H. Gene Hawkins, Jr., Robert J. Benz, and Mike E. Obermeyer, October 1993. This summary does not necessarily reflect the official views of TxDOT or the FHWA.