INDOT Research

TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

TRB Subject Code: 55-5 Traffic Measurements *January 2002*
Publication No.: FHWA/IN/JTRP-2001/18, SPR-2394 *Final Report*

DEVELOPMENT OF A PORTABLE VIDEO DETECTION SYSTEM FOR COUNTING TURNING VEHICLES AT INTERSECTIONS

Introduction

Intersection traffic data including turning counts are primary inputs to many transportation studies and design projects. The manual technique of counting turning volumes at intersections, although sufficiently accurate, is labor-intensive and expensive. There is no machine-based counting dedicated to turning volumes and applicable to both unsignalized and signalized intersections. A more cost effective and sufficiently accurate method is needed.

This research was conducted to test the feasibility of using existing video-detection techniques for counting turning volumes with a portable installation. This was accomplished by integrating a forty-five foot mechanical tower mounted on a van with two video detection systems, Autoscope and VideoTrak. In addition, there was an attempt to enhance the Autoscope system and utilize VideoTraks' capability of tracking vehicles to obtain and classify turning volumes. Videotaped traffic data was collected for several intersections, and a comparative evaluation of both video detection systems was completed to prepare final specifications for a functional design.

Findings

The research project has produced results in three categories:

(1) Two distinct prototype methods of counting turning volumes, one for the spot detection techniques such as Autoscope, and one for a one-dimension vehicle tracking used in the VideoTrak system,
(2) Evaluation results of the two mentioned systems used for counting turning volumes at selected intersections,
(3) General specifications of a portable video-based system for counting vehicles at intersections.

The method based on spot detection uses redundancy of data (more spots than movements) to improve the results quality. A regression technique was used to estimate turning volumes from spot volumes. The method uses the standard features of the Autoscope system. The method is applicable to any detection technique that enables counting vehicles at multiple spots of limited size. The method based on the VideoTrak one-dimensional tracking requires a special format of data produced by, so called, Academia version. Vehicles' maneuvers are classified based on the location where vehicles enter and exit a tracking strip. The method implementation requires modifications of the VideoTrak software to eliminate multiple post-processing of video data.

The spot-counts method applied to Autoscope has been intensively tested based on 2,303 fifteen-minute counts at six signalized and unsignalized intersections. The method relative error was found to be 15 % with a rather large relative standard error of 65 %. It should be mentioned that the light, precipitations, and wind

conditions varied from good to very adverse. Consecutively, the spot-counts (with Autoscope) and vehicle-tracking (with VideoTrak) methods have bee compared based on 245 counts at three intersections. Both the evaluated solutions perform similarly with a tendency of the vehicle-tracking method to slightly over-perform the spot-counts method. The vehicle-tracking method would be more accurate if it employed full-screen rather one-dimension tracking. Both the evaluated methods in their current versions do not meet the accuracy expectations expressed by the INDOT representatives. Future hope lies in the intensive effort of several research centers to develop a full-screen vehicle-tracking algorithm that may produce results ready for implementation within next one-three years.

Implementation

The implementation is envisioned in two steps: (1) Building and testing a prototype unit, (2) Full-scale implementation of the modified unit. The general system specifications were developed to help build a prototype unit. The specifications include example components found on the market today. The biggest challenge is the structure of the system that has to be portable, stable during data collection, and protected against tempering with. The cost of a complete prototype system is estimated to range between $80,000 - $110,000 according to 2001 prices. The final cost depends on the system configuration.

The authors advise postponing building a prototype system by the time needed to develop satisfactory image processing and interpretation software for identifying vehicles' maneuvers at intersections. The Purdue team will build a portable system (mobile traffic lab), which will meet the developed general specifications for the video acquisition system and for the data storage/processing component. The system will serve two purposes: (1) To test the system abilities to acquire and store high quality video from two channels in a sustain manner for an extended period. (2) To create a testing facility for a new generation of vehicle-tracking algorithms.

A prototype system is proposed to be built by a selected contactor and according to the current specifications with possible future modifications after a positive test of counting accuracies and equipment reliability are obtained.

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