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Research Summary Report

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Summary Report 1163-3S

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EVALUATION OF LOOP DETECTOR INSTALLATION PROCEDURES

PROBLEM STATEMENT

Misunderstanding the principles of inductive loop operation is a primary cause of the lack of consistency in the design and use of loop detectors. Induction loops detect the presence or passage of automobiles and trucks. Considering the wide variety of vehicles on the road, it is important to find a loop configuration that will accurately detect the off-sized vehicle, such as motorcycles, mopeds, bicycles, and high profile trucks.

A second problem area with loop detectors involves loop detector installation in the field. Loop detector installation needs to be more efficient, with required testing. Also, the method for the high-speed sawing of loop slots in the pavement needs improvement.

OBJECTIVES

The Texas Transportation Institute (TTI) conducted research study 1163, "Evaluation of Loop Detector Installation Procedures and Preparation of a Texas Traffic Signal Detector Manual," in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA) to study the installation and use of loop detectors. The goals of the research were:

- To investigate techniques (equipment and procedures) to install loops as fast as possible (thereby reducing the need for traffic control during loop installation), assuming that maintenance personnel do the installing and a highly reliable loop detector is the goal.
- To determine the influence of loop shape on the detection of various test vehicles including bicycles and to suggest alternative loop detector shapes. (For further information on loop shape, see Research Report 1163-2.)
- To test various loop sealants in the laboratory and the field.
- To determine, by survey of various agencies and loop installation contractors, the reasons for premature loop failures and to suggest improved procedures for increasing the life of a detector loop.

FINDINGS

This report is a summary of a broad series of studies dealing with the installation of loop detectors. Study areas included: loop shape and vehicle detection, wire encapsulation, high-speed sawing of loop slots, alternative corner treatments, depth of placement influences on detection efficiency, temporary loops, correlation of measured field strength with detection, and loop detector sealants. The following findings highlight the key findings of study 1163-3:

- Premature loop failures are usually the result of poor installation. Loop wire/lead failure is primarily the result of contractor or maintenance crew equipment working in the area.

- Bicycles, MOPEDS, and motorcycles are not easily detected by wire runs perpendicular to the vehicle path. Individual lane detection at a point for counting purposes must be carefully designed to avoid crosstalk.

- The 45 degree skewed loop was the most efficient loop shape for small vehicles (figure 1). Additionally, there is little difference in the loop performance from two to five turns of wire.

- Full loop wire encapsulation, while desirable, is not critical to the successful detection of vehicles.

- To saw cut the pavement slot more quickly and efficiently, the optimal pavement saw for loop slot cutting is a 65hp saw; the optimal blade is a diamond blade. Cutting rates of 20 inch-feet per minute are possible with this combination. High speed sawing requires added weight on the saw blade to control the slot depth. One hundred pounds placed directly over the drive axle is recommended.

- Loops placed as deep as 20 inches below the surface resulted in 100 percent detection of automobile traffic in the lane. Loop depth below the surface is not a critical design issue.

- Three sealants were found to meet the loop sealing requirements established in this study: 3M Loop Sealant, Permanent Sealer 974, and the Fosroc (formally Preco) Gold Label Flex 1P Loop Sealant. However, study 1163-3 found that the purpose of sealing the loop is to hold down the loop wire to prevent traffic damage or excess loop vibration.

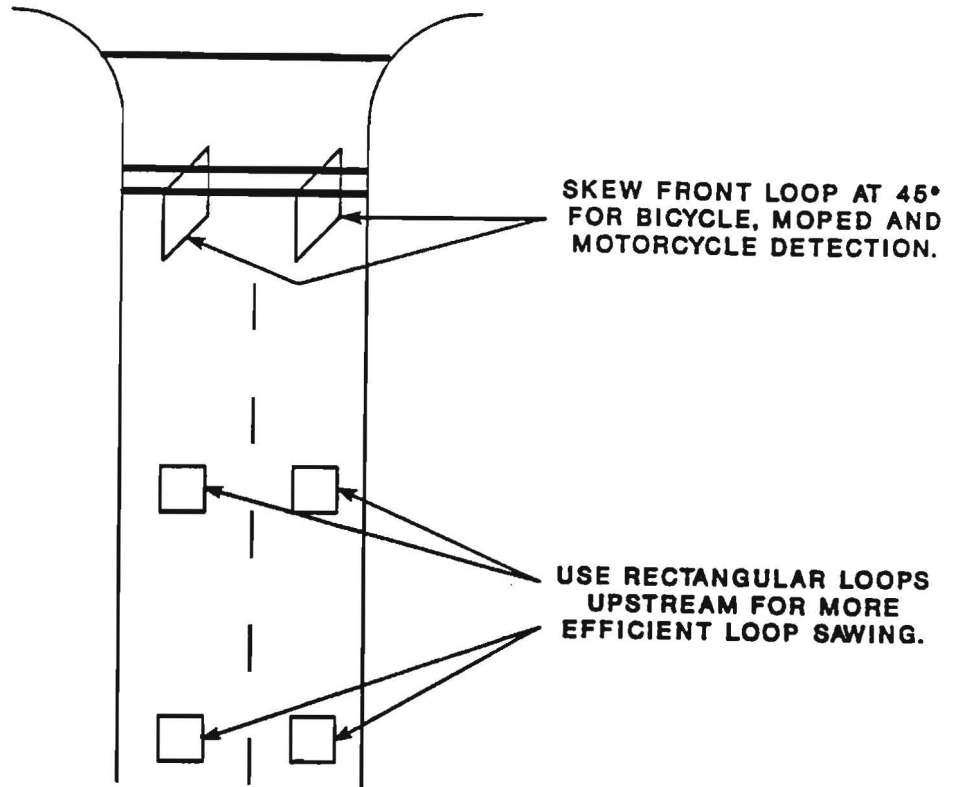


Figure 1: Suggested Detector Layout for Detecting all Design Vehicles

- The modern Texas Standard Detector (TX Detector) is remarkably better than the older detector units. The performance difference is significant enough to justify discontinuing the use of the older detector units and replacing them in the field at the first opportunity.

CONCLUSIONS

Researchers discovered several potential areas for future research in the course of this study:

1. Design a loop wire depth that is compatible with modern detection equipment.
2. Explore the general application of loop detectors beneath bridge decks, with a special emphasis on left-in-place steel forms, steel girders, and placement of the loop relative to the traffic lane.
3. The practice of using wire hold downs and backfilling the slot with loose sand deserves further investigation, as well as the relationship of

wire size to slot width and the type of hold to use.

4. Find ways to reduce the dust problem created during dry, high-speed sawing of asphalt.

5. Examine methods of increasing the life of surface loops.

6. Explore and document the relative efficiency of a loop detector when a metal object is located within it.

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The information described in this summary is reported in detail in TTI Research Report 1163-3F, "Evaluation of Loop Detector Installation Procedures and Preparation of a Texas Traffic Signal Detector Manual," Donald L Woods, February 1991; Revised July 1992. The contents of the summary do not necessarily reflect the official views or policies of the FHWA or TxDOT.

