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This research project installed, tested, and evaluated the Mobilizer video imaging system within the Washington State Department of Transportation's (WSDOT) Traffic Systems Management Center (TSMC). The Mobilizer (developed by Condition Monitoring Systems (CMS)) is a third generation video image processing system that uses a tracking technology as opposed to previous generation systems that use a tripwire technology. CMS advertises Mobilizer's ability to link vehicle sightings at multiple camera locations, translating to travel time estimates along a roadway section. In addition to travel time estimates, the system produces volume, speed, density, distance headway, vehicle classification, and truck percentage data at each camera location. The data are reported for individual lanes, as well as for a section aggregate.

Some of the key objectives of this research were to (1) determine site locations for evaluation; test video compatibility (e.g., quality, field of view, freeway flow levels, camera reliability); (2) establish methods for obtaining reference or "ground truth" data for comparison with the system output; and (3) study feasibility of using the Mobilizer for measuring volume, density, and travel time and its accuracy for different flow and environmental conditions.

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Final Technical Report
Research Project T9903, Task 14
Video Image Tracking

VIDEO IMAGE PROCESSING FOR FREEWAY MONITORING AND CONTROL: EVALUATION OF THE MOBILIZER

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EXECUTIVE SUMMARY

This research project installed, tested, and evaluated the Mobilizer video imaging system within the Washington State Department of Transportation's (WSDOT) Traffic Systems Management Center (TSMC). The Mobilizer (developed by Condition Monitoring Systems (CMS)) is a third generation video image processing system that uses a tracking technology as opposed to previous generation systems that use a tripwire technology. CMS advertises Mobilizer's ability to link vehicle sightings at multiple camera locations, translating to travel time estimates along a roadway section. In addition to travel time estimates, the system produces volume, speed, density, distance headway, vehicle classification and truck percentage data at each camera location. The data are reported for individual lanes, as well as for a section aggregate.

Some of the key objectives of this research were to

- determine site locations for evaluation and test video compatibility (e.g., quality, field of view, freeway flow levels, camera reliability)
- establish methods for obtaining reference or "ground truth" data for comparison with the system output
- study the feasibility of using the Mobilizer in measuring volume, density, and travel time and its accuracy for different flow and environmental conditions.

The selected study section was located along northbound Interstate 5, from NE 117th Street to NE 130th Street, in north Seattle. The section includes four general purpose lanes and a high occupancy vehicle (HOV) lane and has one off-ramp (right side) south of the NE 130th interchange. This portion of I-5 experiences recurrent congestion during the afternoon/evening weekday commute related to a downstream bottleneck beyond the section and a large amount of weaving activity within the section. Additionally, lane 1 (right) breaks down periodically during the peak period because of backup from the downstream off-ramp. The Mobilizer traffic

parameter measurement accuracy was evaluated by analyzing videotaped traffic from this section of Interstate 5.

The researchers decided to utilize video from existing freeway surveillance cameras (because of scope and budget considerations) within the WSDOT surveillance, control and driver information (SC&DI) system for initial testing of the Mobilizer system.

The principal findings of this research were as follows:

- The volume output of the Mobilizer was moderately accurate for a wide range of flow and environmental combinations. Accuracy of 10-minute aggregations for various flow conditions were 80+ percent for low and moderate flow, 55+ percent for high flow.

- The system had significant problems adjusting to severe variances in scene light levels and congestion levels. Additionally, the system did not appear to eliminate double-counts of larger trucks resulting from a skewed camera perspective.

- In the moderate flow condition, the Mobilizer was unable to correlate or track any individual vehicles (zero valid hits) between the camera views, and, therefore, the estimated travel time was irrelevant.

- In the low flow condition, the Mobilizer could track an average of zero to two vehicles (two valid hits) per minute per lane and had an accuracy of 90 percent in travel time estimation.

- The system reported zero valid hits under the moving cloud condition and was, therefore, unable to give useful results in travel time estimation.

- The system did not have the ability to resolve detection errors when skewed camera angles caused some vehicles to be detected in adjacent lanes incorrectly.

- The system was not capable of producing useful density measurement data with the utilized version of software.

INTRODUCTION AND RESEARCH APPROACH

In recent years, legislation on both the federal and state level has established transportation goals and programs that require a substantial increase in transportation data collection. In addition, maximizing the efficiency of the existing transportation network has become increasingly important because of continued traffic growth and limited construction of new highway and arterial facilities [Hughes and JHK 1994]. Intelligent Transportation System (ITS) applications are a primary focus of transportation professionals for enhancing modern traffic control systems by providing integrated systems of traffic monitoring detectors, real-time traffic control systems, motorist information systems, and roadway surveillance systems. The key component of these Advanced Traffic Management Systems (ATMS) is the provision of comprehensive monitoring and control through the use of vehicle detectors and communications media [Hughes and JHK 1994]. The need for such monitoring and control has led to a considerable amount of testing and implementation of detector systems that are intended to enhance the transportation network managers' ability to obtain real-time traffic flow information for operational and strategic purposes.

The range of detector technology being implemented and/or evaluated includes ultrasonic, infrared, microwave radar, video image processing, acoustic, magnetic, and inductive loop technologies. Parallel to these efforts is the continuing development of automatic vehicle identification (AVI) and automatic vehicle location (AVL) systems that utilize the aforementioned technology, and exploration of alternative methods for tracking individual vehicles, such as global positioning systems (GPS). Of the multitude of technologies being investigated, video image processing—collection and computer analysis of transportation data

from video — has shown strong potential in providing both a robust collection of critical traffic data and the greatest range of usefulness.

THE NEED FOR IMPROVED DATA COLLECTION METHODS

In the past few years, several legislative actions have mandated the expansion of transportation data collection efforts. The Clean Air Act Amendments (CAAA) of 1990 established federal vehicular emissions requirements and are linked to the establishment of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The purpose of ISTEA was to encourage the states to collect and maintain information to help in effectively managing scarce resources and minimizing environmental impact. The focus of ISTEA is to use this approach to maintain and improve the efficiency of the transportation infrastructure [Smith 1993]. This objective has created a significant increase in data collection requirements for transportation agencies, which are seeking efficient means to enhance current data collection methods, as well as to supplement them with a wider range of data.

An outgrowth of ISTEA is the federal mandate for states to establish transportation management and monitoring systems. Systems specifically identified include highway safety management, traffic congestion management, public transportation facilities and equipment management, intermodal facilities and equipment management, and traffic monitoring [State of Washington 1992]. Although the Washington State Department of Transportation (WSDOT) has a substantial transportation data collection program currently in place, the program primarily provides vehicular counts, vehicular classification, level of service, safety data, and pavement and bridge condition information. Comprehensive monitoring and data collection must account for elements such as multi-modal transportation usage, congestion level and duration, and vehicular occupancy, to name a few.

On a regional level, the passage in 1990 of Engrossed Substitute House Bill (ESHB) 2929 established specific growth management goals in the state. Included within ESHB 2929 is a requirement to monitor performance measures and implement programs to achieve a growth management goals. [Pivo and Rose 1991]. In addition, the CAAA and other factors stimulated Washington to pass the Commute Trip Reduction Act, which established regional goals for larger employers to reduce SOV use during commute hours.

From both the planning and operational perspectives, accurate transportation data collection is key to maximizing the efficiency of the transportation network in the Puget Sound region. In addition, real-time network information is important for operational and travel demand purposes. For example, a primary target measure of the level of service of transportation links will be travel time, which is not currently measured regularly for all modes of transportation (transit and marine/ferries are the exceptions).

PUGET SOUND TRAFFIC DATA COLLECTION

The Washington State Department of Transportation (WSDOT) currently manages over 80 freeway miles of an integrated traffic management system along Puget Sound freeways, providing traffic surveillance, traffic control, and driver information. As is the case for many of the freeway operation centers around the country, WSDOT is interested in finding more effective techniques for comprehensive data collection to enhance its ability to monitor and manage the transportation network. With the exception of camera surveillance and coordination with region transportation stakeholders (e.g., State Patrol, local media, WSDOT maintenance and incident response personnel), the traffic management operation relies primarily on traffic flow data extracted from loop detectors.

The backbone for traffic data collection on the region's freeways are the induction loop detectors embedded in the pavement. When properly installed and maintained, loop detectors

provide an adequate means of determining vehicular flow characteristics. There are currently over 1,600 loop detector in the urban Puget Sound region, with more scheduled for installation. The loops provide lane volume, occupancy, and spot speed data (select locations) for specific freeway sections. Although the system on a whole works adequately for its intended purpose, it has some shortcomings. Among these are data unreliability, too few speed detectors, occupancy errors for specific areas or flows [Nihan, Jacobson, Bender and Davis 1990], and service interruption due to maintenance and construction.

As mentioned previously, the disadvantage to loops is that they can be costly (at least from a traffic impact standpoint) to install and maintain. However, they are the best means at this time for collecting basic traffic data on a system-wide basis for the freeways. Traffic data in the region is also obtained by manual counts for travel times, origin-destination, and vehicle occupancy measurements. Vehicle classification counts are primarily obtained from traffic tube counters or loops. Transit agencies maintain records on route headways, travel time, and ridership.

With the continued implementation of transportation management programs and associated performance monitoring, the region will need to supplement and enhance current traffic data collection methods. Of primary interest is a method that is flexible to implement and that provides comprehensive traffic data output, both with respect to multi-modal assessment and specific link performance measures. The ideal system would incorporate all of these features.

Alternative detector technologies are being developed with the potential to be installed and maintained without interrupting traffic flow. More importantly, many of these newer detector systems provide increased flexibility of use and produce additional traffic data that are not obtainable with standard loop detectors. Video image processing has emerged as one of the detector technologies with the most potential for comprehensive use. In addition to providing the

traffic data available from standard loop detectors, video image processors can directly measure other traffic parameters such as density, travel time, and vehicle turning movements, which are required for increasing operational efficiency.

CONDITION MONITORING SYSTEMS' MOBILIZER

WSDOT, in conjunction with the USDOT Regional Transportation Center—Transportation Northwest (TransNow)—entered into an agreement with Condition Monitoring Systems to field test a video image processing system prototype, the Mobilizer. This system utilizes a newer concept for video image processing traffic situations that may enhance the accuracy and usefulness of traffic data derived from current commercial video image processing systems.

The Mobilizer unit is considered to be a third generation video image processing system (VIPS) because of its ability to detect vehicles in multiple video frames as they move through the camera's field of view. The vehicle sightings are linked together as tracks of vehicles by a separate data tracker that distinguishes between "good" sightings and false detections (e.g., shadows, two vehicles identified as one) [Dermer, Nasburg, Lall 1995]. This system has the ability to monitor a multiple lane freeway section with two cameras (either end of the section) and link flow characteristics, or "tracks" from one monitoring site to the next. A primary benefit reported for this VIPS over existing commercial systems is the ability to link vehicle sightings at multiple locations. Volume and lane occupancy data from an existing loop detector system can be supplemented with link travel time, origin-destination, and section density information. The system has the potential to expand the transportation data set utilized by WSDOT and to provide a nonintrusive supplement and or replacement (temporary or site-specific) of current induction loop data.

RESEARCH OBJECTIVES

The objectives of the project were to install, test, and evaluate the Mobilizer within the WSDOT Traffic Systems Management Center (TSMC). The test included analysis of video obtained from existing freeway surveillance locations along corridors within the Puget Sound region. The project was divided into two phases: 1) establishment of a test program and valid data collection methods, and 2) analysis of collected traffic data, reporting of the system's accuracy and range of usefulness, and recommendation for further study and/or implementation within the TSMC. This report provides the results of both phases of the research and includes the following objectives:

1) research existing detector technology's capabilities and range of usefulness
2) determine traffic measures and range of environmental conditions to be evaluated
3) determine the site locations for evaluation; test video compatibility (e.g., quality, field of view, freeway flow levels, camera reliability)
4) establish a method for obtaining reference or "ground truth" data for comparison with the system output
5) establish a method for reporting the analysis results
6) recommend a test structure for phase two of the project
7) analyze the system's effectiveness in producing lane counts and volume
8) study the feasibility of using the Mobilizer in measuring travel time for different flow and environmental conditions and its accuracy
9) determine whether the Mobilizer system is capable of providing origin-destination information.

STATE OF THE ART TECHNOLOGY

TRAFFIC MEASURES OF INTEREST

There are three primary areas for use of transportation data, whether for freeways or arterials. These areas can be classified as detection/operation, incident management, and planning. [Hughes and JHK 1994] Obtaining accurate and timely data for each of these areas is an important element in transportation professionals' strategies and plans for maximizing existing transportation facilities.

Primary traffic measures for monitoring, operation, and management of transportation networks are flow/volume, occupancy/density, speed, and travel time. Flow rates are useful for a variety of functions, whether for operational purposes, analyzing existing traffic conditions, or planning for future improvements. [Hughes and JHK 1994]

Both occupancy and density indicate the congestion level of a transportation facility. Occupancy measurements are a key parameter for integrated freeway metering control, such as the WSDOT ramp metering system, as well as for incident identification and historical congestion monitoring.

Speed measurements provide a qualitative indication of the traffic flow on a roadway. [Hughes and JHK 1994] Some form of speed measurement or estimate is produced by most traffic detector technologies. Speed measurements can be utilized to provide incident detection, traveler information in the form of calculated travel times, and measures of effectiveness (including travel time calculation) for system evaluation. [Hall and Persaud 1990]

Travel time measurement is the most important traffic parameter for congestion monitoring systems. The value of travel time measurements is that transportation facilities with differing operations (e.g., arterial vs. freeway) can be effectively compared by utilizing this

universal measure of effectiveness. Current methods for evaluation of travel time center primarily on the floating car technique, license plate matching, cellular telephone reporting, and the detector systems technique. [Hamm 1993]

The floating car technique involves driving a vehicle at the same speed as the traffic stream and recording travel times between identified points. For cellular telephone reporting, individuals call into a central processing location as they pass specific reporting locations. License plate matching requires participants to record license plates at observation points along a corridor and input the data into a computer to match sightings and produce travel times. One flaw in each of these techniques is the magnitude of the studies required to produce statistically significant data (low sample size) and comprehensive, multiple-corridor data.

Use of automated detector data can produce effective travel time estimates, minimizing the labor requirements of the previously mentioned methods. The most common method is to utilize either speed loop data or speeds calculated from loop volume and occupancy data to calculate travel time estimates. The potential problem with either is the dependence on accurate speed loop data or calculated speed data from loops. The latter is dependent on the "g" factor applied to the flow/occupancy calculation. Studies have shown that the factor varies under different occupancy levels [Hall and Persaud, 1990] The University of Washington [Dailey 1993; Dailey, Haselkorn and Nihan 1993] evaluated cross correlation techniques to correct some of these errors associated with the travel time calculation.

DETECTOR TECHNOLOGIES

Numerous transportation detector technologies are in operation today and several new or enhanced technologies are under development. For most, their applications are fairly specific, both with respect to implementation constraints and traffic measures produced.

Inductive Loops

Inductive loops are the most common traffic detectors utilized today. The wire loops operate as inductive units, which, when a vehicle passes over, experiences a decrease in inductance, sending a signal through the electronics to the controller. The loops can provide counts, occupancy, and vehicle passage. Loops can also provide speed data when arranged in two-loop configurations or speed traps.

Ultrasonic Detectors

Ultrasonic detectors emit sound waves in a pulsed mode. The frequencies are in the range of 20 to 65 Khz. [Hughes and JHK 1994] This type of detector is normally mounted overhead and can provide volume, speed, occupancy, presence, and queue information. [Klein, MacCalden and Mills 1993]

Radar

Radar detectors operate on the Doppler principle, echoing a sent signal off of a detected vehicle. This type of detector is commonly used for speed measurements. Radar detectors can also measure presence, which may be useful for monitoring queue lengths on arterials. This type of detector is also being used at toll facilities and for automated truck weighing. [Hughes and JHK 1994]

Acoustic Detectors

Passive acoustic detectors "listen" for sounds of passing vehicles, replicating the traffic measures produced by magnetic loop detectors. [AT&T 1994] They can produce count, occupancy, and stopped vehicle information. The detectors can be set up to ignore sounds outside of a defined detection zone. [Hughes and JHK 1994]

Infrared Detectors

There are two types of infrared detectors: passive, which measure energy emitted from vehicles in the field of view, and active, which reflect an infrared wave that is activated by the presence of a vehicle. This type of detector is readily available and can either be mounted overhead or to the side of lanes. [Labell and May 1990] Inclement weather such as fog, rain or snow tend to affect the operation of these devices. Infrared detectors measure presence/occupancy for multiple lanes, but one detector per lane is required to produce counts.

Magnetometers

Magnetometers provide measures of presence, flow, and occupancy. The devices are installed in the traffic lanes, particularly on bridges where loop detectors cannot be installed. The cylindrical devices detect local changes in the earth's magnetic field caused by the presence of vehicles.

Image Processing

There are currently three primary approaches to video image processing of vehicular traffic. One is normally referred to as the "tripwire" approach, which determines vehicle passage through a video image when a vehicle passes a pre-selected band of pixels within the image [Dermer, Nasburg, Lall 1995]. In effect, the technology provides a video emulation of loop detectors. The other two video image processing approaches are normally referred to as vehicle trackers. These systems are characterized by utilization of the entire video frame, focusing on the movement regions within each frame [Hockaday 1991]. Vehicle trackers utilize one of two processing schemes: identification of differences in successive video frames or analysis of differences between the entire video frame and a background frame (no vehicles present) [Hockaday 1991].

The primary feature of tracker systems such as Condition Monitoring Systems' Mobilizer is that they identify and measure individual vehicle movements, linking the movements together on the basis of actual measurements and utilization of flow-estimation algorithms.

Video image processing systems normally provide measures of traffic volume, occupancy, vehicle classification, headway, and speed. Condition Monitoring Systems (CMS) also claim to be able to produce linked time estimates (and eventually origin/destination data) between successive camera views. The system is also capable of providing traffic measures for several lanes from one video source.

Another form of video image processing is license plate recognition or license plate tracking. These systems provide linked travel time estimates between successive camera locations. The drawback is that the license plate recognition systems only process one lane per camera view. Several of these systems are available or currently under development.

Automatic Vehicle Identification (AVI)

For AVI, electronic transponders are placed on vehicles, and electronic devices for reading those transponders are placed along the roadway. The system determines when a specific transponder has passed a specific point at a specific time [Hallenbeck 1992]. Travel time information can be computed directly from these data. Some drawbacks of this technology include expensive installation and maintenance, and public concerns about privacy [Hallenbeck 1992].

Global Positioning System

The GPS involves using a satellite system to continuously track a vehicle's location. Vehicles are equipped with a receiving device and a screen that shows the exact location of the

vehicle. The main benefit of using GPS is that travel time is actually measured by "probe vehicles and not estimated" [Hamm 1993]. However, the system requires a large number of probe vehicles to operate effectively [Dailey 1995]. As with AVI technology, the public is generally reluctant to install GPS systems in their vehicles.

VIDEO IMAGE PROCESSING

Effects of Operational Variables

In a recent study, Michalopoulos identified several common implementation and reliability concerns related to transportation applications of video image processing [Michalopoulos 1990]. Included among these concerns were reliability of operation under all weather, traffic, and background conditions; adaptability to existing communication and video equipment; range of operation; and implementation costs. In particular, previous testing of VIPS has identified several combinations of weather, traffic flow, and ambient light level parameters that influence the accuracy of the data output [Hockaday 1991]. The effect of each of these variables was considered in formulating a matrix of test parameters for this study.

Just as drivers must adjust for variations in visibility when traveling along a freeway, video image processors must have the ability to correct or account for these environmentally induced variations to produce accurate data. Harsh weather such as heavy rain, fog, or snow minimizes visibility, reducing the reliability of the VIPS data output. Glare from wet pavement (similar to shadows) can cause some systems to identify false images as vehicles. Problems associated with traffic flow normally occur during congested conditions. Some systems do not have algorithms sufficient to handle small headway increments, leading to either inaccurate volume counts or system shutdown. Light level problems are customarily associated with

sudden lighting changes due to cloud cover, shadow effects of vehicles, or stationary objects adjacent to the roadway, and low light conditions [Hockaday 1991].

Hockaday highlighted two additional operational features that caused problems when several VIPS were field tested: occlusion and video perspective. Depending on the processing system, each is minimized or accounted for in different ways. Both of these phenomena are directly related to the location of the camera. Occlusion refers to either vehicles near each other being processed through the system as one vehicle or larger vehicles (trucks, buses, recreational vehicles) shielding smaller vehicles from certain camera angles. Related to occlusion is the problem of larger vehicles being processed as multiple vehicles in adjacent lanes (for less advantageous camera angles). Video perspective problems arise as vehicles move farther away from the camera, so that fewer pixels delineate the vehicles [Hockaday 1991].

Review of Previous Studies

In the U.S., three significant studies have been performed on transportation video image processing systems in the past five years. Each evaluated multiple systems, testing the most promising of the technology under a variety of operational variables. Two of the studies were performed at California Polytechnic State University under contract with the California DOT (Caltrans). The initial study, undertaken from 1989-91 [Hockaday 1991], evaluated five prototype systems and three commercial systems. All three of the commercially available systems were "tripwire" type technology, while three of the five prototype systems incorporated "tracker" technology. A more recent Cal Poly study just completed (identified as VIPS II), analyzed four systems: Econolite's Autoscope, Traficon's CCATS, Eliop's EVA, and Sumitomo's IDET-100.

FHWA sponsored another study undertaken in 1991 by Hughes Aircraft Corp. to investigate detector technologies that could be incorporated in Intelligent Transportation

Systems. The purpose of the study was to establish accuracy specifications for future detector installations, test and compare current detector technology, and determine whether permanent detector test facilities need to be established. Within the study, four video image processing systems were evaluated: Econolite's Autoscope, Computer Recognition Systems' TAS, Traficon's CCATS, and Sumitomo's IDET-100.

Review of Existing Technology

Currently, several video imaging processing systems are either commercially available or under development for transportation applications. [Meusch 1995] Continued implementation of this technology is occurring worldwide.

Autoscope. One of the more recognizable products in the video image processing marketplace today is the Autoscope, supplied by Econolite in North America and Image Sensing Systems internationally. This tripwire imaging system was originally developed by the University of Minnesota and currently has approximately 60 percent of the market share for installed systems. [Mayeaux 1994] The system is reported to be at least 95 percent accurate under all weather and artifact conditions for volume, occupancy, and speed measurements. [Michalopoulos, Jacobson, Anderson and DeBruycker 1993]. Units include multiple detector outputs and video inputs, and functions to define a minimum of 60 detection zones.

As with other imaging systems to varying degrees, the accuracy of data output from Autoscope is somewhat dependent on camera location. A recent study by the Virginia Transportation Research Council [Cottrell 1994] evaluated Autoscope's effectiveness for less than ideal camera placements, utilizing video from existing field surveillance cameras located well off the edge of the freeway and at least one incorporating a slight horizontal curve. The results were generally unsatisfactory. To be fair, the preferred camera location for maximizing the Autoscope's accuracy is above or immediately adjacent to the roadway.

WSDOT currently has Autoscope installations in Spokane, Auburn, and Redmond that will be evaluated over time. Additionally another setup is installed in the Northwest Region's Traffic System Management Center (TSMC) to be used for special studies.

The Mobilizer Tracker System. The Mobilizer video image processing system utilizes data association tracking to extract a wide range of traffic measures from video images. With the exception of Condition Monitoring System's continued testing and recent reporting [Dermer, Nasburg, Lall 1995], no other studies have been completed involving the Mobilizer technology. However, evaluations were underway on prototype systems in Oregon, North Carolina, and Kentucky at the time of this report.

The Mobilizer system consists of two primary components: the Smart Sensor Interface (SSI) and the Mobilizer Advanced Tracking System (MATS). The SSI unit extracts data from video images and transmits them to the MATS. The MATS translates the data into usable traffic flow information by linking multiple object sightings within the field of view into vehicle tracks. Future systems are expected to incorporate Roadside Equipment Interfaces (REIF) to convert SSI output into an understandable form for field controllers to utilize. [Dermer, Nasburg, Lall 1995] Figure 1 shows Condition Monitoring Systems' vision for future architecture of the Mobilizer. The Seattle study only incorporated a MATS and two SSI units. The prototype system provided was contained in three personal computers.

Developers of the Mobilizer claim that their system is able to link vehicle sightings at multiple camera locations, translating the sightings to link time estimates or travel time estimates along a roadway section. In addition to link time estimates, the system produces volume, speed, density, distance headway, vehicle classification, and truck percentage data at each camera location. The data are reported for individual lanes, as well as for a section aggregate. The difference between the Mobilizer processor and some earlier versions of VIPS is that it detects

vehicles in multiple video frames as the vehicles move through the field of view. The theory is that false and true vehicle detections can be better assimilated through multiple looks. Because of this technology, the Mobilizer captures video at one frame per second, significantly less frequently than other VIPS systems. For example, the Autoscope system samples video at 60 frames per second. A view of a digitized video frame processed through the Mobilizer is shown in Figure 2. The figure shows vehicle detections and a false detection (white boxes).

Other Systems. A detailed description of other systems is beyond the scope of this report. However, other manufacturers involved in video imaging system development include Peek Traffic, Computer Recognition Systems, Eliop Trafico, and Traficon.

Source: Condition Monitoring Systems

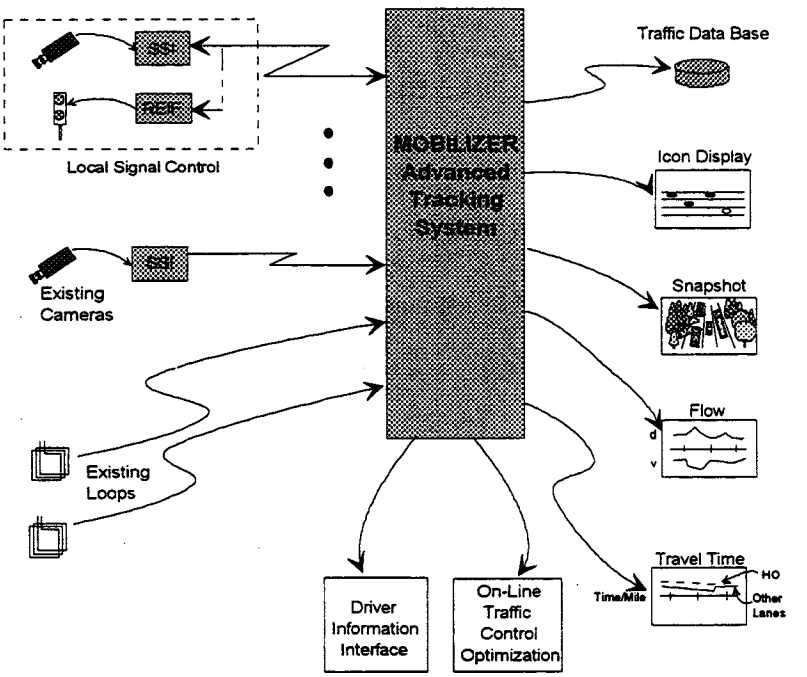


Figure 1. Future Mobilizer Architecture

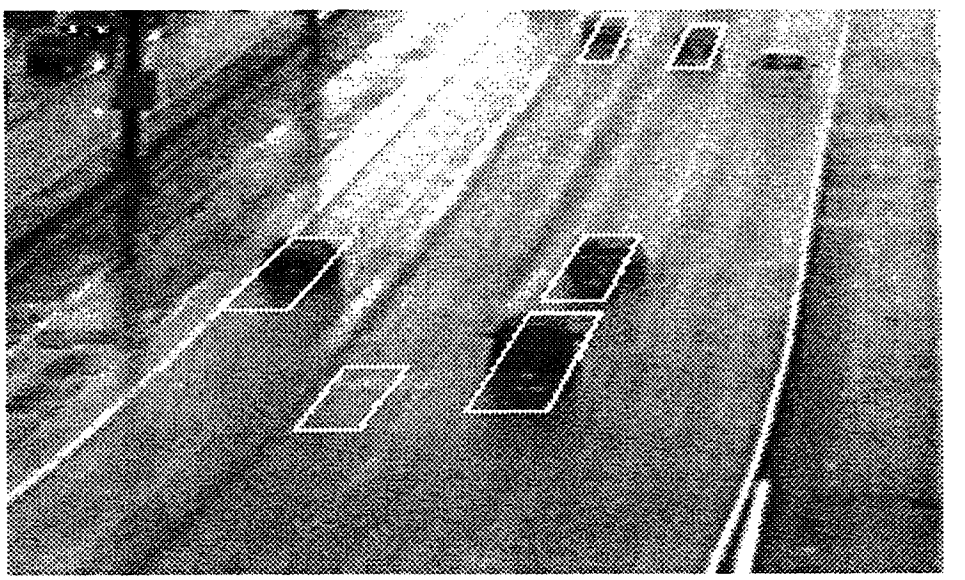
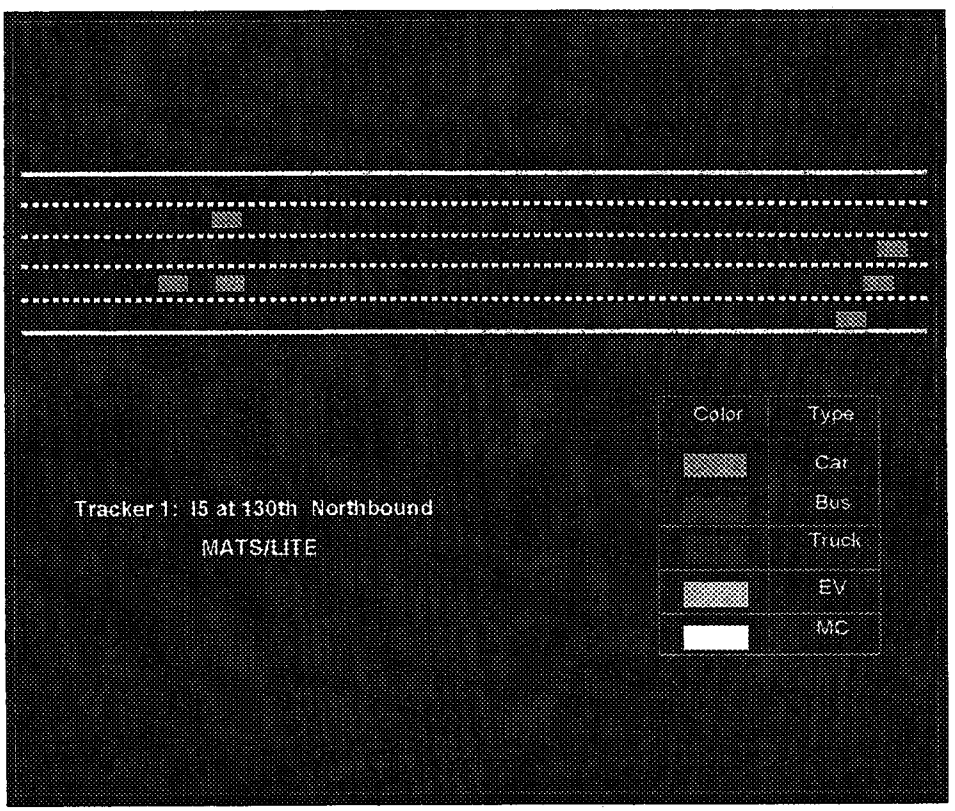


Figure 2. Mobilizer Tracking System

An interesting feature of the Mobilizer system is the provision of a real-time graphical representation of the current traffic flow in one camera's field of view (Figure 3). This feature may be useful for transportation systems that are not fully integrated with video and data transmission but are linked to a central traffic management center. Data extracted from video with a field SSI unit could be transmitted to a TMC via a fairly low-cost, low-bandwidth link. The MATS unit located at the TMC could then translate the SSI data to icon displays to graphically represent the current flow condition (e.g., roadway view). Although technology continues to improve and the costs of transmitting compressed video continue to decline, if the Mobilizer system proves reliable, it may provide a useful function.



Source: Condition Monitoring Systems

Figure 3. Mobilizer Icon Display

RESEARCH DESIGN

INTRODUCTION

The intent of the project was to evaluate the Mobilizer system under a combination of conditions that are typically encountered along urban freeway corridors within the Puget Sound region. Because of the limited budget and scope of the project, video from existing freeway surveillance cameras was used for the evaluation. Additionally, for comparison, reference or "ground truth" data were collected manually from video images. The project evaluation was divided into two modules: (1) establishment of methods for data collection/analysis and an initial pilot test to verify the functionality of the methods and system software, and (2) analysis of data output for an identified matrix of geometric, environmental, and flow conditions.

TEST SETUP

The researchers decided to utilize video from existing freeway surveillance cameras within the WSDOT surveillance, control, and driver information (SC&DI) system to initially test the Mobilizer system. This arrangement offered the potential to capture and analyze video from any of over 140 CCTV cameras, providing a variety of camera perspectives and traffic flow conditions from which to choose. It is also gave the project team the ability to videotape CCTV transmissions at the TSMC in north Seattle. Although several studies [Hockaday 1991, MacCarley et al. 1992, Michalopoulos 1990] have utilized black and white CCTV images for video image processing tests, the project group decided that processing color images from existing surveillance cameras would provide a satisfactory test for initial evaluation of the prototype Mobilizer system.

Criteria that were considered by the project team in preliminarily determining which surveillance cameras could be utilized included reliability of the video transmission, location of the cameras relative to freeway sections where recurrent congestion occurs, and the priority of using the cameras for freeway surveillance. The reason for focusing on freeway sections that experience recurrent congestion was to collect and analyze video data for a full range of traffic flow conditions. This focus is discussed in more detail later in this chapter.

Representatives from Condition Monitoring Systems provided a list of desired criteria for selecting appropriate site(s) for the initial tests. The criteria were based on CMS's experience with the system software at the time. They included the following:

- tangent freeway sections
- preference for camera to be centered over lanes; field of view 91 m. (300 ft.) to 152 m. (500 ft.) of freeway
- two successive cameras spaced no more than one mile apart for link time evaluation
- ability to lock camera positions
- provision of a "clean" video signal that does not break up when digitized through the Mobilizer system.

Equipment and Data Communications

The key factor in determining which surveillance cameras would be utilized for the study was whether the video transmission was compatible with the Mobilizer unit. This factor became more apparent as transmissions from several cameras were digitized through the Mobilizer unit and evaluated for compatibility. The WSDOT freeway communication network produces broadcast quality video at the TSMC, providing over 400 lines of resolution. Although all of the cameras tested produced a clear and consistent image through a television monitor, several transmissions did not digitize acceptably through the Mobilizer. In these cases, the video was "off synch" and produced numerous discontinuities in the digitized frames. It was apparent that

the problem was related to the transmission of the signals through fiber optic communications hubs located in the field. The susceptibility of the Mobilizer system to these electronic interruptions was a concern, but the researchers assumed that this problem was due primarily to hardware deficiencies and that a combination of improved image processing boards and more compatible cameras would improve the performance to acceptable levels.

Experimentation revealed that the section from 92nd Street NE to 205th Street NE along I-5 in north Seattle (Figure 4) provided the best quality processed signal. Not coincidentally, the video transmissions from this section are transmitted directly to the TSMC, without passing through a communication hub.

Interstate 5 between 92nd Street NE and 205th Street NE met most of the criteria identified by the project team and CMS personnel to perform the study. The exception was that the majority of the cameras within this section were located along the edge of the freeway. However, the height of the cameras ranged from 12 to 15 meters (40 to 50 feet) above the freeway surface. An added benefit was that the site was located within a few miles of the TSMC. This proximity provided convenient access for placing calibration marks in the field of view and for performing vehicle drive-throughs for speed calibrations.

The prototype system provided by CMS for this project consisted of three 80386 AT computers and the Mobilizer software for two SSI units and one MATS unit. Required features of the video recorders were that they record in SVHS format, with a horizontal resolution in excess of 400 lines, and that they have slow scan capability for frame by frame analysis. The date/time stamp generator had to be able to provide time reference to the nearest second and not affect the quality of loop-through video. Table 1 provides a list of the equipment that was acquired to perform data collection and analysis.

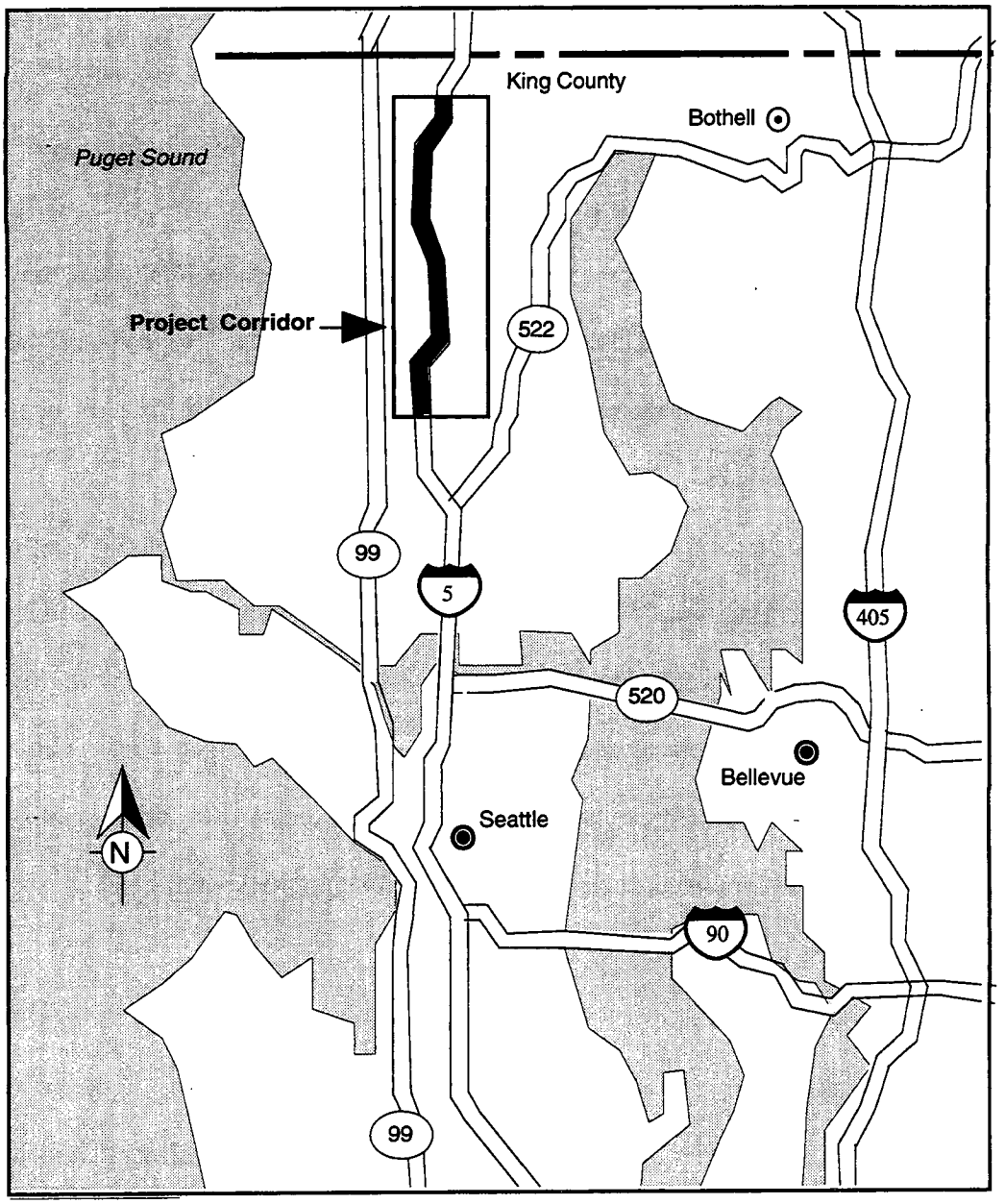


Figure 4. Project Area Map

Table 1. Selected Test Equipment

Equipment Type	Quantity
American Dynamics Date/Time Generator Model Number 1440B	2
JVC SVHS Video Cassette Recorder Model Number HR-S4900U	2
80386 AT, 33Mhz; 6 MB RAM VGA Monitor, 256K Video RAM	3

Field Setup

The selected study section was located along northbound Interstate 5, from NE 117th Street to NE 130th Street, in north Seattle. The section included four general purpose lanes and a high occupancy vehicle (HOV) lane and had one off-ramp (right side) south of the NE 130th interchange. This portion of I-5 experiences recurrent congestion during the afternoon/evening weekday commute related to a downstream bottleneck beyond the section and a large amount of weaving activity within the section. Additionally, lane 1 (right) breaks down periodically during the peak period because of backup from the downstream off-ramp. Figure 5 shows the layout of the test section.

WSDOT Freeway surveillance cameras located at each interchange were utilized to collect taped video data for analysis. The cameras are on poles approximately 15 meters (50 feet) above the surface of the freeway. The Metal Oxide Semiconductor color cameras have pan, tilt, and zoom capability that can be controlled from the Traffic Systems Management Center (TSMC) several miles away. The cameras are rated at 1.5 lux illumination and have a 12.5-mm to 75-mm zoom. The distance between the cameras' fields of view is approximately 1.1 km (0.7 miles) long, and the freeway is in a tangent section at each location.

Calibration marks of temporary reflective strips were placed on the outside shoulder of the freeway section (within video capture zones only) at 15-meter (50-feet) increments. There

was no inside shoulder within the study section, so the strip segments were made as long as possible on the outside shoulder.

There were no induction loops located within the field of view of either of the two cameras. Therefore, no direct correlation between loop and Mobilizer output was made. Loops located south of 117th Street NE, at 120th Street NE, and south of 130th Street NE were used to gauge the level of congestion in the section.

An objective of the project was to evaluate the effectiveness of the system's link time estimator in providing accurate travel time measurements between successive camera views. The selected test site also provided the option of analyzing travel time over a longer distance by allowing incorporation of video from the next camera downstream at 145th Street NE. The distance between 117th and 145th is approximately 2.4 km (1.5 miles). The link time estimator may be evaluated for this longer freeway section in a follow-up project.

MOBILIZER OUTPUT

The Mobilizer is a prototype system under development. For this reason, CMS does not have an automatic feature for data output. The following section discusses the data output available from the Mobilizer.

Traffic Measures

The Mobilizer produces a wide range of traffic measures from processed video images. The output is segregated into two categories: traffic measures extracted from a registration location in the tracker's field of view and link-time estimates between successive tracker locations.

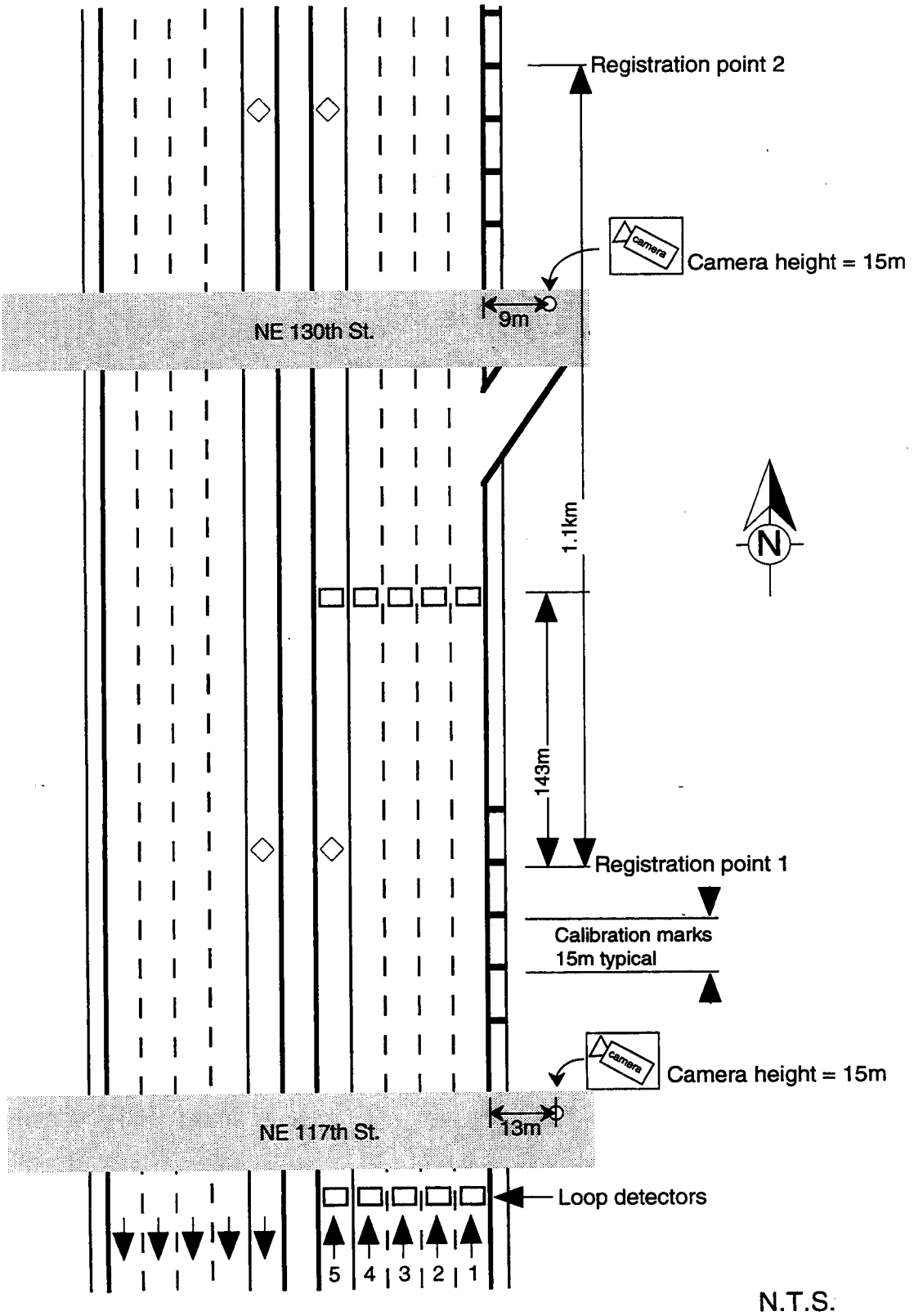
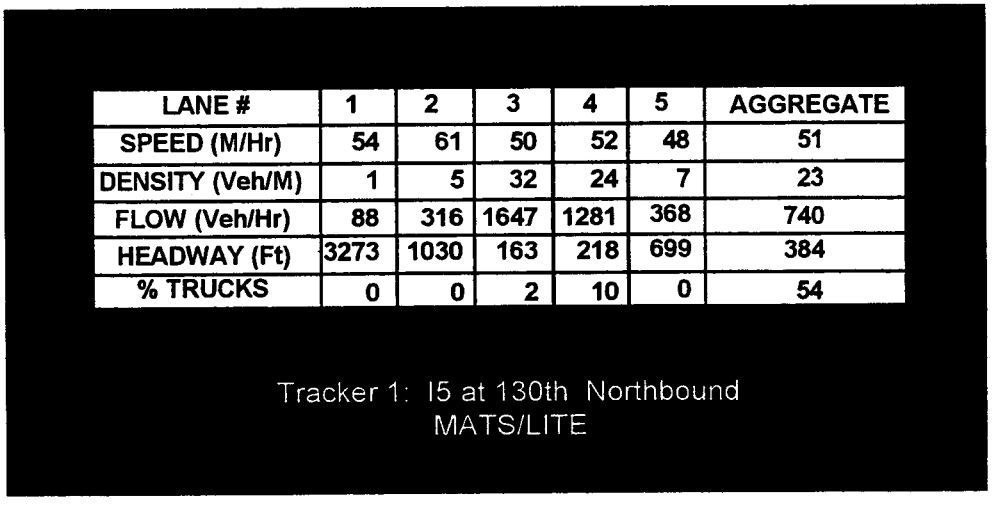


Figure 5. Test Section Layout

Data produced at the registration location include volume/counts, speed, distance headway, density, and percentage of trucks. Currently, the Mobilizer system output is conveyed in conventional U.S. units only, so all data reported in this project's tests will be in U.S. units. Link-time or travel time estimates are extracted from linked tracks of individual vehicles at the source registration point (first tracker field of view) and the measurement registration point (second tracker field of view).

Although functional, the vehicle classification function does not produce reliable data at this time and was not evaluated during this project. Data summary periods are specified by the user within a range of 20 seconds to in excess of 1 hour. Traffic measures are produced for individual lanes, as is an aggregation of statistics from all identified lanes. An example of the graphical display for traffic statistics is shown in Figure 6.



LANE #	1	2	3	4	5	AGGREGATE
SPEED (M/Hr)	54	61	50	52	48	51
DENSITY (Veh/M)	1	5	32	24	7	23
FLOW (Veh/Hr)	88	316	1647	1281	368	740
HEADWAY (Ft)	3273	1030	163	218	699	384
% TRUCKS	0	0	2	10	0	54

Source: *Condition Monitoring Systems*

Figure 6. Mobilizer Statistics Window

Volumes/counts. The system uses a time stamp for each vehicle that passes across the registration line. Identification is made when the back of the vehicle passes the registration line. Volume is expressed in vehicles per hour.

Speed. The system's speed measurements are derived from individual vehicle space-mean-speeds utilizing the following equation:

$$\overline{\mu}_{SMS} = \frac{1}{\sum_{i=1}^{n} \frac{t_i}{n}}$$

where $\overline{\mu}_{SMS}$ = space-mean-speed (miles per hour)

t_i = travel time rate of vehicle i (hours per mile)

n = number of observations in sample

The vehicle travel time rates are derived from the time (seconds) and distance (feet) between sightings of individual vehicles on either side of the registration line. The vehicles' instantaneous location is determined from calibration marks established in the field of view.

Distance headway. The system calculates the average distance headway ($\overline{h}_d$) by utilizing the average vehicle speed ($\overline{\mu}_{SMS}$) and the average time headway ($\overline{h}_t$). Distance headway is measured in feet at the registration line and calculated utilizing the following equation:

$$\overline{h}_d = \overline{\mu}_{SMS} \cdot \overline{h}_t$$

Density. The system assesses macroscopic density of a predefined roadway segment. The measure is derived from instantaneous "snapshots" of the roadway segment, providing vehicle counts averaged over a selected period of time. The output is therefore not reliant on direct measurement of average vehicle speed or headway to assess the section density. Density output is measured in vehicles per lane-mile.

Link-time estimates. The Mobilizer links sightings of individual vehicles on ;the basis of several factors. At both tracker locations, the system assesses multiple sightings of individual

vehicles with respect to size and other characteristics. The system utilizes a Kalman filter, which assesses measured attributes as well as expected data, to attempt to link specific vehicle sightings within two separate fields of views. Link-time output is measured in seconds.

TEST VARIABLES

The researchers intended to test the capabilities of the Mobilizer under conditions normally encountered within the Puget Sound region. Variables that may affect video image processing performance can be separated into six categories: traffic flow conditions, roadway geometry, ambient light level, camera perspective, weather elements, and image quality. [Hockaday 1991, MacCarley et al 1992, Michalopoulos 1990]

Traffic Flow Conditions

Traffic flow can be categorized as low, moderate, and high congestion [Hughes and JHK 1993]. These levels of congestion correlate to uncongested flow, near-capacity flow, and congested flow, respectively. Low flow conditions are characterized by stable, consistent operations, higher speeds, and low volumes. With respect to video image processing, headway between vehicles under this condition is sufficient to allow delineation of individual vehicles. The researchers were most interested in assessing the system's accuracy in measuring low flow volume and speed, and less interested in determining its accuracy in measuring low flow density and travel time. The latter two measures become more significant as congestion levels increase.

Moderate congestion is characterized by somewhat slower average speeds than the low flow condition, shorter average headways, and greater overall vehicular throughput. At some point, traffic flow becomes unstable because the traffic demand approaches or equals the roadway capacity. The researchers were significantly interested in assessing the Mobilizer output for volume, speed, density and travel time under this flow condition.

High congestion is characterized by broken down flow conditions that occur when traffic demand exceeds roadway capacity. Speeds vary from slow to stopped, distance headway between vehicles is minimal, and vehicle throughput is less than that of the moderately congested condition. Again, the researchers were significantly interested in assessing the Mobilizer output for volume, speed, density, and travel time under these conditions.

May [1990] links the three theoretical congestion conditions (uncongested, near-capacity, and congested) to lane density. The congestion category defined as near congestion could be divided into two sub-categories, further delineating the transition from uncongested to congested flow. Because flow conditions in this transitional category can vary from uncongested to congested fairly rapidly, data within the moderate congestion period were not further divided for this analysis. The density categories defined by May were utilized for the tests and are summarized in Table 2.

Table 2. Flow Categories for Evaluation

Density (vehicles/lane-mile)	Flow Level
< 42	Low
42 - 67	Moderate
> 67	High

Roadway Geometry

Roadway geometry variables include the number of lanes in the field of view, tangent versus horizontal curve sections, and presence of ingress/egress ramps. The video image processing systems available vary in the number of lanes the systems can process. The developers of the Mobilizer report that their system can analyze in excess of six lanes. For the purpose of this study, a five-lane section was selected (five is the most lanes in one direction of any freeway section located within the Puget Sound region). Because the Mobilizer had not been

tested thoroughly to date, the research team decided that an effective initial test would be to minimize roadway geometry variables. They therefore selected a test section of tangent freeway, with no ramps within the camera's field of view.

Ambient Light Level

Light level within the camera's field of view plays an important part in the effectiveness of video image processing. A common claim by video processing developers is that vehicles are more easily detected in low-light conditions because there is minimal change in the image background. [Hockaday 1991] Vehicles are identified in these low-light or darkness conditions by their headlight or tail light signature. Previous studies [Hockaday 1991, Hughes and JHK 1993] have mentioned that image quality from cameras that have automatic iris and gain control (AGC) tends to deteriorate for periods of time in reaction to intense light changes. This type of camera darkens the light level in the video image in response to the intense light. A common practice when using video image processing systems is to disable these features on the cameras. CMS representatives indicated that this camera function would not have a measurable effect on the Mobilizer system. Because the test cameras for this project were also being regularly used for surveillance purposes, the AGC remained enabled on both cameras.

In daylight conditions, roadways normally have a combination of moving shadows from vehicles and clouds, as well as stationary shadows from bridge structures, trees, and other objects. A goal of the project was to evaluate the Mobilizer's effectiveness in discriminating between vehicles and shadows. Because Condition Monitoring Systems did not have a functional night algorithm available at the time of phase one testing, only daylight conditions were evaluated. Size and location of shadows was dependent on the time of day of video capture and weather.

Camera Perspective

Perspective with respect to video image processing refers to the location of the camera(s) relative to the vehicle lanes and the traffic flow direction. The most desirable camera location is centered directly above the traffic lanes to be analyzed [Hockaday 1991, Hughes and JHK 1993]. This location naturally eliminates the problem of occluded vehicles and allows the opportunity to install cameras at lower heights (such as directly on a bridge structure spanning the roadway, rather than a greater height on a pole). Larger vertical and lateral camera angles are acceptable in combination with a mounting height greater than 14 meters (45 feet) [Hughes and JHK 1993]. The cameras used for this project were mounted at approximately 15 meters (50 feet) and were located adjacent to the freeway. Again, the intent was to utilize existing surveillance cameras.

Hughes and JHK (1993) identified several factors related to upstream and downstream viewing for video image processing. For example, upstream viewing (i.e., the camera location is upstream of the direction of travel) appears to be more advantageous for processing, particularly for tracker systems. Upstream viewing provides the system with an initial look at vehicles in the foreground and allows an opportunity to monitor tail lights, whose braking will indicate congestion and possibly incidents. Upstream viewing also minimizes the processing effects associated with headlight glare, which is a factor in downstream viewing. Condition Monitoring Systems representatives preferred using an upstream camera view for the evaluation. All video was captured with an upstream view.

Weather

Several weather variables may create problems for video image processing systems. Fog, snow, heavy rain, and heavy cloud cover may affect the ability of the system to distinguish the vehicles from the background and surrounding conditions. Wet pavement will result in vehicle reflections that present problems similar to shadows for video processing systems to

handle. Rain and moving clouds are both prevalent in the Pacific Northwest. In particular, the rapid light level changes due to moving clouds can create problems for some video processing systems. Five weather elements were identified for evaluation in this project: sun, moving clouds, full overcast, rain, and fog.

Image Quality

For long-term implementation of video image processing systems, periodic video quality problems are inevitable. Hockaday (1991) introduced electronic noise in tests of several systems to evaluate their susceptibility to electronic interference. One potential method for introducing distorted video images into the Mobilizer may be to utilize video on VHS tapes instead of SVHS. For the purpose of this study, however, no tests were conducted for this variable.

SELECTED DATA FOR ANALYSIS

Three traffic measures were selected to analyze the accuracy of the Mobilizer system: volume/counts, density, and link time or travel time. These measures were the easiest to obtain reference data for, given the equipment and test site available for the project. In addition, each of the statistical measures is produced independent of the other two for the Mobilizer output. For this reason, analysis of the three measures would provide a comprehensive evaluation of the capabilities of the system.

Approximately 40 two-hour segments of video were captured over six months from July to December 1994. The project team reviewed each of the videos from this library to select 10-minute segments that fulfilled the criteria for evaluating desired test elements. The evaluation concentrated on three flow conditions--low, moderate, and high--and five environmental conditions: sun, partly cloudy, full overcast, rain, and fog. Depending on the traffic measure and flow condition, two to five lanes were analyzed. Generally, two lanes were analyzed for low

flow conditions, and three lanes were analyzed for moderate and high flow conditions, since the variability of traffic statistics is normally less between lanes with low flow than between lanes under higher flow conditions. The chosen lanes had to provide an indication of variability related to single lanes (e.g., occlusion, camera angle) and a representative aggregate of traffic measures for each condition. The exception to this was that all five lanes were analyzed under sunny, clear conditions to evaluate variability in the accuracy of true aggregate measures for various flow conditions. Table 3 provides a summary of data that were analyzed within the project.

The purpose of the analysis was to evaluate the Mobilizer data in sufficient detail, microscopic and macroscopic, to provide an understanding of the system's potential for producing both operational and planning data. Mobilizer output for volume and density was analyzed for 1-and 10-minute periods, providing raw difference, percentage error, and standard deviation information in relation to independently collected reference data. Additionally, 20-second data output for selected lanes/conditions were compared to reference data to highlight the near-immediate reaction of the system to particularly problematic conditions (severe light fluctuation, vehicle shock wave).

The evaluation also included analysis of error output under the low flow (sun) condition. The intent was to evaluate the effects of the camera perspective on error rates for individual lanes, as well as to compare false and missed detection to the 10-minute aggregation error.

Because the Mobilizer system software is still under development, several constraints needed to be considered in the project team's data collection and data analysis plan. Foremost among these constraints were the following factors:

1. The system cannot aggregate link-time (travel time) estimates in greater than 1-minute intervals.

Table 3. Project Test Elements

Test #	Traffic Measure	Location	Date	Time Period	Lanes Evaluated	Flow Element	Environmental Elements
1	Volume	I-5/130th St. NE	8/10/94	16:20 - 16:30 (10 min.)	1, 2, 3, 4, 5	Low	Sun, Clear
2	Volume	I-5/130th St. NE	8/17/94	10:00 - 10:10 (10 min.)	1, 4	Low	Overcast (full)
3	Volume	I-5/130th St. NE	8/16/94	11:15 - 11:25 (10 min.)	1, 4	Low	Partly Overcast (moving clouds)
4	Volume	I-5/130th St. NE	12/19/94	12:25 - 12:35 (10 min.)	1, 4	Low	Rain
5	Volume	I-5/130th St. NE	10/7/94	8:47 - 8:57 (10 min.)	1, 4	Low	Fog
6	Volume	I-5/130th St. NE	8/10/94	15:45 - 15:55 (10 min.)	1, 2, 3, 4, 5	Moderate	Sun, Clear
7	Volume	I-5/130th St. NE	8/16/94	16:20 - 16:30 (10 min.)	1, 3, 4	Moderate	Overcast (full)
8	Volume	I-5/130th St. NE	9/30/94	16:22 - 16:32 (10 min.)	1, 3, 5	Moderate	Partly Overcast (moving clouds)
9	Volume	I-5/130th St. NE	10/20/94	16:45 - 16:55 (10 min.)	1, 3, 4	Moderate	Rain
10	Volume	I-5/130th St. NE	8/10/94	16:20 - 16:30 (10 min.)	1, 2, 3, 4, 5	High	Sun, Clear
11	Volume	I-5/130th St. NE	8/16/94	17:00 - 17:10 (10 min.)	1, 3, 5	High	Overcast (full)
12	Volume	I-5/130th St. NE	10/20/94	17:25 - 17:35 (10 min.)	1, 3, 5	High	Rain, dusk transition
13	Density	I-5/130th St. NE	8/10/94	15:45 - 15:55 (10 min.)	1, 3, 5	Moderate	Sun, Clear
14	Density	I-5/130th St. NE	8/16/94	16:20 - 16:30 (10 min.)	1, 3, 4	Moderate	Overcast (full)
15	Density	I-5/130th St. NE	9/30/94	16:22 - 16:32 (10 min.)	1, 3, 4	Moderate	Partly Overcast (moving clouds)
16	Density	I-5/130th St. NE	10/20/94	16:45 - 16:55 (10 min.)	1, 3, 4	Mod./High	Rain
17	Density	I-5/130th St. NE	8/10/94	16:20 - 16:30 (10 min.)	1, 2, 3, 4, 5	High	Sun, Clear
18	Density	I-5/130th St. NE	8/16/94	17:00 - 17:10 (10 min.)	1, 3, 5	High	Partly Overcast (moving clouds)
19	Travel Time	117th to 130th	9/23/94	15:10 - 15:20 (10 min.)	1, 2, 3, 4, 5	Low	Sun, Clear
20	Travel Time	117th to 130th	9/30/94	14:12 - 14:22 (10 min.)	1, 3	Low	Moving Clouds
21	Travel Time	117th to 130th	10/10/94	11:15 - 11:25 (10 min.)	1, 3	Low	Rain
22	Travel Time	117th to 130th	10/10/94	15:40 - 15:50 (10 min.)	1, 3	Low	Overcast
23	Travel Time	117th to 130th	9/23/94	16:20 - 16:30 (10 min.)	1, 2, 3, 4	Moderate	Sun, Clear

2. The system output for link-time estimates is filtered data and does not reflect a true average of individual vehicle travel times processed through the Mobilizer.

3. In preliminary tests, the system had considerable difficulty processing congested traffic flow data to the point where complete system failure occurred.

These constraints considerably limited the project team's scope of data analysis. The combination of these three factors reduced the variables that were feasible to test to primarily low flow conditions and small data intervals. Unfortunately, testing under these two conditions was not conducive to producing a thorough statistical analysis of the system's capabilities. Under low flow conditions, the sample travel time data extracted by the system would be minimal. Calculating 10-minute averages utilizing the system's 1-minute link-time estimates would not result in a true representation of the system's accuracy because the 1-minute estimates would be filtered data.

Because of the current limitations of the Mobilizer system capabilities in measuring travel time, only uncongested, low flow traffic conditions were analyzed in combination with several environmental conditions. Obviously, the low flow condition simplified the processing task. An analysis of results of individual lanes under a low flow, sun condition assisted in determining the potential effects of camera perspective on data accuracy because the test cameras were not located directly over the freeway lanes. One moderate congestion condition was analyzed to report the system's capabilities under more severe conditions. Additionally, the Mobilizer data were analyzed for the number of valid vehicle tracks (i.e., correct vehicle spottings from one camera location to another), mean travel time, percentage error, and significant difference in means in comparison to the reference data. The "Data Analysis" section provides additional details on proposed methods for analysis.

Reference Data

Reference data were manually collected from selected videotapes for comparison to the Mobilizer output. For collection of volume data, a program called Traffic Data Input Program (TDIP) was utilized to count and summarize individual lane counts. The program, developed by the University of Idaho, allows the user to register a time stamp in a data file each time a computer keyboard key is pressed. The user is able to preset the beginning and ending time of the data collection to match the time stamp on the video analyzed.

Unfortunately, collection of accurate and comprehensive density and travel time data was labor intensive. Because the Mobilizer measures section density on the basis of aggregations of "snapshots," reference data had to be collected by the same method to provide an accurate comparison. Therefore, the project team assessed individual lane density in 20-second aggregations for a 61-meter (200-feet) section length.

The intent of the travel time evaluation was to not only assess the system's travel time estimate accuracy, but also to investigate the system's ability to track specific vehicles from one camera view to the next. The latter goal required a large reference sample to evaluate the Mobilizer's potential origin/destination link effectiveness. The project team again utilized the videotapes (with an embedded time record) to log each vehicle that remained in the same lane from location one to location two. A record was developed for the chosen evaluation lanes that included every vehicle that was sighted in the same lane at both locations. This record allowed calculation of the true mean travel time for any time aggregation up to 10 minutes, as well as provided a record of the tracks population for individual lanes. Data error was estimated to be no greater than +/- 2 seconds.

Mobilizer Data

All of the evaluation for this project utilized videotaped segments of freeway traffic. Each test period was run through the Mobilizer for 20 consecutive minutes. The first 10 minutes of operation allowed the system to adjust its estimate of the background. The second 10 minutes corresponded to the applicable time period listed in Table 3.

Data Analysis

Data accuracy requirements are dependent on the data's application. For instance, to dynamically assess ramp and mainline traffic conditions, WSDOT operates a centrally controlled ramp metering system based on 20-second data from loop detectors. In contrast, for traveler information systems, 5-minute data normally conveys adequate information. Hughes and JHK (1994) identified detector accuracy specifications necessary for future intelligent transportation system (ITS) freeway incident detection/management and ramp meter control applications. For operational (detection) data requirements, they identified accuracy needs for mainline flow as +/- 2.5 percent at 500 vph/lane, those for mainline occupancy as +/- 1 percent, and those for mainline travel time as +/- 5 percent. For planning data, they identified accuracy needs for mainline flow as +/- 2.5 percent; those for mainline occupancy as +/- 2 percent; and those for mainline travel time as +/- 5 percent. Identified needs for ramp metering were similar for mainline flow and occupancy. Under a range of flow and environmental conditions, these target accuracies may be extremely difficult to consistently achieve with current detector technology. For the purpose of this report, conclusions were drawn on the basis of a 1-minute and 10-minute data target accuracy of 95+ percent and analysis of the system's consistency and expediency for adjusting to severe conditions (e.g., flow and/or environmental). Density and volume data were analyzed similarly.

Additionally, graphs of comparisons of 20-second data for select lanes were produced to provide a microscopic indication of how the Mobilizer system handles certain test elements. For volume data comparison, the 1- and 10-minute data were placed in tables, and the 20-second data were put in graphical form.

The project team evaluated the accuracy, variability, and statistical significance of the Mobilizer data in travel time measurement. Primary focus was be on evaluating the system's ability to accurately track individual vehicles from one camera location to the next. The following rules defined by the project team applied in determining valid "tracks":

- The mean travel time must be equal to the reference mean travel time +/- 5 percent.
- The number of valid hits (i.e., tracks) for each 1-minute period must be a minimum of two for the HOV lane and a minimum of five for general purpose lanes under a low flow condition.

The data analysis plan consisted of comparisons of system output to reference data for population size, valid system link-time estimates or "hits," and raw difference in mean values. The statistical significance of sample sizes and mean differences were not analyzed because the constraints of the system output methods and data accuracy combined to produce insufficient data, making the statistical analysis meaningless.

Below is a list of definitions of measures included in the analysis of the travel time data.

Period

Each 10-minute period of analyzed video was divided into ten 1-minute periods. As discussed previously, the constraints of the Mobilizer system at this time required 1-minute intervals.

Population

The population data represented the total number of vehicles that could be tracked by the Mobilizer to produce link-time estimates. It represented the number of vehicles that traveled in the same lane between the source and measurement points within the test corridor. Each vehicle was visually tracked and logged by the project team.

Mean Travel Time

Mean travel time of the reference data was the manually calculated mean travel time in 1-minute aggregation. The formula is

$$\bar{T} = \frac{\sum T}{N}$$

where T denotes the individual vehicle travel time; N denotes the population size. Mean travel time of the Mobilizer data was given in the STATS.LOG output.

Minimum Sample Size Required

Given the individual vehicle travel time of the reference data, the minimum sample size required for the Mobilizer output could be calculated at the 90 percent and 95 percent significance levels. The formula is

$$n = \left(\frac{Z_{\alpha/2}\sigma}{E} \right)^2$$

where $Z_{\alpha/2}$ is the critical Z-value corresponding to the desired significance level, σ is the population standard deviation, and E is the desired confident interval width. As was mentioned previously, a +/- 2 seconds of error (the confidence interval width) was chosen. The minimum sample size with a 95 percent of significance level was

$$n = \left(\frac{1.96\sigma}{2}\right)^2 = (0.98\sigma)^2$$

and with a 90 percent of significance level was

$$n = \left(\frac{1.64\sigma}{2}\right)^2 = (0.82\sigma)^2$$

Hits

The Mobilizer produced a hit for each link-time estimate the system produced. The total number of hits processed by the Mobilizer were found in the LTE.DMP file.

Valid Hits

A valid hit has to fulfill three criteria:

1. It had to be registered as a hit in the LTE.DMP file.
2. The time of entry at the measurement location had to be equal to the reference data time of entry, +/- 2 seconds.
3. The Mobilizer link-time estimate for an individual vehicle had to be equal to the reference data travel time, +/- 2 seconds.

Difference in Mean Travel Time and Percentage Difference

The difference in mean travel time was the difference between the reference data and the Mobilizer data. The absolute values of the 1-minute differences were combined to produce a 10-minute average difference. Absolute value was used to eliminate potential error-balancing, which would have unfavorably skewed the results.

The percentage difference was that between the reference data and the Mobilizer output data. The formula is

$$PD = \frac{Tm - Tr}{Tm} \times 100\%$$

where Tm is the mean travel time estimated by the Mobilizer and Tr is the reference mean travel time.

Significant Difference in Means

The significant difference in means was a hypothesis test to examine whether the difference between the mean travel time of the reference data and the Mobilizer output data was statistically significant or due to random factors. To determine the significance of the mean difference, three significance levels were utilized: 90 percent, 95 percent, and 99 percent. The formula is

$$\hat{S} = \sqrt{\left(\frac{S_r}{n_r}\right)^2 + \left(\frac{S_m}{n_m}\right)^2}$$

where s_r and s_m are the standard deviations of the reference data and the Mobilizer data, and n_r and n_m are the sizes of the reference data and the Mobilizer data. To prove that the difference in means was statistically significant at the 99 percent significance level, the means had to differ by more than $2.58\hat{S}$ or

$$\bar{x}_r - \bar{x}_m > 2.58\hat{S}$$

At the 95 percent significance level, the means had to differ by more than $1.96\hat{S}$ or

$$\bar{x}_r - \bar{x}_m > 1.96\hat{S}$$

A the 90 percent significance level, the means had to differ by more than $1.64\hat{S}$ or

$$\bar{x}_r - \bar{x}_m > 1.64\hat{S}$$

VALIDITY CONCERNS

The project was set up to evaluate the effects of several combinations of variables on the operation and accuracy of the Mobilizer. Video segments of 10 minutes were carefully selected to provide a broad range of tests to evaluate. The project did not evaluate the system's effectiveness over an extended period, so measurements of long-term reliability and capability to adjust for varying flow/environmental conditions were made. The reference data for the project were considered very reliable because they were collected by manual methods. Aggregated system error from coordinating the operation of the Mobilizer with time stamped video was estimated to be minimal, say +/- 1 or 2 seconds.

The decision by the project team to utilize video from existing freeway surveillance cameras, with AGC enabled, may have negatively affected the results somewhat. Other image processing projects [Cottrell 1994] encountered significant problems when attempting this.

TEST PLAN

Tests under this project focused on two goals. The first goal was to become familiarized with the procedures for operating the Mobilizer and for extracting statistical output from the system. The procedure included varying the width of the system lane geometry to determine an optimum geometric setup for the functional tests.

The second goal of this analysis was to evaluate the effectiveness of the Mobilizer in producing accurate volume and travel time data under a variety of operational parameters (refer to Table 1).

RESULTS AND INTERPRETATION

TEST CONDITIONS

Condition Monitoring Systems is continuing to modify existing software and develop new modules of the Mobilizer system. For this report, the software utilized was MATS versus 3.2a and SSI versus 4.1a. The software provided the current version of CMS' tracker and shadow algorithms. It did not include the algorithms to provide a direct-measure section density, nor did it include CMS' most current link-time estimator algorithms. As a result, density measure comparisons are not discussed in this report. These comparisons may be made in a future research project that evaluates the Mobilizer with improved software.

CMS provided the aforementioned software upgrades in mid-February 1995 to perform initial testing. A problem arose related to the upgrades in that the system could not process live video (the system considered live video to be direct feed from cameras or VCR). The problem could not be corrected before testing began, so video segments were digitized to the computer's hard disk and then processed through the Mobilizer. This added step extended the testing period but should not have affected the accuracy of the system output. All other test procedures outlined in Chapter 3 were adhered to.

CMS representatives were not on site during the testing period. MATS parameters specific to the test design (e.g., equipment, video) had previously been set by the developers. The project team did not adjust these parameters during the test period.

The system's sensitivity to lane geometry (defined by the user) was evaluated under two scenarios: moderate and heavy flow conditions, under sunny conditions (with scene shadows). Within the system's Roadway Geometry definer, two different lane widths were implemented. The wide lane definition was established as approximately equivalent to the width of a typical

vehicle within the field of view. The narrow lane definition used was one-half to two-thirds the width of a typical vehicle. These conditions were expected to effectively test the system's output with respect to different lane width definitions. The comparison was based on aggregate volume data from five freeway lanes (the entire roadway section).

RESULTS

The Mobilizer system was reasonably easy to operate. Defining the lane geometry proved to be the only system preparation that required a lot of time to accomplish. An inexperienced user may need up to one-half hour to use the definer to establish lane geometry parameters for a five-lane section. A more experienced user may reduce this time to no more than 15 minutes.

Lane Geometry

Figure 7 and Figure 8 show the results from the lane geometry tests. There did not appear to be a significant difference in accuracy of data relative to different lane geometry definitions. Similarly, there was no significant difference in results for the different flow conditions tested.

One qualification is that several MATS parameters could potentially be modified, so the results could differ if particular MATS parameters were modified. However, the point of the tests performed is that with the parameters that CMS set for the initial testing, the lane definitions utilized yielded similar accuracy results. Therefore, the researchers decided to utilize the narrower of the lane definitions for further testing, thereby reducing the potential for lane spillover (that is, the same vehicle tracking through multiple lanes because of skewed video perspective).

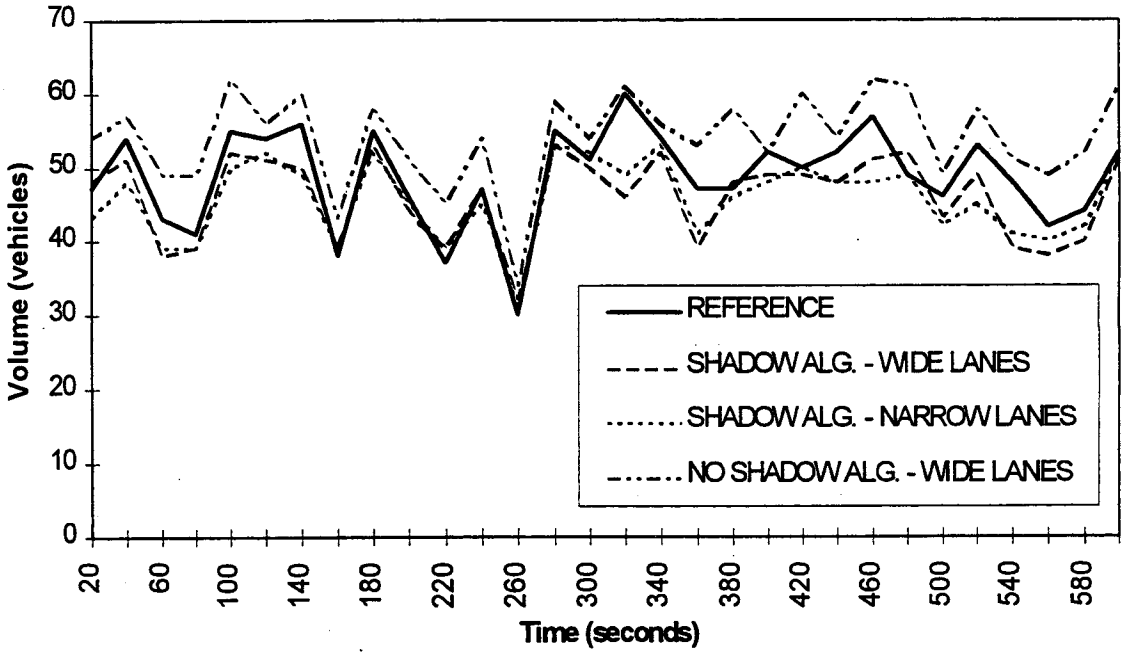


Figure 7. Lane Geometry Comparison

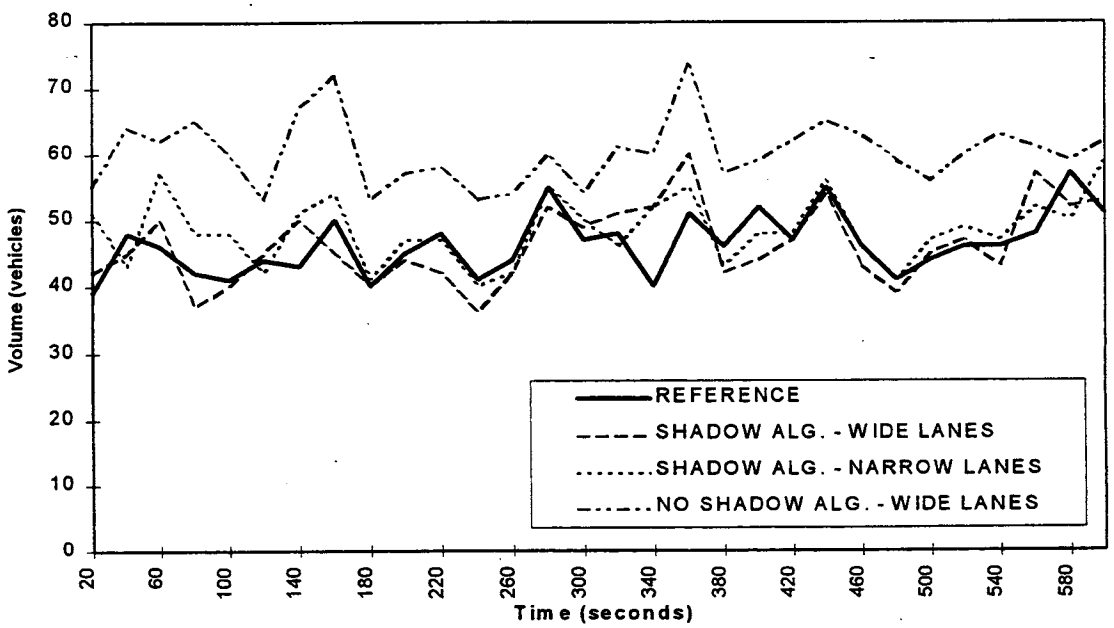


Figure 8. Lane Geometry Comparison

Volume Output

Summary results of the Mobilizer vehicle counts output are provided in Table 4. Generally, the results indicated accuracy of 90+ percent for all conditions for 10-minute aggregations. The exception was test #12, which evaluated the system's ability to process a heavily congested freeway section under poor environmental conditions (rain, dusk transition).

The least accurate of the three flow conditions tested was the moderate flow condition. Traffic flow under this condition tends to be more turbulent, transitioning between high speed, high volume, moderate headway flow and lower speed, high volume, short headway flow. The expectation was that lane 1 would yield more accurate results than lanes 3 and 4 because of the reduced skew of the video perspective. For low flow conditions, the difference was not distinguishable. In the absence of severe congestion conditions, the expectation was fulfilled under moderate to high flow conditions Figures 9 through 11 show this result for 20-second data (test #7).

Table 4. Test Results - Volumes

Test #	Flow Element	Environment	# Lanes	Reference Vol.	Diff.	% Error
1	**Low**	**Sun, Clear**	**5**	**1031**	**64**	**6**
2	Low	Overcast (full)	2	263	25	10
3	Low	Partly Overcast	2	318	29	9
4	Low	Rain	2	343	37	11
5	Low	Fog	2	269	29	11
6	**Moderate**	**Sun, Clear**	**5**	**1462**	**127**	**9**
7	Moderate	Overcast (full)	3	962	97	10
8	Moderate	Partly Overcast	3	709	81	11
9	Moderate	Rain	3	801	133	17
10	**High**	**Sun, Clear**	**5**	**1391**	**171**	**12**
11	High	Overcast (full)	3	783	56	7
12	High	Rain, dusk trans.	3	734	319	43

Reference Vol. = Manually collected data volumes
Diff. = Mobilizer - Reference
% Error = [Diff. / Reference] x 100

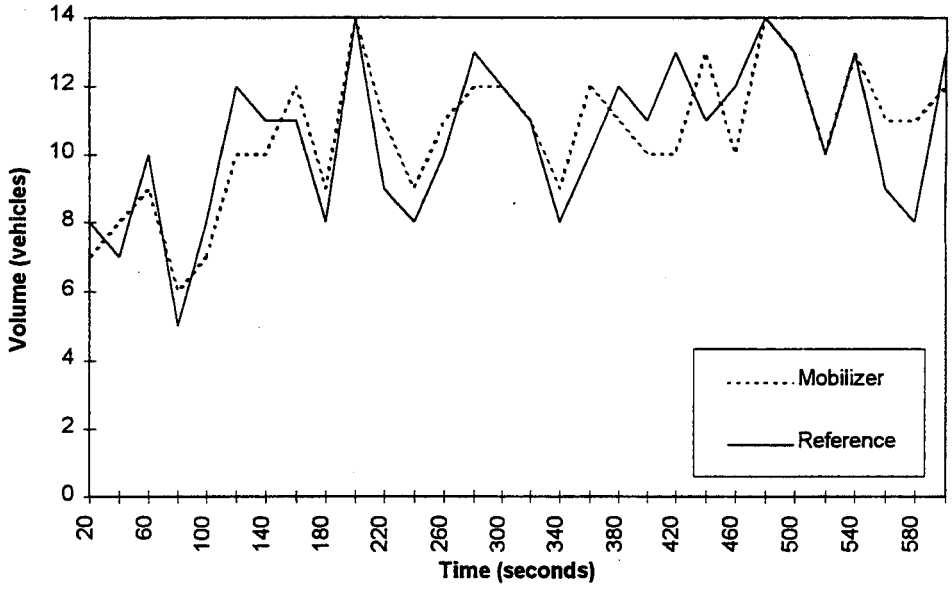


Figure 9. Volume Comparison - Lane 1

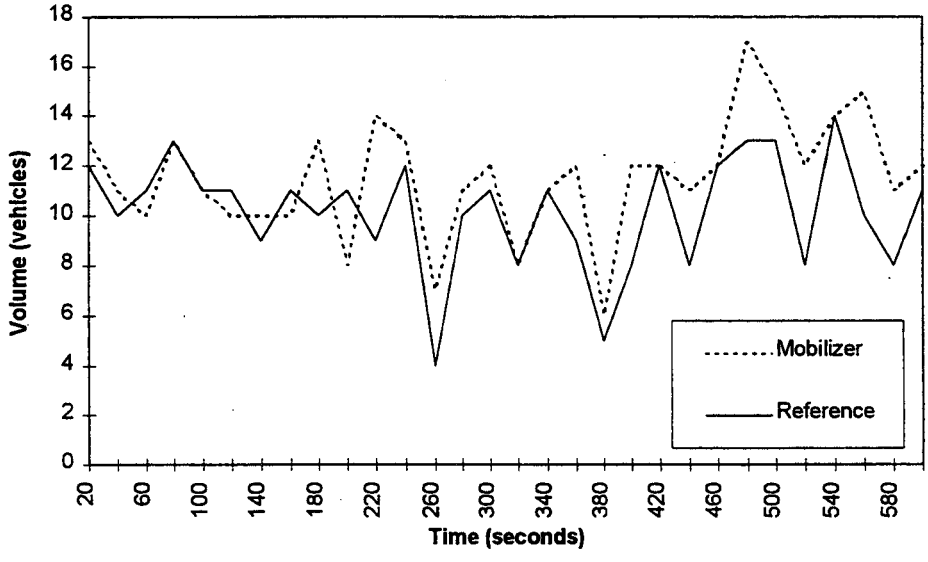


Figure 10. Volume Comparison - Lane 3

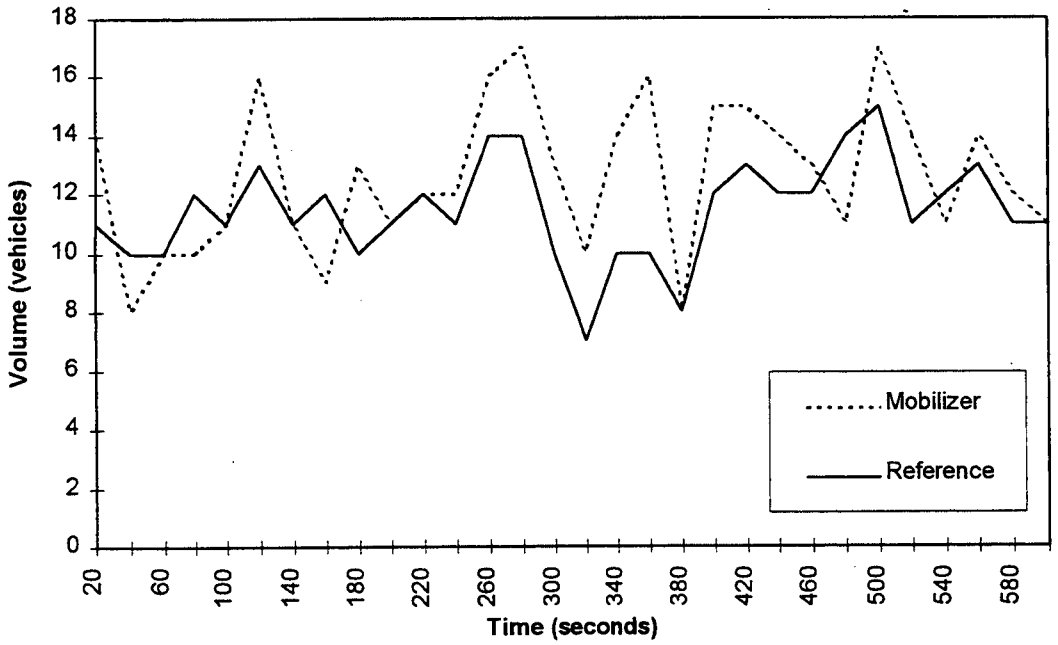


Figure 11. Volume Comparison - Lane 4

Weather elements (vehicular shadows, moving cloud shadows, wet pavement reflections, fog) had varying effects, depending on the flow condition. Rain and fog caused some deterioration of accuracy under low flow conditions. In particular, the fog segment analyzed (test #5) shows a significant difference between the results of lane 1 and lane 4. This is explained by the fact that the camera angle had an effect on visibility through the fog cover. Lane 4 was somewhat easier to see than lane 1 in the background of the image. The results appear to reflect this. Reflections on wet pavement under rain conditions also adversely affected the system accuracy. This is reflected in Figure 12 and Figure 13 (test #9).

Combinations of more severe weather elements (rain, moving clouds) and severe fluctuations in congestion levels caused the system some problems. Figure 14 and Figure 15 (test #10) show an example of this. For lane 1, the 20-second graph indicates the system's slow reaction to a small shock wave (approximately at 320 seconds). For lane 4, the graph indicates a severe reaction to a cloud moving through a bright field of view (the initial 60 seconds of the video segment). In these cases, and others observed, the system was slow to adjust to the sudden condition change, either induced by severe fluctuation in traffic flow or severe change in weather elements. However, note that the video test segments were obtained from a less than ideal camera angle and with the camera's AGC function enabled. Given these factors, the system adjusted fairly well.

The Mobilizer processor was not able to eliminate double-counting of larger vehicles (spillover into adjacent lanes), although narrowing the lane width definitions helped alleviate the problem somewhat. To investigate this further, the individual vehicle detection output for the low flow (sun) condition was analyzed to determine how many false detections occurred and how many vehicle detections were missed. Additionally, the number of trucks and the number of vehicles that

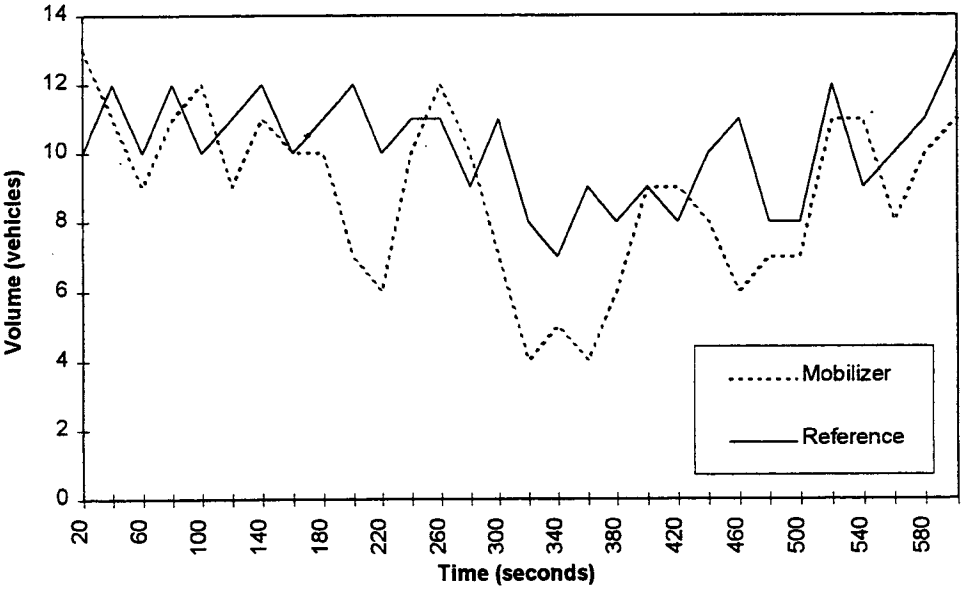


Figure 12. Volume Comparison - Lane 1

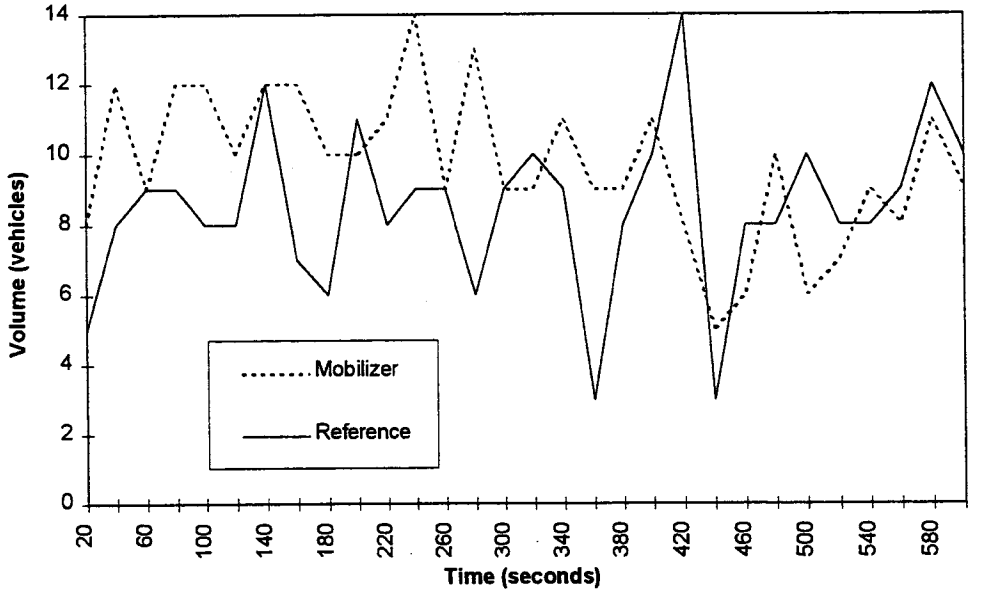


Figure 13. Volume Comparison - Lane 4

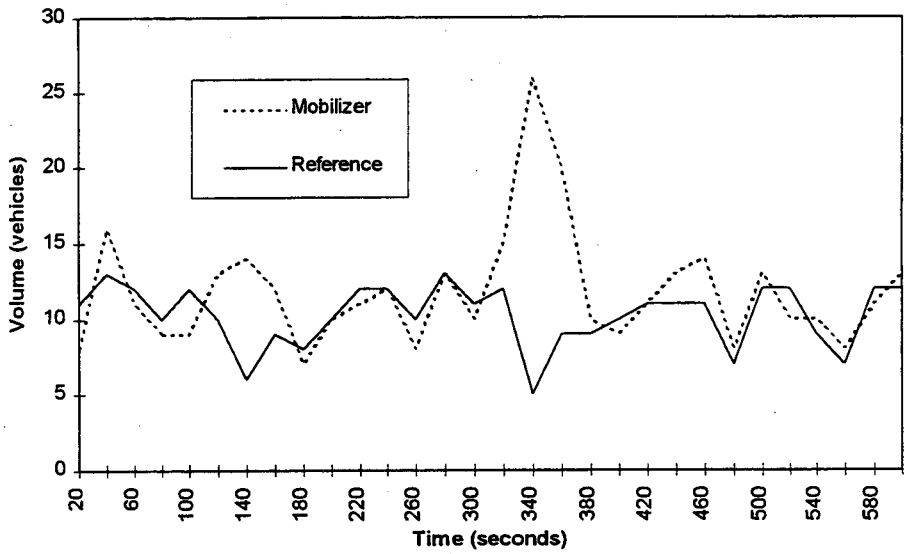


Figure 14. Volume Comparison - Lane 1

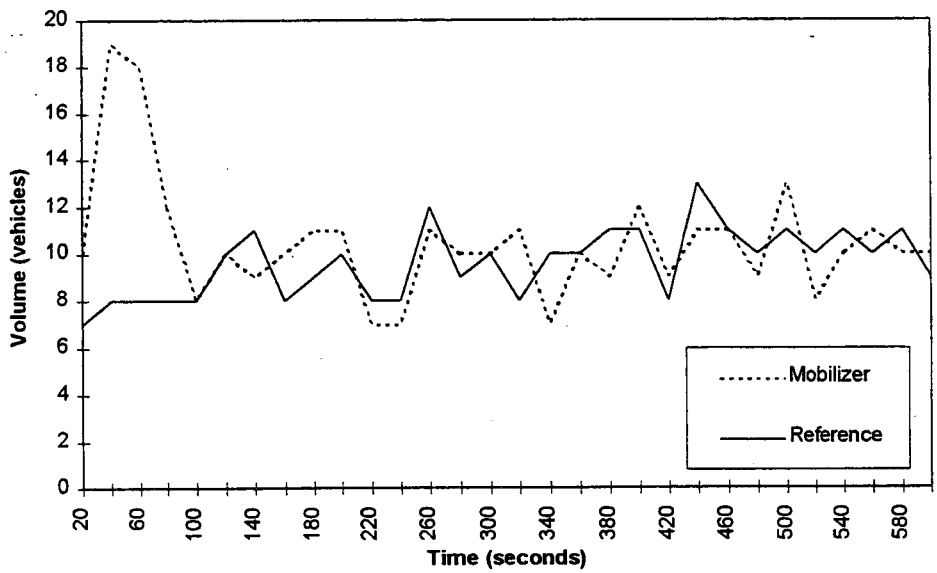


Figure 15. Volume Comparison - Lane 4

had not been detected by the system were recorded for each evaluated lane. For the latter, only three vehicles in lane 2 and three motorcycles in lane 1 appeared to have not been tracked (the vehicle contained within the white box as it moved through the field). The results of the analysis are included in Table 5.

Because of the camera perspective, trucks in adjacent lanes had an increasing effect on false detection errors from lane 1 to lane 4. Lane 1 was not affected by adjacent lane trucks, while lane 4 was severely affected by adjacent lane trucks. Every truck in lane 3 (19 total) appeared to be double-counted in lane 4.

The most interesting data from this analysis was the total number of missed detections for all lanes, and in particular for lanes 1 and 2. Visual observation of vehicle tracks when the Mobilizer was processing, suggested that all but six vehicles had been tracked in lanes 1 and 2; however, the system output did not reflect this. CMS staff expected that the unusual results were due to an insufficient capture zone for vehicle tracks. The project team did not have time to verify this with additional trials, but the problem should be noted for further investigation.

Several video segments (test #4, #7, and #9) were analyzed with and without the shadow algorithm enabled. Each of these either had periods in which significant shadows were present or conditions in which shadows were minimally visible (e.g., under overcast skies). The better of the two analysis results for these tests appear in Table 4. Generally, the magnitude of the cumulative error was similar for each of the two tests, with the difference being either under-counts or over-counts (minus error or plus error).

Table 5. Error Analysis, Low Flow Condition

Reference Data			False Detect.		Missed Detect.		Combined
LANE #	VOLUME	# TRUCKS	TOTAL	% ERROR	TOTAL	% ERROR	% ERROR
1	206	17	2	1	19	-9	-8
2	234	16	4	2	18	-8	-6
3	263	19	12	5	6	-2	3
4	241	9	19	8	13	-5	3

Test element #12 was an interesting segment to evaluate because it introduced several problem conditions within the video scene. The video contained rain, wet pavement, heavy congestion, and transitional light (dusk). The results were significantly worse than the other test segments analyzed. Note that the Mobilizer only contained a daylight algorithm. The video segment will be reanalyzed when CMS produces additional algorithms.

Travel Time

The Mobilizer did not produce sufficient data after all selected video segments had been processed through the system (see the appendix). As mentioned previously, analyses of the statistical significance of sample sizes and mean differences would have been meaningless and were not included in this report.

Low Flow. The success of the Mobilizer in reporting 1-minute travel time data and the number of valid hits are shown in the appendix. Table 6 provides a summary of the travel time data. They are 10-minute average differences of the absolute values of the 1-minute difference in the appendix. Table 7 provides the 10-minute average for the number of valid hits.

Table 6. Ten-minute Average Difference for Travel Time in the Low Flow Condition

Environment	Reference Travel Time (seconds)	Raw difference (seconds)	Percentage Error (%)
Sun, Clear	47	4	10
Overcast	50	2	5
Rain	46	5	10
Moving Clouds	45	7	15

Table 6 indicates a travel time accuracy of 90+ percent for all weather conditions except the moving cloud condition (15 percent error). A representative from Condition Monitoring Systems explained that the moving cloud condition causes many detection errors, and the current version of the Mobilizer is unable to report accurate results [Dermer 1995]. Among the four weather conditions, the overcast condition, which included clear sky and no shadows, gave the most accurate result (5 percent of error) and met the evaluation criteria (+/- 5 percent).

The travel time estimate, as illustrated above, was sufficiently accurate under the low flow condition for the following reasons:

1. The low flow traffic was steady and the travel time data were reasonably constant.
2. The initial travel time estimate assigned by the author was an average of the reference travel time data.
3. The filtering process threw out all extreme and unrealistic travel time data.

Therefore, the estimated travel time was considerably close to the reference data.

The results in Table 7 indicate that the system was able to track some vehicles under sun, overcast, and rain conditions. In the sun condition, two valid hits were reported and they met the evaluation criteria of two hits/min/lane. Again, the results showed that the Mobilizer was unable to handle moving clouds, and zero valid hits were reported under that condition.

Table 7. Ten-minute Average for Number of Valid Hits in the Low Flow Condition

Environment	Reference Population (vehicle/min/lane)	Number of Valid Hits (vehicle/min/lane)
Sun, Clear	20	2
Overcast	18	1
Rain	14	1
Moving Clouds	18	0

Table 8 shows the system travel time for each individual hit under the overcast condition. At time period 8, four hits were reported. The range of travel time was from 19 seconds (0.7/9*3600 = 132 mph) to 80 seconds (0.7/80*3600 = 31 mph) and was irrelevant to the low flow condition. However, the Mobilizer reported all these four hits as valid hits. When the entry times of these four hits at the measurement point were compared with the reference data, none of these hits were determined valid (see the appendix).

Although there were huge errors in the individual hits, the overcast condition still yielded the most accurate results in travel time estimate, as indicated in Table 6 (5 percent of error). Again, the filtering process threw out all extreme and unrealistic travel time data before it reported the estimated travel times.

Table 8. Mobilizer Travel Time Data for Each Individual Hit - Lane 1, Overcast, Low Flow

Time Period	Source Time Tag	Measurement Time Tag	Travel Time (seconds)
8	851.28	886.32	35
	834.34	887.43	53
	826.34	906.7	80
	883.09	902.25	19
9	898.57	939.9	41
10	-	-	-
11	1063.45	1090.96	28

Table 9 and Table 10 show the five-lane comparison of absolute travel time difference and number of valid hits under the sun, low flow condition. Lane 3 had the highest average percentage difference in mean travel time (30 percent) and the fewest valid hits (4). Lane 5 had the lowest average percentage difference in mean travel time (3 percent) and the most valid hits (31).

Table 9. Lane Comparison for Travel Time - Sun, Low Flow

	Absolute Percentage Error (%)				
Time Period	**Lane 1**	**Lane 2**	**Lane 3**	**Lane 4**	**Lane 5**
1	0	5	19	2	2
2	3	3	33	3	2
3	4	3	25	8	2
4	6	6	24	2	4
5	1	3	29	9	3
6	5	2	24	5	3
7	3	10	34	11	3
8	7	11	46	17	7
9	6	9	36	16	3
10	4	4	30	9	2
Absolute Average Percentage Error (%)	**4**	**6**	**30**	**8**	**3**

Table 10. Lane Comparison for Number of Hits - Sun, Low Flow

	Number of Valid Hit (vehicle/min/lane)				
Time Period	**Lane 1**	**Lane 2**	**Lane 3**	**Lane 4**	**Lane 5**
1	0	0	0	2	1
2	1	1	1	1	4
3	1	1	0	1	3
4	1	1	0	0	2
5	4	0	0	4	5
6	0	0	0	3	9
7	6	4	1	9	2
8	0	1	2	2	1
9	2	0	0	1	3
10	1	0	0	4	1
Total number of Valid Hits (vehicle/10 min/lane)	**16**	**8**	**4**	**29**	**31**

The results in Table 9 and Table 10 indicate that lane 3 yielded more inaccurate results than other lanes in the low flow condition. The inaccurate results were due to the skewed camera angles on both the source and measurement points, which caused false detection when vehicles spilled over into adjacent lanes. However, the current version of Mobilizer did not have the capability to resolve these detection errors [Dermer 1995].

Lanes 4 and 5 yielded more accurate results, despite the camera view angles. Most of the vehicles in lanes 4 and 5 did not change lanes, and they may have provided more opportunities for linking. On the other hand, lanes 1, 2 and 3 contained more weaving vehicles and provided fewer opportunities for linking.

Moderate Flow. In the sun, clear condition, the Mobilizer was unable to track any vehicle, and the travel time was never updated. The travel time remained at 88 seconds, which was the initial estimate assigned by the researchers throughout the 10-minute period (appendix). Thus, Table 11 and Table 12 show irrelevant travel time differences and zero valid hits.

The current version of Mobilizer could not handle moderate flow conditions. Shock waves caused the system to fall out of synchronization, and the system was unable to recover after this occurred [Dermer 1995].

Table 11. Ten-minute Average Difference for Travel Time in the Moderate Flow Condition

Environment	Reference Travel Time (seconds)	Raw difference (seconds)	Percentage Error (%)
Sun, Clear	87	--	--

Table 12. Ten-minute Average for Number of Valid Hits in the Moderate Flow Condition

Environment	Reference Population (vehicle/min/lane)	Number of Valid Hits (vehicle/min/lane)
Sun, Clear	17	0

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The volume output of the Mobilizer was moderately accurate for low and moderate flow conditions under a wide range of environmental combinations. For high flow conditions, the Mobilizer was not very accurate under any environmental conditions. The system had significant problems adjusting to severe variances in scene light levels and congestion levels. Additionally, given limited analysis, the system did not appear to eliminate double-counts of larger trucks that resulted from a skewed camera perspective. Because the system was a prototype under continued development, it would have been beneficial to have CMS representatives on site during the tests to troubleshoot system problems and to adjust the operating parameters for optimum results. CMS has improved upon the system's reliability with the latest software upgrade, but its operation can still be unpredictable. CMS expects that the next software release will include improved tracker capabilities, which should improve the accuracy of the output.

Given the test setup, the test results provided a solid indication of the system's capability. However, further testing over an extended period is necessary to determine the Mobilizer's value to WSDOT's traffic management system.

The Mobilizer user functions were fairly easy to operate. For each new video segment, set up took no more than one-half hour. The majority of the time was required to define the geometric file, including the capture region, lane boundaries, calibration marks, and car size designations (for video perspective). With some familiarity, an operator could reduce the set-up time to 15 minutes.

PHASE TWO TESTING

The goals of this phase were to study the accuracy of the Mobilizer in measuring travel time for different flow and environmental conditions, and to determine whether the system can track individual vehicles for providing origin-destination (O-D) information. These were accomplished through the analysis of reference data and Mobilizer output data. Since the system did not produce sufficient data for statistical measurement, the analysis focused on the mean travel time differences and number of valid hits reported by the Mobilizer. The analysis results are summarized as follows:

- In the moderate flow condition, the Mobilizer was unable to correlate or track any individual vehicles (zero valid hits) between the camera views, and, therefore, the estimated travel time was irrelevant.
- In the low flow condition, the Mobilizer tracked an average of zero to two vehicles (two valid hits) per minute per lane, and had an accuracy of 90 percent in travel time estimation.
- The system reported zero valid hits under the moving cloud condition and was, therefore, unable to give useful results in travel time estimation.
- The system did not have the ability to resolve detection errors when skewed camera angles caused some vehicles to be detected in adjacent lanes incorrectly.

These results indicate that the tracking ability claimed by the vendor is highly suspect. Since traffic engineers are most interested in utilizing the system to estimate travel time in the moderate/high flow conditions—because low flow traffic is steady and the travel time can be easily calculated manually—the Mobilizer is not very useful for this application.

RECOMMENDATION FOR FURTHER STUDY

Given the outcome of the phase two tests, in particular the travel time estimates, further long-term testing of the Mobilizer system is recommended. Detectors such as the Mobilizer are of interest to WSDOT because of their flexibility for producing multiple traffic measures. Obtaining accurate and comprehensive measures of effectiveness for transportation facilities will continue to be important to regional transportation authorities.

TransNow is expected to fund a research project to continue evaluation of the Mobilizer system and possibly other systems that are capable of measuring travel times. This research project would begin in September 1995. Continued Mobilizer testing should incorporate video from cameras specific for image processing, preferably centered above the roadway. Test elements should include transitional light (dawn and dusk), as well as night conditions, should CMS have developed algorithms by that time.

CMS continues to modify the existing Mobilizer software, including the tracking system and the travel time module. For this report, the Mobilizer did not show credible promise for tracking individual vehicles and estimating travel time. Further reviews and study are necessary to determine the value of the Mobilizer to both WSDOT and the University of Washington (UW). The following are the recommendations on the basis of this research.

- CMS representatives need to be on-site to adjust the system for optimum results.
- CMS needs to provide a user manual explaining all crucial weight factors in the user-defined files.
- The system should be able to meet the two evaluation criteria stated in Chapter 3 in all flow and environmental combinations.
- The system should be able to eliminate detection errors resulting from skew camera angles.

- The system should be able to check all the hits in one of the Mobilizer output files (LTE.DMP) and throw out extreme and unrealistic data.
- In computing individual travel time of the Mobilizer output, source and measurement time tags in the LTE.DMP file should be included in the same line to make the file simple and easy to understand.

As mentioned previously, two other evaluations of the capabilities of various detectors, including VIPS, have recently been completed. Some systems, such as Autoscope, have been shown to produce sufficiently accurate operational and planning traffic data under most environmental conditions. It is the authors' recommendation that continued research focus on detector systems that may assist in meeting regional data needs for congestion monitoring. AVI technology appears to be the long-term detector focus for future congestion monitoring requirements. However, implementation of comprehensive AVI monitoring along the Puget Sound region's primary transportation routes will take time. Congestion monitoring will require collection and evaluation of various traffic measures of effectiveness such as travel time and vehicle-hours of delay. Several detector technologies have the potential to provide traffic measures that can be utilized for ongoing traveler information programs, as well as for providing data for congestion monitoring. For instance, low-cost devices that provide accurate speed measurements and video image processing systems that can link multiple vehicle sightings are of interest.

Further study beyond this report should re-evaluate the accuracy of the Mobilizer data for volume, density, and travel time measurements. The authors' recommendation for further traffic detector testing and evaluation is to assess one or two speed/volume detectors such as radar or acoustic, assess one or two license plate tracking systems, and continue evaluation of the Mobilizer (further testing structured from results of initial testing). Evaluation reports by Hughes

Aircraft Corp. and Caltrans (available by mid-1995) should be carefully reviewed before candidate detector technologies are selected.

ACKNOWLEDGMENTS

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APPENDIX

Field Travel Time Data Tests on I-5:

Mobilizer Data Sets Versus True Data Sets

Travel Time of Tape Lane 1 (9/23/94)

Date: 9/23/94
Time: 15:10 - 15:20
Conditions: SUNNY, LOW FLOW

	Start Time on 117th	Stop Time on 130th	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	09:09	10:00	00:51					
2	09:11	10:04	00:53					
3	09:13	10:06	00:53					
4	09:14	10:07	00:53					
5	09:17	10:09	00:52					
6	09:19	10:11	00:52					
7	09:20	10:11	00:51					
8	09:21	10:12	00:51					
9	09:23	10:14	00:51					
10	09:26	10:15	00:49					
11	09:25	10:16	00:51					
12	09:27	10:17	00:50					
13	09:33	10:26	00:53					
14	09:34	10:28	00:54					
15	09:40	10:32	00:52					
16	09:42	10:35	00:53					
17	09:43	10:37	00:54					
18	09:44	10:38	00:54					
19	09:47	10:40	00:53					
20	09:51	10:43	00:52					
21	10:01	10:55	00:54					
22	10:05	10:57	00:52					
23	10:06	10:59	00:53	23	00:52	00:01.3	1	1
24	10:08	11:01	00:53					
25	10:14	11:05	00:51					
26	10:15	11:06	00:51					
27	10:24	11:21	00:57					
28	10:25	11:23	00:58					
29	10:30	11:26	00:56					
30	10:33	11:27	00:54					
31	10:40	11:38	00:58					
32	10:43	11:42	00:59					
33	10:45	11:48	01:03					
34	10:57	11:54	00:57					
35	10:59	11:51	00:52					
36	11:00	11:56	00:56					
37	11:11	11:57	00:46					
38	11:18	11:59	00:41	15	00:54	00:02.8	9	6
39	11:19	12:07	00:48					
40	11:24	12:10	00:46					
41	11:24	12:11	00:47					
42	11:29	12:20	00:51					
43	11:31	12:23	00:52					
44	11:31	12:25	00:54					
45	11:37	12:27	00:50					
46	11:38	12:29	00:51					
47	11:39	12:31	00:52					
48	11:40	12:33	00:53					
49	11:46	12:36	00:50					
50	11:48	12:39	00:51					
51	11:50	12:41	00:51					
52	11:53	12:43	00:50					
53	12:04	12:54	00:50	15	00:50	00:02.1	4	3

54	12:10	13:06	00:56					
55	12:11	13:07	00:56					
56	12:17	13:08	00:51					
57	12:20	13:12	00:52					
58	12:21	13:13	00:52					
59	12:24	13:16	00:52					
60	12:40	13:34	00:54					
61	12:40	13:35	00:55					
62	12:44	13:39	00:55					
63	12:47	13:44	00:57					
64	12:49	13:46	00:57					
65	12:51	13:47	00:56					
66	12:52	13:49	00:57					
67	12:53	13:50	00:57					
68	13:00	13:54	00:54					
69	13:06	13:58	00:52	16	00:55	00:02.1	4	3
70	13:08	14:02	00:54					
71	13:10	14:03	00:53					
72	13:16	14:08	00:52					
73	13:17	14:09	00:52					
74	13:20	14:17	00:57					
75	13:24	14:18	00:54					
76	13:30	14:23	00:53					
77	13:32	14:24	00:52					
78	13:35	14:28	00:53					
79	13:40	14:30	00:50					
80	13:43	14:33	00:50					
81	13:45	14:37	00:52					
82	13:48	14:40	00:52					
83	13:52	14:43	00:51					
84	13:57	14:47	00:50					
85	14:03	14:48	00:45					
86	14:04	14:57	00:53					
87	14:05	14:58	00:53	18	00:52	00:02.4	4	3
88	14:09	15:02	00:53					
89	14:10	15:04	00:54					
90	14:13	15:05	00:52					
91	14:16	15:06	00:50					
92	14:22	15:11	00:49					
93	14:26	15:12	00:46					
94	14:29	15:15	00:46					
95	14:36	15:23	00:47					
96	14:40	15:36	00:56					
97	14:46	15:39	00:53					
98	14:47	15:39	00:52					
99	14:49	15:41	00:52					
100	14:55	15:45	00:50					
101	14:57	15:46	00:49					
102	14:58	15:48	00:50					
103	15:00	15:52	00:52					
104	15:02	15:53	00:51					
105	15:04	15:57	00:53					
106	15:05	15:59	00:54	19	00:51	00:02.7	9	6
107	15:08	16:00	00:52					
108	15:12	16:05	00:53					
109	15:13	16:06	00:53					
110	15:16	16:08	00:52					

111	15:18	16:11	00:53					
112	15:20	16:14	00:54					
113	15:20	16:15	00:55					
114	15:22	16:17	00:55					
115	15:23	16:18	00:55					
116	15:28	16:21	00:53					
117	15:30	16:24	00:54					
118	15:52	16:45	00:53					
119	15:58	16:46	00:48					
120	16:05	16:53	00:48					
121	16:10	16:55	00:45	15	00:52	00:02.8	9	6
122	16:10	17:02	00:52					
123	16:11	17:03	00:52					
124	16:13	17:04	00:51					
125	16:17	17:10	00:53					
126	16:20	17:11	00:51					
127	16:23	17:14	00:51					
128	16:30	17:17	00:47					
129	16:32	17:18	00:46					
130	16:36	17:22	00:46					
131	16:37	17:24	00:47					
132	16:37	17:25	00:48					
133	16:38	17:26	00:48					
134	16:45	17:32	00:47					
135	16:48	17:38	00:50					
136	16:49	17:40	00:51					
137	16:50	17:40	00:50					
138	16:53	17:41	00:48					
139	17:02	17:47	00:45					
140	17:04	17:48	00:44	19	00:49	00:02.6	9	6
141	17:10	18:01	00:51					
142	17:13	18:03	00:50					
143	17:20	18:07	00:47					
144	17:23	18:11	00:48					
145	17:24	18:13	00:49					
146	17:34	18:22	00:48					
147	17:36	18:25	00:49					
148	17:39	18:26	00:47					
149	17:41	18:31	00:50					
150	17:42	18:32	00:50					
151	17:46	18:35	00:49					
152	17:47	18:37	00:50					
153	17:51	18:40	00:49					
154	17:56	18:44	00:48					
155	17:57	18:44	00:47	15	00:49	00:01.2	1	1
156	18:09	19:00	00:51					
157	18:10	19:01	00:51					
158	18:13	19:02	00:49					
159	18:14	19:04	00:50					
160	18:15	19:05	00:50					
161	18:17	19:06	00:49					
162	18:21	19:13	00:52					
163	18:23	19:15	00:52					
164	18:29	19:18	00:49					
165	18:30	19:20	00:50					
166	18:48	19:36	00:48					
167	18:49	19:37	00:48					

168	18:57	19:47	00:50					
169	19:01	19:51	00:50					
170	19:04	19:53	00:49					
171	19:06	19:56	00:50					
172	19:08	19:59	00:51	17	00:50	00:01.2	1	1

Average = 00:51

Travel Time of Tape Lane 2 (9/23/94)

1 1
4 3
9 6
15 11

Time: 15:10 - 15:20
Conditions: SUNNY, LOW FLOW

	Start Time on 117th	Stop Time on 130th	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	09:09	10:05	00:56					
2	09:19	10:10	00:51					
3	09:20	10:11	00:51					
4	09:27	10:16	00:49					
5	09:17	10:19	01:02					
6	09:25	10:24	00:59					
7	09:30	10:26	00:56					
8	09:31	10:28	00:57					
9	09:33	10:29	00:56					
10	09:36	10:32	00:56					
11	09:39	10:33	00:54					
12	09:40	10:34	00:54					
13	09:48	10:39	00:51					
14	09:51	10:43	00:52					
15	10:01	10:45	00:44					
16	09:57	10:48	00:51					
17	10:02	10:51	00:49					
18	10:05	10:56	00:51					
19	10:07	10:58	00:51	19	00:53	00:04.0	15	11
20	10:12	11:04	00:52					
21	10:15	11:07	00:52					
22	10:17	11:09	00:52					
23	10:20	11:12	00:52					
24	10:27	11:17	00:50					
25	10:31	11:21	00:50					
26	10:41	11:31	00:50					
27	10:45	11:36	00:51					
28	10:50	11:46	00:56					
29	10:53	11:49	00:56					
30	10:59	11:53	00:54					
31	11:01	11:54	00:53	12	00:52	00:02.0	4	3
32	11:13	12:00	00:47					
33	11:15	12:05	00:50					
34	11:16	12:06	00:50					
35	11:21	12:16	00:55					
36	11:24	12:22	00:58					
37	11:26	12:23	00:57					
38	11:33	12:29	00:56					
39	11:35	12:30	00:55					
40	11:39	12:33	00:54					
41	11:40	12:34	00:54					
42	11:44	12:36	00:52					
43	11:46	12:38	00:52					
44	11:49	12:40	00:51					
45	11:56	12:41	00:45					
46	11:58	12:44	00:46					
47	12:00	12:47	00:47					
48	12:05	12:56	00:51					
49	12:09	12:59	00:50	18	00:52	00:03.7	15	11
50	12:13	13:04	00:51					

51	12:19	13:11	00:52					
52	12:22	13:12	00:50					
53	12:25	13:16	00:51					
54	12:30	13:27	00:57					
55	12:32	13:30	00:58					
56	12:33	13:31	00:58					
57	12:35	13:33	00:58					
58	12:41	13:35	00:54					
59	12:45	13:36	00:51					
60	12:48	13:40	00:52					
61	12:51	13:42	00:51					
62	12:52	13:44	00:52					
63	12:54	13:45	00:51					
64	12:57	13:47	00:50					
65	12:58	13:48	00:50					
66	12:59	13:50	00:51					
67	13:01	13:52	00:51					
68	13:04	13:53	00:49					
69	13:05	13:58	00:53	20	00:53	00:02.8	9	6
70	13:15	14:00	00:45					
71	13:16	14:02	00:46					
72	13:20	14:11	00:51					
73	13:27	14:15	00:48					
74	13:28	14:17	00:49					
75	13:31	14:22	00:51					
76	13:33	14:23	00:50					
77	13:41	14:28	00:47					
78	13:42	14:32	00:50					
79	13:44	14:33	00:49					
80	13:46	14:34	00:48					
81	13:48	14:36	00:48					
82	13:51	14:38	00:47					
83	13:54	14:45	00:51					
84	13:56	14:46	00:50					
85	13:57	14:47	00:50					
86	14:00	14:49	00:49					
87	14:01	14:50	00:49					
88	14:09	14:55	00:46	19	00:49	00:01.8	4	3
89	14:16	15:05	00:49					
90	14:18	15:09	00:51					
91	14:27	15:16	00:49					
92	14:29	15:19	00:50					
93	14:31	15:23	00:52					
94	14:32	15:24	00:52					
95	14:34	15:26	00:52					
96	14:38	15:29	00:51					
97	14:41	15:32	00:51					
98	14:45	15:38	00:53					
99	14:47	15:39	00:52					
100	14:54	15:43	00:49					
101	14:55	15:45	00:50					
102	14:57	15:47	00:50					
103	15:01	15:49	00:48					
104	15:02	15:51	00:49					
105	15:03	15:53	00:50					
106	15:01	15:55	00:54					
107	15:10	15:57	00:47	19	00:50	00:01.7	4	3

108	15:12	16:01	00:49					
109	15:14	16:04	00:50					
110	15:20	16:07	00:47					
111	15:22	16:10	00:48					
112	15:23	16:10	00:47					
113	15:26	16:13	00:47					
114	15:27	16:17	00:50					
115	15:28	16:18	00:50					
116	15:30	16:21	00:51					
117	15:38	16:24	00:46					
118	15:48	16:31	00:43					
119	15:49	16:34	00:45					
120	15:54	16:36	00:42					
121	15:55	16:38	00:43					
122	16:02	16:44	00:42					
123	16:06	16:46	00:40					
124	16:13	16:49	00:36					
125	16:02	16:55	00:53	18	00:46	00:04.2	15	11
126	16:15	17:03	00:48					
127	16:17	17:04	00:47					
128	16:19	17:08	00:49					
129	16:26	17:13	00:47					
130	16:31	17:17	00:46					
131	16:27	17:15	00:48					
132	16:32	17:18	00:46					
133	16:38	17:22	00:44					
134	16:41	17:26	00:45					
135	16:45	17:31	00:46					
136	16:53	17:39	00:46					
137	16:54	17:41	00:47					
138	16:56	17:42	00:46					
139	17:00	17:45	00:45					
140	17:03	17:49	00:46					
141	17:08	17:50	00:42					
142	17:12	17:59	00:47	17	00:46	00:01.6	4	3
143	17:16	18:01	00:45					
144	17:17	18:04	00:47					
145	17:20	18:06	00:46					
146	17:22	18:08	00:46					
147	17:28	18:11	00:43					
148	17:30	18:13	00:43					
149	17:33	18:18	00:45					
150	17:45	18:25	00:40					
151	17:39	18:27	00:48					
152	17:41	18:28	00:47					
153	17:42	18:29	00:47					
154	17:46	18:34	00:48					
155	17:49	18:36	00:47					
156	17:50	18:38	00:48					
157	17:57	18:44	00:47					
158	17:59	18:47	00:48					
159	18:04	18:53	00:49	17	00:46	00:02.2	4	3
160	18:19	19:06	00:47					
161	18:20	19:07	00:47					
162	18:21	19:10	00:49					
163	18:29	19:13	00:44					
164	18:31	19:16	00:45					

165	18:32	19:19	00:47					
166	18:33	19:20	00:47					
167	18:35	19:22	00:47					
168	18:38	19:28	00:50					
169	18:40	19:32	00:52					
170	18:52	19:40	00:48					
171	18:58	19:44	00:46					
172	18:59	19:46	00:47					
173	19:06	19:53	00:47					
174	19:07	19:56	00:49					
175	19:10	20:00	00:50	16	00:48	00:01.9	4	3

Average = 00:49

Travel Time of Tape Lane 3 (9/23/94)

Date: 9/23/94
Time: 15:10 - 15:20
Conditions: SUNNY, LOW FLOW

	Start Time on 117th	Stop Time on 130th	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	09:06	10:01	00:55					
2	09:12	10:04	00:52					
3	09:15	10:06	00:51					
4	09:17	10:09	00:52					
5	09:19	10:10	00:51					
6	09:20	10:11	00:51					
7	09:24	10:16	00:52					
8	09:33	10:22	00:49					
9	09:35	10:24	00:49					
10	09:39	10:26	00:47					
11	09:41	10:28	00:47					
12	09:42	10:28	00:46					
13	09:43	10:29	00:46					
14	09:50	10:37	00:47					
15	09:53	10:41	00:48					
16	10:00	10:49	00:49					
17	09:57	10:52	00:55					
18	10:07	10:56	00:49					
19	10:08	10:57	00:49					
20	10:09	10:58	00:49	21	00:50	00:02.6	9	6
21	10:12	11:02	00:50					
22	10:20	11:08	00:48					
23	10:21	11:09	00:48					
24	10:27	11:14	00:47					
25	10:35	11:18	00:43					
26	10:37	11:20	00:43					
27	10:43	11:28	00:45					
28	10:46	11:29	00:43					
29	10:53	11:36	00:43					
30	10:55	11:43	00:48					
31	10:56	11:44	00:48					
32	10:58	11:47	00:49					
33	11:00	11:48	00:48					
34	11:06	11:52	00:46					
35	11:08	11:55	00:47					
36	11:09	11:55	00:46					
37	11:13	11:57	00:44	17	00:46	00:02.3	4	3
38	11:15	12:01	00:46					
39	11:16	12:03	00:47					
40	11:17	12:04	00:47					
41	11:18	12:05	00:47					
42	11:19	12:06	00:47					
43	11:21	12:08	00:47					
44	11:24	12:13	00:49					
45	11:30	12:19	00:49					
46	11:39	12:29	00:50					
47	11:38	12:27	00:49					
48	11:41	12:31	00:50					
49	11:44	12:32	00:48					
50	11:47	12:33	00:46					
51	11:48	12:34	00:46					
52	11:52	12:38	00:46					
53	12:00	12:49	00:49					

54	12:01	12:50	00:49					
55	12:02	12:51	00:49					
56	12:03	12:51	00:48					
57	12:07	12:53	00:46					
58	12:09	12:57	00:48	21	00:48	00:01.3	1	1
59	12:11	13:00	00:49					
60	12:13	13:01	00:48					
61	12:16	13:05	00:49					
62	12:23	13:10	00:47					
63	12:27	13:13	00:46					
64	12:35	13:18	00:43					
65	12:41	13:32	00:51					
66	12:38	13:29	00:51					
67	12:42	13:33	00:51					
68	12:46	13:35	00:49					
69	12:49	13:40	00:51					
70	12:51	13:41	00:50					
71	12:53	13:43	00:50					
72	12:56	13:44	00:48					
73	12:56	13:45	00:49					
74	12:58	13:46	00:48					
75	12:59	13:47	00:48					
76	13:02	13:53	00:51					
77	13:04	13:55	00:51					
78	13:08	13:58	00:50					
79	13:10	13:59	00:49	21	00:49	00:02.0	4	3
80	13:12	14:00	00:48					
81	13:13	14:02	00:49					
82	13:17	14:04	00:47					
83	13:21	14:05	00:44					
84	13:24	14:13	00:49					
85	13:26	14:15	00:49					
86	13:30	14:17	00:47					
87	13:32	14:19	00:47					
88	13:33	14:21	00:48					
89	13:34	14:22	00:48					
90	13:35	14:23	00:48					
91	13:38	14:24	00:46					
92	13:39	14:25	00:46					
93	13:40	14:27	00:47					
94	13:45	14:31	00:46					
95	13:48	14:35	00:47					
96	13:53	14:37	00:44					
97	13:55	14:41	00:46					
98	13:56	14:44	00:48					
99	13:58	14:45	00:47					
100	13:59	14:47	00:48					
101	14:01	14:50	00:49					
102	14:04	14:51	00:47					
103	14:06	14:53	00:47					
104	14:07	14:55	00:48					
105	14:08	14:56	00:48	26	00:47	00:01.3	1	1
106	14:16	15:04	00:48					
107	14:21	15:06	00:45					
108	14:28	15:17	00:49					
109	14:29	15:19	00:50					
110	14:25	15:23	00:58					

111	14:31	15:26	00:55					
112	14:33	15:28	00:55					
113	14:35	15:29	00:54					
114	14:40	15:32	00:52					
115	14:48	15:35	00:47					
116	14:49	15:36	00:47					
117	14:50	15:38	00:48					
118	14:51	15:39	00:48					
119	15:00	15:44	00:44					
120	15:01	15:46	00:45					
121	15:03	15:48	00:45					
122	15:04	15:49	00:45					
123	15:07	15:55	00:48					
124	15:10	15:57	00:47	19	00:49	00:03.9	15	11
125	15:13	16:00	00:47					
126	15:17	16:06	00:49					
127	15:20	16:07	00:47					
128	15:21	16:08	00:47					
129	15:24	16:10	00:46					
130	15:28	16:12	00:44					
131	15:32	16:15	00:43					
132	15:34	16:16	00:42					
133	15:40	16:26	00:46					
134	15:47	16:31	00:44					
135	15:50	16:32	00:42					
136	15:51	16:33	00:42					
137	15:52	16:35	00:43					
138	15:53	16:36	00:43					
139	15:54	16:37	00:43					
140	15:55	16:38	00:43					
141	15:58	16:41	00:43					
142	15:59	16:42	00:43					
143	16:04	16:46	00:42					
144	16:08	16:57	00:49					
145	16:11	16:59	00:48	21	00:45	00:02.4	4	3
146	16:20	17:04	00:44					
147	16:21	17:06	00:45					
148	16:24	17:07	00:43					
149	16:30	17:10	00:40					
150	16:33	17:12	00:39					
151	16:34	17:14	00:40					
152	16:37	17:20	00:43					
153	16:39	17:21	00:42					
154	16:41	17:24	00:43					
155	16:46	17:26	00:40					
156	16:50	17:35	00:45					
157	16:51	17:38	00:47					
158	16:56	17:40	00:44					
159	16:58	17:41	00:43					
160	17:01	17:43	00:42					
161	17:02	17:44	00:42					
162	17:03	17:44	00:41					
163	17:03	17:45	00:42					
164	17:07	17:50	00:43					
165	17:12	17:54	00:42	20	00:42	00:01.9	4	3
166	17:21	18:04	00:43					
167	17:16	18:07	00:51					

168	17:39	18:20	00:41					
169	17:42	18:22	00:40					
170	17:44	18:23	00:39					
171	17:45	18:26	00:41					
172	17:46	18:29	00:43					
173	17:48	18:31	00:43					
174	17:49	18:33	00:44					
175	17:52	18:35	00:43					
176	17:58	18:41	00:43					
177	18:06	18:49	00:43					
178	18:02	18:52	00:50	13	00:43	00:03.3	9	6
179	18:11	19:04	00:53					
180	18:24	19:06	00:42					
181	18:26	19:09	00:43					
182	18:36	19:19	00:43					
183	18:41	19:25	00:44					
184	18:43	19:31	00:48					
185	18:50	19:34	00:44					
186	18:53	19:36	00:43					
187	18:55	19:37	00:42					
188	18:59	19:41	00:42					
189	19:00	19:47	00:47					
190	19:01	19:51	00:50					
191	19:12	19:56	00:44					
192	19:13	19:57	00:44					
193	19:15	19:58	00:43					
194	19:16	19:59	00:43	16	00:45	00:03.1	9	6

Average = 00:47

Travel Time of Tape Lane 4 (9/23/94)

Time: 15:10 - 15:20
Conditions: SUNNY, LOW FLOW

				POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
	Start Time on 117th	Stop Time on 130th	Travel Time					
1	09:08	10:00	00:52					
2	09:09	10:01	00:52					
3	09:11	10:02	00:51					
4	09:14	10:04	00:50					
5	09:18	10:07	00:49					
6	09:19	10:08	00:49					
7	09:21	10:11	00:50					
8	09:22	10:13	00:51					
9	09:26	10:15	00:49					
10	09:28	10:17	00:49					
11	09:30	10:18	00:48					
12	09:32	10:19	00:47					
13	09:36	10:22	00:46					
14	09:38	10:24	00:46					
15	09:39	10:25	00:46					
16	09:41	10:26	00:45					
17	09:42	10:27	00:45					
18	09:43	10:28	00:45					
19	09:44	10:30	00:46					
20	09:48	10:34	00:46					
21	09:49	10:35	00:46					
22	09:54	10:41	00:47					
23	09:56	10:42	00:46					
24	09:57	10:44	00:47					
25	09:59	10:46	00:47					
26	10:00	10:47	00:47					
27	10:00	10:48	00:48					
28	10:01	10:49	00:48					
29	10:03	10:51	00:48					
30	10:04	10:52	00:48					
31	10:05	10:54	00:49					
32	10:07	10:55	00:48					
33	10:08	10:56	00:48					
34	10:08	10:57	00:49					
35	10:09	10:58	00:49	35	00:48	00:01.9	4	3
36	10:14	11:00	00:46					
37	10:16	11:02	00:46					
38	10:17	11:04	00:47					
39	10:18	11:05	00:47					
40	10:20	11:09	00:49					
41	10:22	11:10	00:48					
42	10:27	11:13	00:46					
43	10:28	11:14	00:46					
44	10:33	11:16	00:43					
45	10:34	11:17	00:43					
46	10:40	11:23	00:43					
47	10:41	11:25	00:44					
48	10:42	11:27	00:45					
49	10:45	11:29	00:44					
50	10:46	11:31	00:45					
51	10:50	11:33	00:43					
52	10:52	11:37	00:45					
53	10:53	11:38	00:45					
54	10:56	11:42	00:46					
55	10:56	11:43	00:47					
56	10:58	11:44	00:46					
57	10:59	11:47	00:48					
58	11:00	11:48	00:48					

1 1
4 3
9 6
15 11

59	11:01	11:50	00:49					
60	11:05	11:52	00:47					
61	11:09	11:55	00:46					
62	11:10	11:56	00:46					
63	11:11	11:58	00:47	28	00:46	00:01.7	4	3
64	11:13	12:00	00:47					
65	11:14	12:03	00:49					
66	11:20	12:05	00:45					
67	11:22	12:07	00:45					
68	11:23	12:09	00:46					
69	11:27	12:13	00:46					
70	11:28	12:14	00:46					
71	11:29	12:15	00:46					
72	11:30	12:17	00:47					
73	11:31	12:19	00:48					
74	11:32	12:21	00:49					
75	11:33	12:22	00:49					
76	11:35	12:24	00:49					
77	11:38	12:25	00:47					
78	11:42	12:28	00:46					
79	11:44	12:30	00:46					
80	11:45	12:31	00:46					
81	11:48	12:33	00:45					
82	11:53	12:35	00:42					
83	11:58	12:40	00:42					
84	11:54	12:40	00:46					
85	12:00	12:44	00:44					
86	12:01	12:46	00:45					
87	12:07	12:54	00:47					
88	12:10	12:57	00:47					
89	12:13	12:59	00:46	26	00:46	00:01.8	4	3
90	12:14	13:00	00:46					
91	12:15	13:01	00:46					
92	12:15	13:02	00:47					
93	12:18	13:04	00:46					
94	12:34	13:19	00:45					
95	12:36	13:21	00:45					
96	12:38	13:27	00:49					
97	12:39	13:29	00:50					
98	12:40	13:30	00:50					
99	12:41	13:31	00:50					
100	12:42	13:32	00:50					
101	12:43	13:33	00:50					
102	12:47	13:35	00:48					
103	12:48	13:36	00:48					
104	12:49	13:37	00:48					
105	12:51	13:39	00:48					
106	12:51	13:40	00:49					
107	12:52	13:42	00:50					
108	12:53	13:43	00:50					
109	12:56	13:46	00:50					
110	12:57	13:48	00:51					
111	12:58	13:49	00:51					
112	13:01	13:52	00:51					
113	13:02	13:54	00:52					
114	13:06	13:53	00:47					
115	13:08	13:56	00:48					
116	13:09	13:58	00:49					
117	13:11	13:59	00:48	28	00:49	00:01.9	4	3
118	13:12	14:00	00:48					
119	13:15	14:03	00:48					
120	13:17	14:04	00:47					
121	13:19	14:09	00:50					
122	13:20	14:11	00:51					

123	13:27	14:13	00:46					
124	13:30	14:15	00:45					
125	13:32	14:17	00:45					
126	13:33	14:18	00:45					
127	13:34	14:20	00:46					
128	13:36	14:21	00:45					
129	13:38	14:23	00:45					
130	13:42	14:26	00:44					
131	13:43	14:27	00:44					
132	13:44	14:30	00:46					
133	13:50	14:34	00:44					
134	13:51	14:35	00:44					
135	13:52	14:38	00:46					
136	13:53	14:39	00:46					
137	13:54	14:40	00:46					
138	13:55	14:40	00:45					
139	13:56	14:43	00:47					
140	14:00	14:44	00:44					
141	14:00	14:44	00:44					
142	14:01	14:45	00:44					
143	14:03	14:47	00:44					
144	14:02	14:52	00:50					
145	14:04	14:54	00:50					
146	14:05	14:54	00:49					
147	14:07	14:55	00:48					
148	14:08	14:56	00:48					
149	14:10	14:59	00:49	32	00:46	00:02.1	4	3
150	14:11	15:00	00:49					
151	14:12	15:01	00:49					
152	14:14	15:02	00:48					
153	14:19	15:03	00:44					
154	14:20	15:04	00:44					
155	14:22	15:05	00:43					
156	14:23	15:10	00:47					
157	14:24	15:11	00:47					
158	14:25	15:12	00:47					
159	14:31	15:17	00:46					
160	14:33	15:21	00:48					
161	14:34	15:22	00:48					
162	14:36	15:25	00:49					
163	14:39	15:28	00:49					
164	14:40	15:30	00:50					
165	14:41	15:30	00:49					
166	14:42	15:32	00:50					
167	14:45	15:33	00:48					
168	14:46	15:36	00:50					
169	14:50	15:38	00:48					
170	14:51	15:38	00:47					
171	14:52	15:40	00:48					
172	14:53	15:41	00:48					
173	14:56	15:43	00:47					
174	14:57	15:44	00:47					
175	14:58	15:45	00:47					
176	14:59	15:46	00:47					
177	15:00	15:47	00:47					
178	15:01	15:48	00:47					
179	15:03	15:49	00:46					
180	15:04	15:50	00:46					
181	15:06	15:50	00:44					
182	15:08	15:52	00:44					
183	15:10	15:55	00:45					
184	15:11	15:57	00:46					
185	15:12	15:58	00:46					
186	15:13	15:59	00:46	37	00:47	00:01.8	4	3

187	15:14	16:00	00:46					
188	15:11	16:03	00:52					
189	15:19	16:05	00:46					
190	15:20	16:06	00:46					
191	15:22	16:07	00:45					
192	15:25	16:09	00:44					
193	15:26	16:10	00:44					
194	15:28	16:13	00:45					
195	15:30	16:15	00:45					
196	15:31	16:16	00:45					
197	15:32	16:17	00:45					
198	15:33	16:18	00:45					
199	15:34	16:19	00:45					
200	15:35	16:20	00:45					
201	15:39	16:24	00:45					
202	15:39	16:24	00:45					
203	15:40	16:25	00:45					
204	15:48	16:32	00:44					
205	15:50	16:34	00:44					
206	15:51	16:35	00:44					
207	15:52	16:36	00:44					
208	15:54	16:37	00:43					
209	15:55	16:39	00:44					
210	15:57	16:40	00:43					
211	15:59	16:44	00:45					
212	16:04	16:47	00:43					
213	16:06	16:48	00:42					
214	16:07	16:50	00:43					
215	16:10	16:51	00:41					
216	16:16	16:53	00:37					
217	16:14	16:57	00:43					
218	16:16	16:59	00:43					
219	16:16	16:59	00:43	33	00:44	00:02.2	4	3
220	16:22	17:02	00:40					
221	16:24	17:04	00:40					
222	16:34	17:17	00:43					
223	16:36	17:18	00:42					
224	16:38	17:19	00:41					
225	16:40	17:22	00:42					
226	16:42	17:26	00:44					
227	16:44	17:29	00:45					
228	16:48	17:31	00:43					
229	16:52	17:33	00:41					
230	16:54	17:34	00:40					
231	16:56	17:35	00:39					
232	16:57	17:38	00:41					
233	17:01	17:39	00:38					
234	16:58	17:41	00:43					
235	17:01	17:43	00:42					
236	17:02	17:45	00:43					
237	17:03	17:45	00:42					
238	17:10	17:48	00:38					
239	17:12	17:50	00:38					
240	17:13	17:53	00:40					
241	17:15	17:56	00:41					
242	17:16	17:57	00:41	23	00:41	00:01.9	4	3
243	17:24	18:09	00:45					
244	17:25	18:11	00:46					
245	17:26	18:13	00:47					
246	17:36	18:16	00:40					
247	17:40	18:19	00:39					
248	17:42	18:21	00:39					
249	17:47	18:26	00:39					
250	17:47	18:29	00:42					

251	17:50	18:30	00:40					
252	17:53	18:33	00:40					
253	18:01	18:42	00:41					
254	18:05	18:47	00:42					
255	18:07	18:51	00:44					
256	18:09	18:52	00:43					
257	18:10	18:53	00:43					
258	18:11	18:55	00:44					
259	18:12	18:57	00:45	17	00:42	00:02.5	9	6
260	18:15	19:00	00:45					
261	18:17	19:02	00:45					
262	18:18	19:03	00:45					
263	18:20	19:05	00:45					
264	18:21	19:06	00:45					
265	18:23	19:07	00:44					
266	18:25	19:09	00:44					
267	18:28	19:12	00:44					
268	18:32	19:13	00:41					
269	18:35	19:17	00:42					
270	18:36	19:18	00:42					
271	18:38	19:19	00:41					
272	18:40	19:21	00:41					
273	18:43	19:23	00:40					
274	18:44	19:25	00:41					
275	18:46	19:31	00:45					
276	18:47	19:32	00:45					
277	18:49	19:33	00:44					
278	18:51	19:35	00:44					
279	18:52	19:36	00:44					
280	18:53	19:37	00:44					
281	18:55	19:38	00:43					
282	19:02	19:44	00:42					
283	19:07	19:52	00:45					
284	19:08	19:54	00:46					
285	19:09	19:55	00:46					
286	19:11	19:56	00:45					
287	19:12	19:57	00:45					
288	19:15	19:59	00:44					
289	19:17	20:00	00:43	29	00:44	00:01.6	4	3

Average = 00:46

Travel Time of Tape Lane 5 (9/23/94)

Time: 15:10 - 15:20
Conditions: SUNNY, LOW FLOW

				1	1
				4	3
				9	6
				15	11

	Start Time on 117th	Stop Time on 130th	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	09:23	10:08	00:45					
2	09:25	10:10	00:45					
3	09:27	10:12	00:45					
4	09:30	10:14	00:44					
5	09:35	10:16	00:41					
6	09:36	10:18	00:42					
7	09:41	10:23	00:42					
8	09:44	10:27	00:43					
9	09:45	10:28	00:43					
10	09:46	10:29	00:43					
11	09:54	10:39	00:45					
12	09:55	10:39	00:44					
13	09:58	10:41	00:43					
14	10:01	10:43	00:42					
15	10:03	10:47	00:44					
16	10:04	10:47	00:43					
17	10:07	10:49	00:42					
18	10:09	10:51	00:42					
19	10:10	10:53	00:43					
20	10:13	10:55	00:42	20	00:43	00:01.2	1	1
21	10:21	11:04	00:43					
22	10:23	11:06	00:43					
23	10:27	11:11	00:44					
24	10:37	11:21	00:44					
25	10:39	11:22	00:43					
26	10:42	11:26	00:44					
27	10:46	11:27	00:41					
28	10:48	11:29	00:41					
29	10:51	11:34	00:43					
30	10:57	11:41	00:44					
31	10:59	11:43	00:44					
32	11:02	11:45	00:43					
33	11:04	11:48	00:44					
34	11:05	11:52	00:47					
35	11:09	11:53	00:44					
36	11:12	11:55	00:43					
37	11:16	11:57	00:41	17	00:43	00:01.4	1	1
38	11:18	12:02	00:44					
39	11:20	12:04	00:44					
40	11:21	12:06	00:45					
41	11:23	12:08	00:45					
42	11:24	12:09	00:45					
43	11:26	12:10	00:44					
44	11:28	12:11	00:43					
45	11:32	12:16	00:44					
46	11:34	12:17	00:43					
47	11:39	12:21	00:42					
48	11:40	12:23	00:43					
49	11:48	12:30	00:42					
50	11:50	12:32	00:42					
51	11:52	12:33	00:41					
52	11:53	12:34	00:41					
53	11:54	12:35	00:41					
54	11:57	12:39	00:42					

55	12:01	12:41	00:40					
56	12:03	12:42	00:39					
57	12:06	12:49	00:43					
58	12:08	12:49	00:41					
59	12:09	12:50	00:41					
60	12:10	12:53	00:43					
61	12:12	12:56	00:44	24	00:43	00:01.6	4	3
62	12:21	13:02	00:41					
63	12:28	13:06	00:38					
64	12:38	13:18	00:40					
65	12:45	13:30	00:45					
66	12:47	13:31	00:44					
67	12:48	13:33	00:45					
68	12:49	13:33	00:44					
69	12:51	13:36	00:45					
70	12:52	13:38	00:46					
71	12:54	13:40	00:46					
72	12:55	13:41	00:46					
73	12:57	13:42	00:45					
74	13:00	13:44	00:44					
75	13:02	13:45	00:43					
76	13:04	13:47	00:43					
77	13:05	13:50	00:45					
78	13:06	13:51	00:45					
79	13:08	13:53	00:45					
80	13:13	13:56	00:43	19	00:44	00:02.1	4	3
81	13:19	14:04	00:45					
82	13:21	14:07	00:46					
83	13:23	14:09	00:46					
84	13:27	14:12	00:45					
85	13:33	14:18	00:45					
86	13:37	14:21	00:44					
87	13:38	14:23	00:45					
88	13:39	14:24	00:45					
89	13:40	14:26	00:46					
90	13:42	14:27	00:45					
91	13:44	14:29	00:45					
92	13:53	14:37	00:44					
93	13:56	14:39	00:43					
94	13:57	14:41	00:44					
95	14:00	14:42	00:42					
96	14:05	14:47	00:42					
97	14:06	14:48	00:42					
98	14:11	14:55	00:44					
99	14:13	14:56	00:43					
100	14:15	14:58	00:43					
101	14:16	14:59	00:43	21	00:44	00:01.3	1	1
102	14:19	15:01	00:42					
103	14:20	15:05	00:45					
104	14:22	15:06	00:44					
105	14:24	15:08	00:44					
106	14:26	15:09	00:43					
107	14:27	15:13	00:46					
108	14:29	15:15	00:46					
109	14:30	15:16	00:46					
110	14:31	15:17	00:46					
111	14:33	15:18	00:45					

112	14:34	15:20	00:46					
113	14:35	15:21	00:46					
114	14:37	15:22	00:45					
115	14:39	15:23	00:44					
116	14:40	15:25	00:45					
117	14:41	15:26	00:45					
118	14:42	15:28	00:46					
119	14:43	15:29	00:46					
120	14:44	15:30	00:46					
121	14:45	15:31	00:46					
122	14:47	15:32	00:45					
123	14:49	15:35	00:46					
124	14:51	15:36	00:45					
125	14:56	15:39	00:43					
126	15:00	15:42	00:42					
127	15:01	15:43	00:42					
128	15:02	15:44	00:42					
129	15:03	15:45	00:42					
130	15:08	15:51	00:43					
131	15:09	15:52	00:43					
132	15:13	15:54	00:41	32	00:44	00:01.6	4	3
133	15:21	16:04	00:43					
134	15:23	16:05	00:42					
135	15:26	16:07	00:41					
136	15:29	16:09	00:40					
137	15:30	16:10	00:40					
138	15:32	16:15	00:43					
139	15:36	16:18	00:42					
140	15:40	16:20	00:40					
141	15:49	16:30	00:41					
142	16:00	16:42	00:42					
143	16:00	16:43	00:43					
144	16:03	16:46	00:43					
145	16:05	16:48	00:43					
146	16:06	16:49	00:43					
147	16:09	16:50	00:41					
148	16:11	16:58	00:47	16	00:42	00:01.7	4	3
149	16:23	17:02	00:39					
150	16:36	17:13	00:37					
151	16:39	17:17	00:38					
152	16:53	17:35	00:42					
153	16:52	17:35	00:43					
154	16:54	17:36	00:42					
155	16:56	17:37	00:41					
156	16:59	17:42	00:43					
157	17:02	17:45	00:43					
158	17:03	17:46	00:43					
159	17:13	17:55	00:42	11	00:41	00:02.1	4	3
160	17:23	18:06	00:43					
161	17:24	18:07	00:43					
162	17:25	18:09	00:44					
163	17:44	18:25	00:41					
164	17:45	18:26	00:41					
165	17:50	18:28	00:38					
166	17:51	18:29	00:38					
167	17:59	18:41	00:42					
168	18:13	18:58	00:45	9	00:42	00:02.3	4	3

169	18:22	19:02	00:40					
170	18:30	19:12	00:42					
171	18:34	19:16	00:42					
172	18:35	19:17	00:42					
173	18:39	19:19	00:40					
174	18:49	19:34	00:45					
175	18:50	19:36	00:46					
176	18:52	19:37	00:45					
177	18:53	19:38	00:45					
178	18:56	19:39	00:43					
179	18:57	19:40	00:43					
180	19:00	19:42	00:42					
181	19:01	19:43	00:42					
182	19:02	19:44	00:42					
183	19:03	19:46	00:43					
184	19:10	19:53	00:43					
185	19:11	19:54	00:43					
186	19:15	19:58	00:43	18	00:43	00:01.6	4	3

Average = 00:43

Travel Time of Tape 1 Lane 1 (9/23/94)

* Sunny Moderate Flow
* Time: 16:20 - 16:30 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05	
1	18:33	20:00	01:27					
2	18:34	20:02	01:28					
3	18:36	20:06	01:30					
4	18:37	20:07	01:30					
5	18:45	20:08	01:23					
6	18:42	20:10	01:28					
7	18:45	20:12	01:27					
8	18:47	20:16	01:29					
9	18:50	20:22	01:32					
10	18:51	20:25	01:34					
11	18:54	20:27	01:33					
12	18:55	20:29	01:34					
13	18:58	20:33	01:35					
14	19:05	20:48	01:43					
15	19:01	20:44	01:43					
16	19:12	20:53	01:41					
17	19:10	20:58	01:48	17	01:33	00:06.6	47	33
18	19:15	21:00	01:45					
19	19:20	21:04	01:44					
20	19:21	21:07	01:46					
21	19:23	21:09	01:46					
22	19:25	21:15	01:50					
23	19:37	21:16	01:39					
24	19:34	21:19	01:45					
25	19:52	21:37	01:45					
26	19:56	21:43	01:47					
27	19:57	21:50	01:53					
28	20:00	21:53	01:53					
29	20:01	21:55	01:54					
30	20:04	21:57	01:53					
31	20:12	21:59	01:47	14	01:48	00:04.2		
32	20:20	22:13	01:53					
33	20:22	22:15	01:53					
34	20:23	22:19	01:56					
35	20:27	22:21	01:54					
36	20:31	22:26	01:55					
37	20:34	22:30	01:56					
38	20:37	22:32	01:55					
39	20:43	22:34	01:51					
40	20:46	22:36	01:50					
41	20:59	22:40	01:41					
42	20:52	22:44	01:52					
43	20:56	22:46	01:50					
44	20:59	22:47	01:48					
45	21:02	22:49	01:47					
46	21:06	22:52	01:46					
47	21:10	22:54	01:44					
48	21:13	22:57	01:44					
49	21:15	22:59	01:44	18	01:50	00:04.6		
50	21:22	23:03	01:41					
51	21:34	23:10	01:36					
52	21:36	23:11	01:35					
53	21:38	23:13	01:35					
54	21:40	23:15	01:35					

55	21:46	23:16	01:30			
56	21:49	23:19	01:30			
57	22:04	23:21	01:17			
58	22:05	23:23	01:18			
59	22:14	23:26	01:12			
60	22:01	23:27	01:26			
61	22:43	23:34	00:51			
62	22:49	23:36	00:47			
63	22:18	23:37	01:19			
64	22:21	23:39	01:18			
65	23:01	23:45	00:44			
66	22:35	23:52	01:17			
67	22:43	23:55	01:12			
68	22:47	23:56	01:09	18	01:17	00:15.9
69	22:49	24:00	01:11			
70	22:50	24:01	01:11			
71	22:52	24:02	01:10			
72	22:55	24:06	01:11			
73	22:57	24:07	01:10			
74	22:58	24:06	01:08			
75	22:59	24:09	01:10			
76	23:01	24:11	01:10			
77	23:10	24:17	01:07			
78	23:11	24:19	01:08			
79	23:13	24:20	01:07			
80	23:15	24:22	01:07			
81	23:13	24:24	01:11			
82	23:18	24:26	01:08			
83	23:20	24:28	01:08			
84	23:22	24:30	01:08			
85	23:25	24:33	01:08			
86	23:26	24:36	01:10			
87	23:27	24:38	01:11			
88	23:31	24:42	01:11			
89	23:37	24:44	01:07			
90	23:33	24:47	01:14			
91	23:36	24:50	01:14			
92	23:37	24:55	01:18			
93	23:41	24:57	01:16	25	01:10	00:02.8
94	23:45	25:00	01:15			
95	23:47	25:05	01:18			
96	23:51	25:10	01:19			
97	23:58	25:20	01:22			
98	23:59	25:21	01:22			
99	24:00	25:23	01:23			
100	24:03	25:27	01:24			
101	23:51	25:35	01:44			
102	24:26	25:38	01:12			
103	24:27	25:40	01:13			
104	24:29	25:44	01:15			
105	24:33	25:47	01:14			
106	24:22	25:49	01:27			
107	24:40	25:52	01:12			
108	24:43	25:55	01:12			
109	24:44	25:57	01:13			
110	24:46	25:59	01:13			
111	24:45	25:50	01:05	18	01:18	00:08.3

112	24:49	26:02	01:13			
113	24:55	26:05	01:10			
114	24:36	26:04	01:28			
115	24:57	26:12	01:15			
116	24:49	26:13	01:24			
117	24:51	26:14	01:23			
118	25:10	26:18	01:08			
119	25:02	26:22	01:20			
120	25:03	26:24	01:21			
121	25:06	26:29	01:23			
122	25:08	26:32	01:24			
123	25:10	26:38	01:28			
124	25:11	26:42	01:31			
125	25:13	26:55	01:42			
126	25:17	26:48	01:31			
127	25:19	26:53	01:34			
128	25:22	26:59	01:37	17	01:24	00:09.1
129	25:23	27:01	01:38			
130	25:27	27:05	01:38			
131	25:31	27:07	01:36			
132	25:38	27:10	01:32			
133	25:40	27:13	01:33			
134	25:44	27:17	01:33			
135	25:49	27:21	01:32			
136	25:51	27:28	01:37			
137	25:59	27:35	01:36			
138	26:03	27:37	01:34			
139	26:02	27:41	01:39			
140	26:06	27:44	01:38			
141	26:08	27:46	01:38			
142	26:13	27:50	01:37			
143	26:15	27:51	01:36			
144	26:17	27:53	01:36	16	01:36	00:02.2
145	26:24	28:03	01:39			
146	26:25	28:06	01:41			
147	26:29	28:07	01:38			
148	26:41	28:17	01:36			
149	26:46	28:19	01:33			
150	26:48	28:21	01:33			
151	26:49	28:36	01:47			
152	26:51	28:42	01:51			
153	26:53	28:46	01:53			
154	26:58	28:52	01:54			
155	27:02	28:55	01:53	11	01:43	00:07.9
156	27:12	29:03	01:51			
157	27:15	29:06	01:51			
158	27:25	29:08	01:43			
159	27:31	29:10	01:39			
160	27:35	29:16	01:41			
161	27:43	29:19	01:36			
162	27:51	29:23	01:32			
163	28:01	29:28	01:27			
164	27:52	29:32	01:40			
165	27:55	29:41	01:46			
166	27:57	29:46	01:49			
167	28:02	29:48	01:46			
168	28:11	29:50	01:39			

169	28:11	29:51	01:40			
170	28:13	29:53	01:40			
171	28:14	29:55	01:41			
172	28:15	29:56	01:41			
173	28:17	29:58	01:41	18	01:41	00:05.9

Average = 01:41

Travel Time for Tape 1 Lane 2 (9/23/94)

* Sunny Moderate Flow
* Time: 16:20 - 16:30 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05
1	18:33	20:02	01:29				
2	18:35	20:05	01:30				
3	18:42	20:12	01:30				
4	18:43	20:16	01:33				
5	18:45	20:17	01:32				
6	18:47	20:20	01:33				
7	18:49	20:23	01:34				
8	18:51	20:25	01:34				
9	18:52	20:26	01:34				
10	18:57	20:32	01:35				
11	19:06	20:37	01:31				
12	19:09	20:38	01:29				
13	19:14	20:45	01:31				
14	19:22	20:55	01:33				
15	19:26	20:56	01:30				
16	19:29	20:58	01:29	16	01:32	00:02.0	
17	19:30	21:00	01:30				
18	19:32	21:02	01:30				
19	19:35	21:05	01:30				
20	19:40	21:10	01:30				
21	19:45	21:14	01:29				
22	19:48	21:17	01:29				
23	19:53	21:27	01:34				
24	19:56	21:31	01:35				
25	20:04	21:44	01:40				
26	20:03	21:42	01:39				
27	20:07	21:53	01:46				
28	20:09	21:55	01:46				
29	20:11	21:57	01:46				
30	20:17	21:59	01:42	14	01:36	00:06.6	
31	20:20	22:05	01:45				
32	20:26	22:09	01:43				
33	20:30	22:12	01:42				
34	20:33	22:15	01:42				
35	20:36	22:17	01:41				
36	20:44	22:19	01:35				
37	20:49	22:23	01:34				
38	20:51	22:24	01:33				
39	20:59	22:27	01:28				
40	21:02	22:29	01:27				
41	21:06	22:34	01:28				
42	21:09	22:37	01:28				
43	21:13	22:40	01:27				
44	21:15	22:42	01:27				
45	21:22	22:45	01:23				
46	21:25	22:51	01:26				
47	21:28	22:54	01:26				
48	21:33	22:56	01:23				
49	21:36	22:57	01:21				
50	21:37	22:59	01:22	20	01:31	00:07.6	
51	21:40	23:04	01:24				

52	21:43	23:06	01:23			
53	21:45	23:08	01:23			
54	21:48	23:09	01:21			
55	21:58	23:11	01:13			
56	21:57	23:14	01:17			
57	22:00	23:16	01:16			
58	22:05	23:17	01:12			
59	22:07	23:23	01:16			
60	22:15	23:31	01:16			
61	22:22	23:32	01:10			
62	22:23	23:34	01:11			
63	22:25	23:37	01:12			
64	22:30	23:43	01:13			
65	22:39	23:46	01:07			
66	22:46	23:49	01:03			
67	22:48	23:56	01:08	17	01:14	00:05.8
68	22:52	24:02	01:10			
69	22:55	24:05	01:10			
70	22:56	24:06	01:10			
71	22:58	24:07	01:09			
72	22:59	24:09	01:10			
73	23:02	24:10	01:08			
74	23:02	24:12	01:10			
75	23:04	24:12	01:08			
76	23:10	24:17	01:07			
77	23:18	24:27	01:09			
78	23:29	24:33	01:04			
79	23:33	24:34	01:01			
80	23:31	24:39	01:08			
81	23:33	24:40	01:07			
82	23:39	24:42	01:03			
83	23:41	24:45	01:04			
84	23:45	24:47	01:02			
85	23:52	24:51	00:59			
86	23:54	24:53	00:59	19	01:06	00:03.7
87	24:04	25:06	01:02			
88	24:00	25:03	01:03			
89	23:57	25:58	02:01			
90	24:07	25:08	01:01			
91	24:09	25:11	01:02			
92	24:11	25:15	01:04			
93	24:14	25:23	01:09			
94	24:15	25:25	01:10			
95	24:19	25:26	01:07			
96	24:20	25:29	01:09			
97	24:22	25:31	01:09			
98	24:26	25:35	01:09			
99	24:31	25:38	01:07			
100	24:36	25:41	01:05			
101	24:38	25:49	01:11			
102	24:47	25:51	01:04			
103	24:49	25:54	01:05	17	01:09	00:13.3
104	24:50	26:03	01:13			
105	24:57	26:06	01:09			
106	25:04	26:08	01:04			
107	25:06	26:09	01:03			
108	25:08	26:11	01:03			

109	25:17	26:20	01:03			
110	25:18	26:21	01:03			
111	25:20	26:23	01:03			
112	25:21	26:24	01:03			
113	25:26	26:28	01:02			
114	25:27	26:32	01:05			
115	25:28	26:34	01:06			
116	25:35	26:42	01:07			
117	25:36	26:46	01:10			
118	25:39	26:48	01:09			
119	25:42	26:53	01:11			
120	25:43	26:56	01:13	17	01:06	00:03.7
121	25:47	27:04	01:17			
122	25:54	27:14	01:20			
123	26:12	27:15	01:03			
124	26:13	27:16	01:03			
125	26:07	27:34	01:27			
126	26:16	27:46	01:30			
127	26:18	27:51	01:33			
128	26:23	27:56	01:33			
129	26:26	27:58	01:32	9	01:22	00:11.5
130	26:27	28:03	01:36			
131	26:32	28:07	01:35			
132	26:37	28:15	01:38			
133	26:40	28:17	01:37			
134	26:43	28:20	01:37			
135	26:52	28:23	01:31			
136	27:07	28:30	01:23			
137	27:09	28:37	01:28			
138	27:11	28:39	01:28			
139	27:14	28:41	01:27			
140	27:17	28:46	01:29			
141	27:21	28:48	01:27	12	01:31	00:04.8
142	27:23	29:01	01:38			
143	27:25	29:03	01:38			
144	27:37	29:12	01:35			
145	27:40	29:13	01:33			
146	27:41	29:19	01:38			
147	27:43	29:32	01:49			
148	27:47	29:41	01:54			
149	27:57	29:38	01:41			
150	27:58	29:40	01:42			
151	28:01	29:41	01:40			
152	28:03	29:47	01:44			
153	28:07	29:55	01:48			
154	28:08	29:57	01:49			
155	28:10	30:00	01:50	14	01:43	00:06.1

Average = 01:22

Travel Time of Tape 1 Lane 3 (9/23/94)

* Sunny Moderate Flow
* Time: 16:20 - 16:30 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05
1	18:28	20:00	01:32				
2	18:33	20:02	01:29				
3	18:34	20:07	01:33				
4	18:37	20:08	01:31				
5	18:39	20:10	01:31				
6	18:41	20:13	01:32				
7	18:42	20:14	01:32				
8	18:46	20:17	01:31				
9	18:47	20:19	01:32				
10	18:48	20:21	01:33				
11	18:50	20:23	01:33				
12	19:01	20:29	01:28				
13	19:05	20:41	01:36				
14	19:12	20:44	01:32				
15	19:14	20:46	01:32				
16	19:18	20:47	01:29				
17	19:20	20:56	01:36				
18	19:21	20:59	01:38	18	01:32	00:02.4	
19	19:23	21:01	01:38				
20	19:25	21:03	01:38				
21	19:30	21:04	01:34				
22	19:31	21:06	01:35				
23	19:32	21:08	01:36				
24	19:34	21:11	01:37				
25	19:36	21:16	01:40				
26	19:39	21:19	01:40				
27	19:42	21:22	01:40				
28	19:46	21:26	01:40				
29	19:48	21:27	01:39				
30	19:52	21:29	01:37				
31	19:54	21:31	01:37				
32	19:57	21:32	01:35				
33	19:59	21:35	01:36				
34	20:00	21:36	01:36				
35	20:01	21:37	01:36				
36	20:11	21:44	01:33				
37	20:15	21:47	01:32				
38	20:18	21:48	01:30				
39	20:20	21:50	01:30				
40	20:24	21:53	01:29				
41	20:26	21:56	01:30				
42	20:28	21:57	01:29	24	01:35	00:03.6	
43	20:30	22:01	01:31				
44	20:39	22:08	01:29				
45	20:41	22:09	01:28				
46	20:46	22:13	01:27				
47	20:52	22:16	01:24				
48	20:54	22:17	01:23				
49	20:55	22:19	01:24				
50	20:58	22:22	01:24				
51	21:07	22:27	01:20				
52	21:13	22:30	01:17				
53	21:15	22:32	01:17				
54	21:21	22:35	01:14				

55	21:23	22:38	01:15			
56	21:24	22:39	01:15			
57	21:38	22:43	01:05			
58	21:41	22:46	01:05			
59	21:43	22:47	01:04			
60	21:56	22:52	00:56			
61	21:46	22:56	01:10			
62	21:48	22:59	01:11	20	01:17	00:09.4
63	21:51	23:02	01:11			
64	21:55	23:04	01:09			
65	22:02	23:06	01:04			
66	22:01	23:14	01:13			
67	22:04	23:17	01:13			
68	22:06	23:19	01:13			
69	22:11	23:23	01:12			
70	22:16	23:24	01:08			
71	22:13	23:26	01:13			
72	22:15	23:27	01:12			
73	22:20	23:31	01:11			
74	22:22	23:35	01:13			
75	22:25	23:37	01:12			
76	22:27	23:39	01:12			
77	22:32	23:44	01:12			
78	22:35	23:46	01:11			
79	22:37	23:47	01:10			
80	22:42	23:50	01:08			
81	22:46	23:53	01:07			
82	22:48	23:56	01:08			
83	22:54	23:58	01:04			
84	22:56	23:59	01:03	22	01:10	00:03.1
85	22:57	24:01	01:04			
86	22:59	24:07	01:08			
87	23:00	24:08	01:08			
88	23:03	24:13	01:10			
89	23:09	24:17	01:08			
90	23:11	24:22	01:11			
91	23:15	24:25	01:10			
92	23:19	24:27	01:08			
93	23:23	24:30	01:07			
94	23:25	24:31	01:06			
95	23:27	24:32	01:05			
96	23:29	24:37	01:08			
97	23:36	24:44	01:08			
98	23:41	24:48	01:07			
99	23:47	24:51	01:04			
100	23:50	24:55	01:05			
101	23:54	24:58	01:04	17	01:07	00:02.1
102	23:57	25:00	01:03			
103	24:05	25:02	00:57			
104	24:06	25:05	00:59			
105	24:08	25:08	01:00			
106	24:11	25:10	00:59			
107	24:14	25:14	01:00			
108	24:18	25:16	00:58			
109	24:17	25:17	01:00			
110	24:20	25:19	00:59			
111	24:22	25:26	01:04			

112	24:24	25:28	01:04			
113	24:33	25:35	01:02			
114	24:36	25:37	01:01			
115	24:38	25:39	01:01			
116	24:40	25:42	01:02			
117	24:42	25:46	01:04			
118	24:53	25:57	01:04			
119	24:55	25:59	01:04	18	01:01	00:02.2
120	24:57	26:02	01:05			
121	24:58	26:03	01:05			
122	25:01	26:07	01:06			
123	25:03	26:12	01:09			
124	25:10	26:14	01:04			
125	25:19	26:20	01:01			
126	25:21	26:22	01:01			
127	25:22	26:25	01:03			
128	25:23	26:28	01:05			
129	25:27	26:32	01:05			
130	25:30	26:35	01:05			
131	25:31	26:36	01:05			
132	25:33	26:38	01:05			
133	25:36	26:48	01:12			
134	25:39	26:52	01:13			
135	25:41	26:52	01:11			
136	25:44	26:58	01:14	17	01:06	00:03.8
137	25:46	27:01	01:15			
138	25:48	27:04	01:16			
139	25:50	27:06	01:16			
140	25:53	27:09	01:16			
141	25:55	27:11	01:16			
142	26:02	27:14	01:12			
143	26:04	27:18	01:14			
144	26:19	27:40	01:21			
145	26:22	27:45	01:23			
146	26:25	27:51	01:26			
147	26:27	27:55	01:28			
148	26:31	27:56	01:25	12	01:19	00:05.1
149	26:34	28:28	01:54			
150	26:37	28:31	01:54			
151	26:39	28:33	01:54			
152	26:42	28:35	01:53			
153	26:45	28:37	01:52			
154	26:49	28:39	01:50			
155	26:56	28:54	01:58	7	01:54	00:02.3
156	27:00	29:02	02:02			
157	27:05	29:06	02:01			
158	27:19	29:09	01:50			
159	27:21	29:12	01:51			
160	27:22	29:15	01:53			
161	27:24	29:17	01:53			
162	27:25	29:19	01:54			
163	27:26	29:21	01:55			
164	27:28	29:23	01:55			
165	27:33	29:25	01:52			
166	27:36	29:29	01:53			
167	27:40	29:31	01:51			
168	27:42	29:33	01:51			

169	27:48	29:36	01:48			
170	27:53	29:42	01:49			
171	27:54	29:44	01:50			
172	28:00	29:48	01:48			
173	28:01	29:50	01:49			
174	28:03	29:52	01:49			
175	28:04	29:53	01:49			
176	28:05	29:54	01:49			
177	28:07	29:57	01:50			
178	28:11	29:59	01:48	23	01:52	00:03.7

Average = 01:23

Travel Time for Tape 1 Lane 4 (9/23/94)

* Sunny Moderate Flow
* Time: 16:20 - 16:30 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05
1	18:19	20:02	01:43				
2	18:29	20:06	01:37				
3	18:30	20:10	01:40				
4	18:33	20:12	01:39				
5	18:34	20:13	01:39				
6	18:36	20:16	01:40				
7	18:41	20:17	01:36				
8	18:43	20:21	01:38				
9	18:45	20:23	01:38				
10	18:46	20:24	01:38				
11	18:48	20:26	01:38				
12	18:51	20:31	01:40				
13	18:52	20:33	01:41				
14	18:54	20:36	01:42				
15	18:57	20:39	01:42				
16	18:59	20:40	01:41				
17	19:03	20:47	01:44				
18	19:05	20:48	01:43				
19	19:08	20:50	01:42				
20	19:09	20:51	01:42				
21	19:11	20:56	01:45				
22	19:12	20:57	01:45				
23	19:14	20:59	01:45	23	01:41	00:02.6	
24	19:16	21:01	01:45				
25	19:18	21:05	01:47				
26	19:26	21:07	01:41				
27	19:29	21:11	01:42				
28	19:31	21:14	01:43				
29	19:37	21:19	01:42				
30	19:40	21:22	01:42				
31	19:42	21:25	01:43				
32	19:45	21:26	01:41				
33	19:46	21:27	01:41				
34	19:48	21:29	01:41				
35	19:53	21:30	01:37				
36	19:59	21:32	01:33				
37	20:01	21:34	01:33				
38	20:05	21:40	01:35				
39	20:10	21:42	01:32				
40	20:12	21:46	01:34				
41	20:14	21:48	01:34				
42	20:15	21:48	01:33				
43	20:16	21:51	01:35				
44	20:19	21:54	01:35				
45	20:21	21:56	01:35				
46	20:23	21:58	01:35	23	01:38	00:04.4	
47	20:27	22:01	01:34				
48	20:29	22:04	01:35				
49	20:35	22:07	01:32				
50	20:39	22:10	01:31				
51	20:42	22:12	01:30				

52	20:46	22:13	01:27			
53	20:50	22:15	01:25			
54	20:51	22:16	01:25			
55	20:57	22:19	01:22			
56	20:59	22:20	01:21			
57	21:03	22:25	01:22			
58	21:05	22:28	01:23			
59	21:06	22:28	01:22			
60	21:07	22:30	01:23			
61	21:10	22:32	01:22			
62	21:12	22:36	01:24			
63	21:14	22:38	01:24			
64	21:16	22:39	01:23			
65	21:19	22:41	01:22			
66	21:21	22:44	01:23			
67	21:23	22:46	01:23			
68	21:29	22:53	01:24			
69	21:30	22:54	01:24			
70	21:34	22:58	01:24			
71	21:35	22:59	01:24	25	01:25	00:03.9
72	21:37	23:01	01:24			
73	21:40	23:02	01:22			
74	21:42	23:04	01:22			
75	21:47	23:08	01:21			
76	21:56	23:17	01:21			
77	21:59	23:20	01:21			
78	22:03	23:22	01:19			
79	22:05	23:24	01:19			
80	22:06	23:26	01:20			
81	22:10	23:30	01:20			
82	22:23	23:32	01:09			
83	22:24	23:33	01:09			
84	22:26	23:35	01:09			
85	22:29	23:41	01:12			
86	22:30	23:42	01:12			
87	22:33	23:44	01:11			
88	22:35	23:48	01:13			
89	22:39	23:51	01:12			
90	22:42	23:54	01:12			
91	22:46	23:55	01:09			
92	22:48	23:56	01:08			
93	22:49	23:58	01:09	22	01:15	00:05.4
94	22:53	24:00	01:07			
95	22:56	24:03	01:07			
96	22:59	24:04	01:05			
97	23:03	24:07	01:04			
98	23:07	24:11	01:04			
99	23:12	24:12	01:00			
100	23:13	24:14	01:01			
101	23:15	24:17	01:02			
102	23:17	24:20	01:03			
103	23:18	24:23	01:05			
104	23:22	24:26	01:04			
105	23:23	24:27	01:04			
106	23:25	24:30	01:05			
107	23:26	24:32	01:06			
108	23:37	24:39	01:02			

109	23:39	24:41	01:02			
110	23:34	24:36	01:02			
111	23:43	24:46	01:03			
112	23:54	24:50	00:56			
113	23:46	24:51	01:05			
114	23:47	24:52	01:05			
115	23:51	24:57	01:06	22	01:04	00:02.5
116	23:56	25:01	01:05			
117	24:03	25:05	01:02			
118	24:07	25:07	01:00			
119	24:09	25:10	01:01			
120	24:11	25:13	01:02			
121	24:13	25:15	01:02			
122	24:14	25:17	01:03			
123	24:15	25:18	01:03			
124	24:16	25:19	01:03			
125	24:18	25:23	01:05			
126	24:22	25:29	01:07			
127	24:24	25:33	01:09			
128	24:24	25:36	01:12			
129	24:28	25:38	01:10			
130	24:30	25:41	01:11			
131	24:35	25:45	01:10			
132	24:36	25:47	01:11			
133	24:38	25:49	01:11			
134	24:45	25:51	01:06			
135	24:46	25:53	01:07			
136	24:47	25:56	01:09			
137	24:50	25:58	01:08			
138	24:55	25:59	01:04	23	01:06	00:03.7
139	25:01	26:03	01:02			
140	25:02	26:05	01:03			
141	25:04	26:07	01:03			
142	25:06	26:09	01:03			
143	25:07	26:11	01:04			
144	25:09	26:13	01:04			
145	25:13	26:17	01:04			
146	25:17	26:21	01:04			
147	25:19	26:23	01:04			
148	25:20	26:25	01:05			
149	25:26	26:30	01:04			
150	25:28	26:33	01:05			
151	25:30	26:37	01:07			
152	25:32	26:39	01:07			
153	25:34	26:42	01:08			
154	25:35	26:44	01:09			
155	25:37	26:47	01:10			
156	25:38	26:50	01:12			
157	25:39	26:59	01:20	19	01:06	00:04.2
158	25:40	27:03	01:23			
159	25:44	27:06	01:22			
160	25:47	27:09	01:22			
161	25:48	27:12	01:24			
162	25:49	27:15	01:26			
163	25:52	27:40	01:48			
164	25:54	27:43	01:49			
165	25:54	27:47	01:53			

166	25:56	27:50	01:54			
167	25:58	27:53	01:55			
168	26:05	27:56	01:51	11	01:39	00:14.2
169	26:07	28:02	01:55			
170	26:12	28:12	02:00			
171	26:16	28:14	01:58			
172	26:25	28:17	01:52			
173	26:27	28:21	01:54			
174	26:23	28:15	01:52			
175	26:29	28:26	01:57			
176	26:31	28:29	01:58			
177	26:32	28:30	01:58			
178	26:34	28:36	02:02			
179	26:38	28:38	02:00			
180	26:41	28:40	01:59			
181	26:42	28:42	02:00			
182	26:45	28:45	02:00			
183	26:47	28:47	02:00			
184	26:48	28:52	02:04			
185	26:52	28:59	02:07	17	01:59	00:03.8
186	26:55	29:01	02:06			
187	26:54	29:03	02:09			
188	27:03	29:09	02:06			
189	27:13	29:23	02:10			
190	27:14	29:27	02:13			
191	27:20	29:32	02:12			
192	27:26	29:35	02:09			
193	27:28	29:37	02:09			
194	27:29	29:40	02:11			
195	27:31	29:41	02:10			
196	27:32	29:45	02:13			
197	27:35	29:47	02:12			
198	27:36	29:49	02:13			
199	27:37	29:52	02:15			
200	27:38	29:53	02:15			
201	27:43	29:57	02:14			
202	27:45	30:00	02:15	17	02:11	00:02.8

Average = 01:28

Travel Time for Tape 1 Lane 5 (9/23/94)

* Sunny Moderate Flow
* Time: 16:20 - 16:30 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05
1	17:38	20:00	2:22				
2	17:39	20:01	2:22				
3	17:41	20:03	2:22				
4	17:44	20:06	2:22				
5	17:45	20:08	2:23				
6	17:47	20:10	2:23				
7	17:55	20:13	2:18				
8	17:51	20:15	2:24				
9	17:53	20:17	2:24				
10	17:56	20:19	2:23				
11	17:59	20:21	2:22				
12	18:04	20:26	2:22				
13	18:07	20:29	2:22				
14	18:08	20:30	2:22				
15	18:14	20:33	2:19				
16	18:18	20:37	2:19				
17	18:23	20:41	2:18				
18	18:24	20:42	2:18				
19	18:26	20:48	2:22				
20	18:27	20:51	2:24				
21	18:31	20:53	2:22				
22	18:34	20:56	2:22				
23	18:37	20:57	2:20	23	21:31	01:51.7	
24	18:45	21:03	2:18				
25	18:44	21:05	2:21				
26	18:48	21:06	2:18				
27	18:50	21:08	2:18				
28	18:54	21:11	2:17				
29	19:00	21:15	2:15				
30	19:01	21:17	2:16				
31	19:02	21:19	2:17				
32	19:04	21:21	2:17				
33	19:07	21:23	2:16				
34	19:08	21:25	2:17				
35	19:13	21:27	2:14				
36	19:18	21:29	2:11				
37	19:24	21:33	2:09				
38	19:29	21:35	2:06				
39	19:32	21:37	2:05				
40	19:34	21:38	2:04				
41	20:03	21:43	1:40				
42	19:56	21:40	1:44				
43	19:50	21:47	1:57				
44	19:52	21:50	1:58				
45	19:54	21:52	1:58				
46	20:13	21:54	1:41				
47	20:14	21:55	1:41				
48	20:16	21:57	1:41				
49	20:30	21:59	1:29	26	04:09	15:15.2	
50	20:31	22:01	1:30				
51	20:32	22:05	1:33				
52	20:36	22:08	1:32				
53	20:38	22:11	1:33				
54	20:42	22:12	1:30				

55	20:43	22:13	1:30			
56	20:45	22:15	1:30			
57	20:49	22:16	1:27			
58	20:50	22:17	1:27			
59	20:52	22:20	1:28			
60	20:53	22:22	1:29			
61	20:54	22:24	1:30			
62	20:56	22:26	1:30			
63	20:58	22:28	1:30	28	41:32	14:49.6
64	21:00	22:29	1:29			
65	21:04	22:31	1:27			
66	21:07	22:34	1:27			
67	21:11	22:36	1:25			
68	21:13	22:37	1:24			
69	21:15	22:39	1:24			
70	21:17	22:40	1:23			
71	21:28	22:43	1:15			
72	21:34	22:49	1:15			
73	21:36	22:51	1:15			
74	21:38	22:53	1:15			
75	21:41	22:54	1:13			
76	21:43	22:55	1:12			
77	21:45	22:57	1:12			
78	21:47	22:58	1:11			
79	21:49	23:01	1:12			
80	21:52	23:03	1:11			
81	21:53	23:05	1:12			
82	21:55	23:07	1:12			
83	21:58	23:09	1:11			
84	22:02	23:10	1:08			
85	22:06	23:13	1:07			
86	22:08	23:16	1:08			
87	22:10	23:18	1:08			
88	22:16	23:22	1:06			
89	22:18	23:23	1:05	26	14:53	07:04.0
90	22:20	23:25	1:05			
91	22:21	23:27	1:06			
92	22:22	23:30	1:08			
93	22:24	23:31	1:07			
94	22:26	23:33	1:07			
95	22:29	23:34	1:05			
96	22:31	23:37	1:06			
97	22:34	23:40	1:06			
98	22:35	23:42	1:07			
99	22:37	23:44	1:07			
100	22:40	23:46	1:06			
101	22:42	23:47	1:05			
102	22:44	23:50	1:06			
103	22:49	23:50	1:01			
104	22:46	23:52	1:06			
105	22:48	23:53	1:05			
106	22:50	22:55	0:05			
107	22:51	22:57	0:06			
108	22:53	24:00	1:07			
109	22:54	24:00	1:06			
110	22:57	24:02	1:05			
111	23:00	24:04	1:04			

112	23:02	24:06	1:04
113	23:04	24:07	1:03
114	23:05	24:08	1:03
115	23:11	24:10	0:59
116	23:07	24:12	1:05
117	23:12	24:15	1:03
118	23:09	24:16	1:07
119	23:14	24:18	1:04
120	23:17	24:21	1:04
121	23:20	24:22	1:02
122	23:22	24:24	1:02
123	23:26	24:27	1:01
124	23:29	24:29	1:00
125	23:31	24:31	1:00
126	23:35	24:33	0:58
127	23:36	24:35	0:59
128	23:37	24:37	1:00
129	23:38	24:38	1:00
130	23:39	24:39	1:00
131	23:40	24:40	1:00
132	16:23:42	24:42	1:00
133	16:23:43	24:44	1:01
134	16:23:46	24:49	1:03
135	16:23:47	24:51	1:04
136	16:23:49	24:52	1:03
137	16:23:50	24:54	1:04
138	16:23:56	24:55	0:59
139	16:24:01	24:57	0:56
140	16:24:02	24:59	0:57
141	16:24:03	25:01	0:58
142	16:24:05	25:04	0:59
143	16:24:06	25:05	0:59
144	16:24:07	25:07	1:00
145	16:24:09	25:08	0:59
146	16:24:11	25:10	0:59
147	16:24:17	25:12	0:55
148	16:24:19	25:14	0:55
149	16:24:22	25:16	0:54
150	16:24:28	25:19	0:51
151	16:24:37	25:31	0:54
152	16:24:41	25:34	0:53
153	16:24:43	25:36	0:53
154	16:24:44	25:38	0:54
155	16:24:46	25:40	0:54
156	16:24:48	25:42	0:54
157	16:24:50	25:44	0:54
158	16:24:52	25:47	0:55
159	16:24:53	25:49	0:56
160	16:24:55	25:52	0:57
161	16:24:57	25:54	0:57
162	16:24:58	25:56	0:58
163	16:24:59	25:58	0:59
164	16:25:02	26:03	1:01
165	16:25:04	26:04	1:00
166	16:25:05	26:06	1:01
167	16:25:06	26:08	1:02
168	16:25:08	26:10	1:02

169	16:25:09	26:13	1:04
170	16:25:11	26:15	1:04
171	16:25:12	26:17	1:05
172	25:14	26:21	1:07
173	25:15	26:32	1:07
174	25:18	26:38	1:20
175	25:20	26:43	1:23
176	25:22	26:50	1:28
177	25:24	26:56	1:32
178	25:26	27:00	1:34
179	25:28	27:03	1:35
180	25:32	27:06	1:34
181	25:33	27:08	1:35
182	25:34	27:12	1:38
183	25:35	27:25	1:50
184	25:37	27:31	1:54
185	25:39	27:35	1:56
186	25:41	27:40	1:59
187	25:42	27:42	2:00
188	25:44	27:44	2:00
189	25:45	27:46	2:01
190	25:47	27:50	2:03
191	25:49	27:55	2:06
192	26:04	28:04	2:00
193	26:08	28:10	2:02
194	26:09	28:14	2:05
195	26:10	28:17	2:07
196	26:12	28:19	2:07
197	26:13	28:21	2:08
198	26:14	28:24	2:10
199	26:26	28:32	2:06
200	26:26	28:32	2:06
201	26:29	28:34	2:05
202	26:31	28:37	2:06
203	26:33	28:38	2:05
204	26:35	28:40	2:05
205	26:38	28:43	2:05
206	26:51	28:47	1:56
207	26:55	28:49	1:54
208	26:57	28:53	1:56
209	26:59	28:54	1:55
210	27:07	28:56	1:49
211	27:11	28:59	1:48
212	27:11	29:00	1:49
213	27:15	29:02	1:47
214	27:22	29:05	1:43
215	27:25	29:08	1:43
216	27:27	29:09	1:43
217	27:30	29:10	1:40
218	27:31	29:13	1:42
219	27:33	29:17	1:44
220	27:35	29:19	1:44
221	27:37	29:22	1:45
222	27:40	29:25	1:45
223	27:43	29:30	1:47
224	27:49	29:35	1:46
225	27:52	29:38	1:46

226	27:56	29:40	1:44
227	27:59	29:41	1:42
228	28:02	29:43	1:41
229	28:04	29:47	1:43
230	28:07	29:54	1:47
231	28:15	29:56	1:41
232	28:22	30:00	1:38

Average = 1:38

LOW LTE 1 (4)

TT-9-23				
MINUTE	OUT		TRAVEL TIME	0
	MINUTE	SECOND		
1	9	39	59	
	10	27	60	
	10	9	48	
2	10	56	54	
	10	48	50	
3	11	52	52	
	11	42	51	
	12	11	52	
	11	35	59	
4	13	11	50	
	13	8	50	
5	13	55	59	
	13	45	45	
	13	51	56	
	14	7	54	
	14	4	53	
	13	40	63	
	13	42	61	
	13	36	54	
6	14	32	58	
7	15	37	52	
	16	5	51	
	16	3	52	
	16	19	55	
	15	39	52	
	16	10	50	
8	16	56	51	
	17	25	54	
	16	53	44	
	17	7	45	
9	18	11	49	
	18	23	49	
	18	18	53	
	17	55	83	
10	19	0	53	

LOW LTE 2 (3)

TT-9-23								
MINUTE	SOURCE	MEASURE	IN		OUT		TRAVEL TIME	0
			MINUTE	SECOND	MINUTE	SECOND		
1	532.53	587.64	8	53	9	48	55.11	
	538.81	574.53	8	59	9	35	35.72	
	528.76	592.27	8	49	9	52	63.51	
2	591.94	637.84	9	52	10	38	45.90	
	609.41	660.79	10	9	11	1	51.38	
	616.4	668.77	10	16	11	9	52.37	
3	664.66	713.66	11	5	11	54	49.00	
	686.9	716.41	11	27	11	56	29.51	
4	746.2	794.79	12	26	13	15	48.59	
5	764.62	817.1	12	45	13	37	52.48	
	792.84	839.92	13	13	13	60	47.08	
	792.84	838.43	13	13	13	58	45.59	
	760.78	813.8	12	41	13	34	53.02	
	766.17	819.57	12	46	13	40	53.40	
6	843.7	898.41	14	4	14	58	54.71	
	832.6	880.52	13	53	14	41	47.92	
	824.58	888.86	13	45	14	49	64.28	
	822.66	874.94	13	43	14	35	52.28	
7	915.32	964.82	15	15	16	5	49.50	
	894.43	943.08	14	54	15	43	48.65	
	901.53	947.95	15	2	15	48	46.42	
	897.6	945.7	14	58	15	46	48.10	
8	962.81	1015.48	16	3	16	55	52.67	
	986.82	1038.99	16	27	17	19	52.17	
9	1041.24	1093.71	17	21	18	14	52.47	
	1024.54	1070.53	17	5	17	51	45.99	
	1023.82	1058.17	17	4	17	38	34.35	
10	1111.5	1166.25	18	31	19	26	54.75	
	1066.19	1120.92	17	46	18	41	54.73	

LOW LTE 3 (2)

TT-9-23								
MINUTE	SOURCE	MEASUR	IN		OUT		TRAVEL TIME	0
			MINUTE	SECOND	MINUTE	SECOND		
1	509.85	587.57	8	30	9	48	77.72	
2	594.27	662.57	9	54	11	3	68.30	
	608.11	688.52	10	8	11	29	80.41	
	577.67	640.34	9	38	10	40	62.67	
3	661.76	717.69	11	2	11	58	55.93	
4	709.07	771.38	11	49	12	51	62.31	
	713.46	793.3	11	53	13	13	79.84	
	725.22	789.49	12	5	13	9	64.27	
	727.98	778.43	12	8	12	58	50.45	
5								
6								
7	877.46	937.3	14	37	15	37	59.84	
	900.67	976.14	15	1	16	16	75.47	
	929.37	988.65	15	29	16	29	59.28	
	897.24	957.77	14	57	15	58	60.53	
	911.39	960.26	15	11	16	0	48.87	
8	980.93	1044.26	16	21	17	24	63.33	
	974.97	1031.05	16	15	17	11	56.08	
9	1048.85	1075.24	17	29	17	55	26.39	
	1023.36	1070.78	17	3	17	51	47.42	
10								

LOW LTE 4 (1)

TT-9-23				
MINUTE	OUT		TRAVEL TIME	0
	MINUTE	SECOND		
1	10	23	50	
	10	28	45	
	10	27	45	
	9	48	61	
2	11	23	49	
	11	9	59	
	10	29	45	
	11	1	53	
3	11	39	59	
	11	37	51	
	12	21	49	
4	13	10	51	
	13	2	53	
5	13	41	52	
	14	15	46	
	14	27	45	
	13	59	48	
	13	54	62	
	13	59	57	
6	14	48	53	
	14	40	46	
	14	53	40	
	14	39	46	
	14	45	44	
7	15	47	46	
	15	48	42	
	16	13	42	
	16	1	46	
	15	50	45	
	16	5	55	
	15	31	49	
	16	8	47	
	15	42	49	
	16	16	58	
	16	8	48	
	15	46	49	
8	17	3	44	
	16	41	43	
	16	44	45	
9	18	22	55	
	17	58	53	
	17	36	38	
10	18	30	43	
	19	8	44	
	19	18	44	
	19	19	43	
	19	9	31	

LOW LTE 5 (0)

TT-9-23				
MINUTE	OUT		TRAVEL TIME	0
	MINUTE	SECOND		
1	10	18	42	
	9	51	45	
	10	28	34	
	9	38	44	
	10	12	17	
2	11	6	43	
	10	29	43	
	11	5	43	
	11	11	43	
	10	50	35	
	11	29	37	
3	11	41	44	
	12	16	27	
	12	24	43	
	12	3	53	
	12	5	39	
	11	44	41	
4	12	31	42	
	12	57	43	
	13	9	43	
	12	43	46	
	13	8	43	
5	13	54	45	
	14	28	42	
	13	49	44	
	13	34	45	
	13	45	42	
	14	12	45	
	13	41	40	
	14	0	54	
6	14	37	44	
	14	42	42	
	14	47	42	
	15	19	44	
	15	9	38	
	15	21	45	
	15	0	54	
	15	13	44	
	15	28	44	
	15	17	45	
	15	8	45	
	15	20	42	
7	15	54	51	
	15	37	51	
	15	29	40	
	16	18	47	
	15	31	45	
	15	35	52	
	15	45	32	
	15	51	29	
8	17	9	46	
	16	42	43	
	17	17	88	
9	18	12	46	

LOW LTE 5 (0)

	17	46	43	
	18	7	43	
	17	56	21	
	18	27	38	
10	19	3	49	
	18	57	57	
	19	13	38	
	19	18	42	

DATE: SEPTEMBER 23, 1994
TIME: 16:20:00 - 16:30:00
CONDITION: SUN, MODERATE FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference
1	1	17	93	0	88	0	-5	-5.4
	2	14	108	0	88	0	-20	-18.5
	3	18	110	0	88	0	-22	-20.0
	4	18	77	0	88	0	11	14.3
	5	25	70	0	88	0	18	25.7
	6	18	78	0	88	0	10	12.8
	7	17	84	0	88	0	4	4.8
	8	16	96	0	88	0	-8	-8.3
	9	11	103	0	88	0	-15	-14.6
	10	18	101	0	88	0	-13	-12.9
2	1	16	92	0	88	0	-4	-4.3
	2	14	96	0	88	0	-8	-8.3
	3	20	91	0	88	0	-3	-3.3
	4	17	74	0	88	0	14	18.9
	5	19	66	0	88	0	22	33.3
	6	17	69	0	88	0	19	27.5
	7	17	66	0	88	0	22	33.3
	8	9	82	0	88	0	6	7.3
	9	12	91	0	88	0	-3	-3.3
	10	14	103	0	88	0	-15	-14.6
3	1	18	92	0	88	0	-4	-4.3
	2	24	95	0	88	0	-7	-7.4
	3	20	77	0	88	0	11	14.3
	4	22	70	0	88	0	18	25.7
	5	17	67	0	88	0	21	31.3
	6	18	61	0	88	0	27	44.3
	7	17	66	0	88	0	22	33.3
	8	12	79	0	88	0	9	11.4
	9	7	114	0	88	0	-26	-22.8
	10	23	112	0	88	0	-24	-21.4

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds

DATE: SEPTEMBER 23, 1994
TIME: 16:20:00 - 16:30:00
CONDITION: SUN, MODERATE FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference
4	1	23	101	0	88	0	-13	-12.9
	2	23	98	0	88	0	-10	-10.2
	3	25	85	0	88	0	3	3.5
	4	22	75	0	88	0	13	17.3
	5	22	66	0	88	0	22	33.3
	6	23	66	0	88	0	22	33.3
	7	19	66	0	88	0	22	33.3
	8	11	99	0	88	0	-11	-11.1
	9	17	119	0	88	0	-31	-26.1
	10	17	131	0	88	0	-43	-32.8

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds

DATE: SEPTEMBER 23, 1994
TIME: 15:10:00 - 15:20:00
CONDITION: SUN, LOW FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference
1	1	23	52	3	51.9	0	-0.1	-0.2
	2	15	54	2	52.2	1	-1.8	-3.3
	3	15	50	4	52.1	1	2.1	4.2
	4	16	55	2	51.7	1	-3.3	-6.0
	5	18	52	8	52.5	4	0.5	1.0
	6	19	51	1	53.7	0	2.7	5.3
	7	15	52	6	53.3	6	1.3	2.5
	8	19	49	4	52.2	0	3.2	6.5
	9	15	49	4	51.9	2	2.9	5.9
	10	17	50	1	52.1	1	2.1	4.2
2	1	19	53	3	50.5	0	-2.5	-4.7
	2	12	52	3	50.7	1	-1.3	-2.5
	3	18	52	2	50.4	1	-1.6	-3.1
	4	20	53	1	50	1	-3	-5.7
	5	19	49	5	50.5	0	1.5	3.1
	6	19	50	4	51.1	0	1.1	2.2
	7	18	46	4	50.6	4	4.6	10.0
	8	17	46	2	50.9	1	4.9	10.7
	9	17	46	3	49.9	0	3.9	8.5
	10	16	48	2	50	0	2	4.2
3	1	21	50	1	59.3	0	9.3	18.6
	2	17	46	3	61.1	1	15.1	32.8
	3	21	48	1	60.1	0	12.1	25.2
	4	21	49	4	60.7	0	11.7	23.9
	5	26	47	0	60.7	0	13.7	29.1
	6	19	49	0	60.7	0	11.7	23.9
	7	21	45	5	60.5	1	15.5	34.4
	8	20	42	2	61.1	2	19.1	45.5
	9	13	43	2	58.4	0	15.4	35.8
	10	16	45	0	58.4	0	13.4	29.8

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds

DATE: SEPTEMBER 23, 1994
TIME: 15:10:00 - 15:20:00
CONDITION: SUN, LOW FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference
4	1	35	48	4	49	2	1	2.1
	2	28	46	4	44.5	1	-1.5	-3.3
	3	26	46	3	49.8	1	3.8	8.3
	4	28	49	2	50	0	1	2.0
	5	32	46	6	50	4	4	8.7
	6	37	47	5	49.1	3	2.1	4.5
	7	33	44	12	48.8	9	4.8	10.9
	8	23	41	3	47.8	2	6.8	16.6
	9	17	42	3	48.9	1	6.9	16.4
	10	29	44	5	47.8	4	3.8	8.6
5	1	20	43	5	42.3	1	-0.7	-1.6
	2	17	43	6	42.2	4	-0.8	-1.9
	3	24	43	6	42.1	3	-0.9	-2.1
	4	19	44	5	42.3	2	-1.7	-3.9
	5	21	44	8	42.6	5	-1.4	-3.2
	6	32	44	12	42.9	9	-1.1	-2.5
	7	16	42	8	43.4	2	1.4	3.3
	8	11	41	3	43.9	1	2.9	7.1
	9	9	42	5	43.3	3	1.3	3.1
	10	18	43	4	43.8	1	0.8	1.9

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds

Traffic Time of Tape Lane 1 (9/30/94)

Time: 14:12 - 14:22
Conditions: Cloudy, Low Flow

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	11:26	12:20	00:54					
2	11:27	12:22	00:55					
3	11:29	12:24	00:55					
4	11:46	12:32	00:46					
5	11:47	12:32	00:45					
6	11:52	12:36	00:44					
7	11:56	12:42	00:46					
8	11:59	12:43	00:44					
9	12:02	12:50	00:48					
10	12:05	12:53	00:48					
11	12:11	12:56	00:45					
12	12:12	12:58	00:46	12	00:48	00:04.0		
13	12:16	13:04	00:48					
14	12:18	13:05	00:47					
15	12:20	13:07	00:47					
16	12:22	13:09	00:47					
17	12:34	13:21	00:47					
18	12:42	13:25	00:43					
19	12:35	13:25	00:50					
20	12:37	13:28	00:51					
21	12:46	13:31	00:45					
22	12:47	13:37	00:50					
23	12:48	13:38	00:50					
24	12:50	13:40	00:50					
25	12:53	13:43	00:50					
26	12:57	13:47	00:50					
27	12:59	13:48	00:49					
28	13:00	13:50	00:50					
29	13:01	13:51	00:50					
30	13:02	13:52	00:50					
31	13:09	13:55	00:46					
32	13:10	13:56	00:46	20	00:48	00:02.1		
33	13:15	14:01	00:46					
34	13:16	14:05	00:49					
35	13:21	14:07	00:46					
36	13:24	14:10	00:46					
37	13:26	14:11	00:45					
38	13:37	14:22	00:45					
39	13:40	14:25	00:45					
40	13:48	14:34	00:46					
41	13:51	14:36	00:45					
42	13:53	14:41	00:48					
43	13:56	14:42	00:46					
44	14:01	14:47	00:46					
45	14:06	14:53	00:47					
46	14:08	14:54	00:46					
47	14:11	14:57	00:46					
48	14:13	14:59	00:46	16	00:46	00:01.1		
49	14:19	15:07	00:48					
50	14:20	15:10	00:50					
51	14:21	15:11	00:50					
52	14:22	15:12	00:50					
53	14:24	15:13	00:49					

54	14:26	15:15	00:49			
55	14:31	15:16	00:45			
56	14:32	15:17	00:45			
57	14:33	15:20	00:47			
58	14:35	15:21	00:46			
59	14:36	15:25	00:49			
60	14:41	15:28	00:47			
61	14:46	15:36	00:50			
62	14:54	15:42	00:48			
63	14:56	15:47	00:51			
64	14:57	15:48	00:51			
65	15:01	15:51	00:50			
66	15:03	15:52	00:49			
67	15:05	15:54	00:49			
68	15:07	15:57	00:50			
69	15:07	15:59	00:52	21	00:49	00:01.9
70	15:09	16:00	00:51			
71	15:14	16:03	00:49			
72	15:18	16:07	00:49			
73	15:20	16:09	00:49			
74	15:30	16:15	00:45			
75	15:29	16:19	00:50			
76	15:31	16:20	00:49			
77	15:34	16:21	00:47			
78	15:47	16:35	00:48			
79	15:50	16:36	00:46			
80	15:52	16:39	00:47			
81	15:57	16:41	00:44			
82	15:59	16:47	00:48			
83	16:03	16:50	00:47			
84	16:04	16:53	00:49			
85	16:06	16:55	00:49			
86	16:08	16:58	00:50	17	00:48	00:01.8
87	16:15	17:02	00:47			
88	16:17	17:03	00:46			
89	16:20	17:05	00:45			
90	16:38	17:30	00:52			
91	16:36	17:25	00:49			
92	16:27	17:20	00:53			
93	16:38	17:31	00:53			
94	16:39	17:32	00:53			
95	16:40	17:33	00:53			
96	16:41	17:34	00:53			
97	16:46	17:39	00:53			
98	16:54	17:45	00:51			
99	16:56	17:47	00:51			
100	16:57	17:49	00:52	14	00:51	00:02.8
101	17:15	18:02	00:47			
102	17:23	18:06	00:43			
103	17:27	18:12	00:45			
104	17:31	18:14	00:43			
105	17:34	18:16	00:42			
106	17:33	18:17	00:44			
107	17:37	18:19	00:42			
108	17:41	18:28	00:47			
109	17:49	18:36	00:47			

110	17:59	18:46	00:47			
111	18:04	18:49	00:45			
112	18:09	18:55	00:46	12	00:45	00:01.9
113	18:15	19:04	00:49			
114	18:21	19:09	00:48			
115	18:21	19:11	00:50			
116	18:30	19:17	00:47			
117	18:37	19:23	00:46			
118	18:38	19:24	00:46			
119	18:45	19:32	00:47			
120	18:47	19:35	00:48			
121	18:51	19:38	00:47			
122	18:58	19:47	00:49			
123	19:04	19:50	00:46			
124	19:08	19:54	00:46	12	00:47	00:01.3
125	19:14	20:00	00:46			
126	19:19	20:03	00:44			
127	19:23	20:11	00:48			
128	19:25	20:15	00:50			
129	19:31	20:20	00:49			
130	19:34	20:22	00:48			
131	19:36	20:23	00:47			
132	19:39	20:25	00:46			
133	19:41	20:27	00:46			
134	19:44	20:30	00:46			
135	19:48	20:36	00:48			
136	19:50	20:37	00:47			
137	19:54	20:42	00:48			
138	19:55	20:46	00:51			
139	19:56	20:47	00:51			
140	19:57	20:48	00:51			
141	20:00	20:50	00:50			
142	20:02	20:52	00:50			
143	20:05	20:54	00:49			
144	20:10	20:56	00:46	20	00:48	00:02.0
145	20:14	21:00	00:46			
146	20:16	21:02	00:46			
147	20:17	21:05	00:48			
148	20:20	21:07	00:47			
149	20:24	21:10	00:46			
150	20:26	21:11	00:45			
151	20:26	21:14	00:48			
152	20:31	21:17	00:46			
153	20:33	21:18	00:45			
154	20:35	21:22	00:47			
155	20:36	21:25	00:49			
156	20:42	21:30	00:48			
157	20:45	21:37	00:52			
158	20:47	21:41	00:54			
159	20:49	21:43	00:54	15	00:48	00:02.9

Average = 00:48

Traffic Time of Tape Lane 3 (9/30/94)

Time: 14:12 - 14:22

Conditions: Cloudy, Low Flow

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	11:22	12:00	00:38					
2	11:23	12:02	00:39					
3	11:26	12:11	00:45					
4	11:35	12:20	00:45					
5	11:37	12:21	00:44					
6	11:42	12:24	00:42					
7	11:43	12:27	00:44					
8	11:45	12:30	00:45					
9	11:47	12:31	00:44					
10	11:50	12:34	00:44					
11	11:54	12:37	00:43					
12	11:59	12:39	00:40					
13	11:59	12:41	00:42					
14	12:06	12:43	00:37					
15	12:09	12:48	00:39					
16	12:11	12:54	00:43					
17	12:12	12:55	00:43					
18	12:14	12:57	00:43					
19	12:16	12:59	00:43	18	00:42	00:02.4		
20	12:18	13:00	00:42					
21	12:26	13:10	00:44					
22	12:27	13:11	00:44					
23	12:28	13:12	00:44					
24	12:31	13:14	00:43					
25	12:32	13:15	00:43					
26	12:36	13:17	00:41					
27	12:42	13:21	00:39					
28	12:43	13:26	00:43					
29	12:44	13:27	00:43					
30	12:46	13:28	00:42					
31	12:49	13:30	00:41					
32	12:51	13:34	00:43					
33	12:53	13:37	00:44					
34	12:58	13:39	00:41					
35	13:13	13:57	00:44					
36	13:17	13:58	00:41					
37	13:18	13:59	00:41	17	00:42	00:01.4		
38	13:19	14:00	00:41					
39	13:20	14:01	00:41					
40	13:25	14:04	00:39					
41	13:27	14:05	00:38					
42	13:29	14:07	00:38					
43	13:31	14:10	00:39					
44	13:31	14:10	00:39					
45	13:33	14:11	00:38					
46	13:38	14:20	00:42					
47	13:39	14:21	00:42					
48	13:42	14:24	00:42					
49	13:45	14:30	00:45					
50	13:54	14:35	00:41					
51	13:55	14:36	00:41					
52	13:58	14:44	00:46					
53	14:04	14:47	00:43					
54	14:07	14:49	00:42	17	00:41	00:02.2		
55	14:18	15:01	00:43					
56	14:19	15:02	00:43					
57	14:20	15:04	00:44					
58	14:24	15:07	00:43					
59	14:25	15:08	00:43					
60	14:27	15:12	00:45					
61	14:30	15:14	00:44					

62	14:32	15:15	00:43			
63	14:35	15:17	00:42			
64	14:37	15:19	00:42			
65	14:38	15:20	00:42			
66	14:39	15:22	00:43			
67	14:41	15:24	00:43			
68	14:43	15:25	00:42			
69	14:46	15:26	00:40			
70	14:48	15:28	00:40			
71	14:52	15:30	00:38			
72	14:54	15:32	00:38			
73	14:56	15:39	00:43			
74	14:59	15:41	00:42			
75	15:01	15:43	00:42			
76	15:07	15:49	00:42			
77	15:09	15:53	00:44			
78	15:13	15:57	00:44	24	00:42	00:01.7
79	15:16	16:00	00:44			
80	15:33	16:14	00:41			
81	15:35	16:18	00:43			
82	15:37	16:22	00:45			
83	15:40	16:23	00:43			
84	15:41	16:25	00:44			
85	15:44	16:28	00:44			
86	15:46	16:30	00:44			
87	15:49	16:31	00:42			
88	15:53	16:33	00:40			
89	15:54	16:35	00:41			
90	15:57	16:38	00:41			
91	15:58	16:39	00:41			
92	16:02	16:44	00:42			
93	16:04	16:46	00:42			
94	16:07	16:49	00:42			
95	16:08	16:51	00:43			
96	16:10	16:52	00:42			
97	16:12	16:55	00:43			
98	16:14	16:56	00:42			
99	16:15	16:58	00:43			
100	16:16	16:59	00:43	22	00:42	00:01.2
101	16:18	17:01	00:43			
102	16:19	17:02	00:43			
103	16:22	17:05	00:43			
104	16:23	17:06	00:43			
105	16:28	17:12	00:44			
106	16:26	17:11	00:45			
107	16:30	17:13	00:43			
108	16:31	17:14	00:43			
109	16:32	17:15	00:43			
110	16:34	17:17	00:43			
111	16:35	17:20	00:45			
112	16:36	17:22	00:46			
113	16:38	17:23	00:45			
114	16:39	17:24	00:45			
115	16:43	17:27	00:44			
116	16:45	17:29	00:44			
117	16:46	17:30	00:44			
118	16:48	17:33	00:45			
119	16:50	17:37	00:47			
120	16:51	17:40	00:49			
121	17:01	17:48	00:47			
122	17:14	17:59	00:45			
123	17:03	17:53	00:50	23	00:45	00:01.9
124	17:23	18:06	00:43			
125	17:26	18:08	00:42			
126	17:28	18:09	00:41			

127	17:34	18:16	00:42			
128	17:35	18:17	00:42			
129	17:36	18:18	00:42			
130	17:37	18:19	00:42			
131	17:39	18:21	00:42			
132	17:40	18:22	00:42			
133	17:41	18:23	00:42			
134	17:44	18:26	00:42			
135	17:54	18:33	00:39			
136	17:57	18:38	00:41			
137	17:58	18:39	00:41			
138	18:05	18:51	00:46			
139	18:09	18:54	00:45			
140	18:17	18:59	00:42	23	00:43	00:02.7
141	18:18	19:00	00:42			
142	18:19	19:01	00:42			
143	18:20	19:02	00:42			
144	18:22	19:06	00:44			
145	18:24	19:08	00:44			
146	18:32	19:13	00:41			
147	18:34	19:15	00:41			
148	18:41	19:22	00:41			
149	18:43	19:24	00:41			
150	18:50	19:31	00:41			
151	18:55	19:37	00:42			
152	19:00	19:43	00:43			
153	19:04	19:47	00:43			
154	19:06	19:49	00:43			
155	19:07	19:50	00:43			
156	19:13	19:56	00:43			
157	19:14	19:57	00:43			
158	19:17	19:58	00:41	18	00:42	00:01.0
159	19:19	20:01	00:42			
160	19:20	20:02	00:42			
161	19:22	20:07	00:45			
162	19:26	20:08	00:42			
163	19:31	20:10	00:39			
164	19:34	20:17	00:43			
165	19:36	20:19	00:43			
166	19:37	20:20	00:43			
167	19:38	20:21	00:43			
168	19:41	20:23	00:42			
169	19:45	20:24	00:39			
170	19:48	20:33	00:45			
171	19:56	20:38	00:42			
172	19:59	20:42	00:43			
173	20:00	20:43	00:43			
174	20:01	20:44	00:43			
175	20:02	20:45	00:43			
176	20:03	20:46	00:43			
177	20:05	20:49	00:44			
178	20:07	20:50	00:43			
179	20:10	20:53	00:43			
180	20:12	20:55	00:43			
181	20:15	20:58	00:43			
182	20:18	20:59	00:41	24	00:43	00:01.4
183	20:20	21:01	00:41			
184	20:21	21:01	00:40			
185	20:23	21:03	00:40			
186	20:26	21:09	00:43			
187	20:28	21:11	00:43			
188	20:30	21:13	00:43			
189	20:31	21:15	00:44			
190	20:34	21:18	00:44			
191	20:36	21:20	00:44			

192	20:41	21:23	00:42			
193	20:46	21:29	00:43			
194	20:47	21:31	00:44			
195	20:50	21:32	00:42			
196	20:56	21:38	00:42			
197	20:59	21:39	00:40			
198	21:03	21:42	00:39			
199	21:08	21:51	00:43			
200	21:11	21:53	00:42			
201	21:13	21:55	00:42			
202	21:18	21:58	00:40			
203	21:19	21:59	00:40	21	00:42	00:01.6

Average = 00:42

Traffic Time of Tape Lane 5 (9/30/94)

Time: 14:12 - 14:22
Conditions: Cloudy, Low Flow

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	11:28	12:12	00:44					
2	11:32	12:13	00:41					
3	11:33	12:14	00:41					
4	11:47	12:24	00:37					
5	11:49	12:25	00:36					
6	11:55	12:33	00:38					
7	11:56	12:35	00:39					
8	12:06	12:45	00:39	8	00:39	00:02.4		
9	12:22	13:05	00:43					
10	12:22	13:05	00:43					
11	12:23	13:06	00:43					
12	12:24	13:07	00:43					
13	12:44	13:24	00:40					
14	12:49	13:31	00:42					
15	12:50	13:32	00:42	7	00:42	00:01.0		
16	13:25	14:03	00:38					
17	13:29	14:05	00:36					
18	13:35	14:11	00:36					
19	14:00	14:44	00:44					
20	14:07	14:48	00:41					
21	14:08	14:49	00:41					
22	14:09	14:50	00:41	7	00:40	00:02.8		
23	14:20	15:01	00:41					
24	14:28	15:09	00:41					
25	14:32	15:12	00:40					
26	14:40	15:18	00:38					
27	14:42	15:19	00:37					
28	14:52	15:30	00:38					
29	15:03	15:43	00:40					
30	15:12	15:52	00:40	8	00:39	00:01.4		
31	15:43	16:24	00:41					
32	15:50	16:33	00:43					
33	16:05	16:46	00:41					
34	16:07	16:51	00:44					
35	16:09	16:52	00:43					
36	16:17	16:58	00:41					
37	16:19	16:59	00:40	7	00:42	00:01.4		
38	16:20	17:00	00:40					
39	16:35	17:17	00:42					
40	16:54	17:35	00:41	3	00:41	00:00.8		
41	17:31	18:13	00:42					
42	17:46	18:30	00:44					
43	17:48	18:35	00:47					
44	18:09	18:48	00:39	4	00:43	00:02.9		
45	18:46	19:26	00:40					
46	18:50	19:29	00:39	2	00:39	00:00.5		
47	19:34	20:11	00:37					
48	19:32	20:13	00:41					
49	19:47	20:28	00:41					
50	19:50	20:29	00:39					

51	19:57	20:39	00:42			
52	19:57	20:40	00:43			
53	19:58	20:41	00:43			
54	20:00	20:43	00:43	8	00:41	00:02.0
55	20:27	21:08	00:41			
56	20:38	21:18	00:40			
57	20:53	21:33	00:40			
58	21:00	21:41	00:41			
59	21:10	21:50	00:40	5	00:40	00:00.5

Average = 00:41

LTE 1 (4)

TT-9-30								
MINUTE	SOURCE	MEASURE	IN		OUT		TRAVEL TIME	2
			MINUTE	SECOND	MINUTE	SECOND		
1								
2	592.99	629.88	11	53	12	30	36.89	
3								
4	705.61	755.26	13	46	14	35	49.65	
	717.03	757.26	13	57	14	37	40.23	
5	770.59	823.36	14	51	15	43	52.77	
	805.94	854.54	15	26	16	15	48.60	
6	877.43	924.7	16	37	17	25	47.27	
7								
8								
9								
10								

LTE 3 (2)

TT-9-30								
MINUTE	SOURCE	MEASURE	IN		OUT		TRAVEL TIME	2
			MINUTE	SECOND	MINUTE	SECOND		
1	519.37	573.27	10	39	11	33	53.90	
2	594.91	648.93	11	55	12	49	54.02	
3	664.5	716.55	13	4	13	57	52.05	
	674.39	740.8	13	14	14	21	66.41	
4								
5								
6								
7	915.16	955.25	17	15	17	55	40.09	
8								
9	1051.84	1101.26	19	32	20	21	49.42	
10								

DATE: SEPTEMBER, 30, 1994
TIME: 14:12:00 - 14:22:00
CONDITION: MOVING CLOUDS, LOW FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference
1	1	12	48	0	51.7	0	3.7	7.7
	2	20	48	1	51.7	0	3.7	7.7
	3	16	46	0	51.7	0	5.7	12.4
	4	21	49	2	51.3	0	2.3	4.7
	5	17	48	2	51.6	0	3.6	7.5
	6	14	51	1	51.6	1	0.6	1.2
	7	12	45	0	51.6	0	6.6	14.7
	8	12	47	0	51.6	0	4.6	9.8
	9	20	48	0	51.6	0	3.6	7.5
	10	15	48	0	51.6	0	3.6	7.5
3	1	18	42	1	51.2	0	9.2	21.9
	2	17	42	1	51.8	0	9.8	23.3
	3	17	41	2	51.9	0	10.9	26.6
	4	24	42	0	51.9	0	9.9	23.6
	5	22	42	0	51.9	0	9.9	23.6
	6	23	45	0	51.9	0	6.9	15.3
	7	23	43	1	51.9	0	8.9	20.7
	8	18	42	0	51.9	0	9.9	23.6
	9	24	43	1	51.4	0	8.4	19.5
	10	21	42	0	51.4	0	9.4	22.4

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds

10-10-lane1-overcast

Travel Time Lane 1 (10/10/94)

Time: 15:40:00 - 16:00:00
Conditions: OVERCAST, LOW FLOW

	Start Time on 117th	Stop Time on 130th	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	39:15	40:03	00:48					
2	39:16	40:04	00:48					
3	39:17	40:07	00:50					
4	39:22	40:09	00:47					
5	39:29	40:19	00:50					
6	39:34	40:22	00:48					
7	39:53	40:37	00:44					
8	39:54	40:41	00:47					
9	39:55	40:44	00:49					
10	39:57	40:46	00:49					
11	40:00	40:52	00:52					
12	40:01	40:53	00:52					
13	40:02	40:54	00:52					
14	40:05	40:56	00:51					
15	40:06	40:58	00:52	15	00:49	00:02.3		
16	40:21	41:11	00:50					
17	40:22	41:12	00:50					
18	40:24	41:13	00:49					
19	40:26	41:15	00:49					
20	40:28	41:18	00:50					
21	40:31	41:19	00:48					
22	40:32	41:23	00:51					
23	40:35	41:24	00:49					
24	40:41	41:29	00:48					
25	40:42	41:33	00:51					
26	40:44	41:34	00:50					
27	40:45	41:35	00:50					
28	40:51	41:41	00:50					
29	40:53	41:43	00:50					
30	40:54	41:45	00:51					
31	40:56	41:47	00:51					
32	40:57	41:49	00:52					
33	40:59	41:50	00:51					
34	41:02	41:53	00:51					
35	41:07	41:56	00:49					
36	41:09	41:59	00:50	21	00:50	00:01		
37	41:11	42:00	00:49					
38	41:13	42:03	00:50					
39	41:15	42:04	00:49					
40	41:17	42:09	00:52					
41	41:19	42:11	00:52					
42	41:22	42:12	00:50					
43	41:24	42:16	00:52					
44	41:26	42:20	00:54					
45	41:28	42:21	00:53					
46	41:34	42:26	00:52					
47	41:41	42:33	00:52					
48	41:46	42:36	00:50					
49	41:47	42:37	00:50					
50	41:49	42:40	00:51					
51	41:50	42:42	00:52					
52	41:58	42:52	00:54					
53	42:00	42:54	00:54					
54	42:05	42:57	00:52					
55	42:09	42:57	00:48	19	00:51	00:02		
56	42:11	43:05	00:54					
57	42:13	43:06	00:53					
58	42:15	43:08	00:53					
59	42:15	43:12	00:57					
60	42:18	43:13	00:55					
61	42:19	43:14	00:55					
62	42:21	43:16	00:55					
63	42:26	43:20	00:54					

10-10-lane1-overcast

64	42:28	43:22	00:54			
65	42:32	43:33	01:01			
66	43:02	43:52	00:50			
67	43:07	43:55	00:48			
68	43:10	43:58	00:48			
69	43:11	43:59	00:48	16	00:53	00:04
70	43:15	44:04	00:49			
71	43:21	44:19	00:58			
72	43:28	44:27	00:59			
73	43:31	44:29	00:58			
74	43:34	44:31	00:57			
75	43:58	44:52	00:54			
76	43:59	44:53	00:54			
77	44:05	44:58	00:53	8	00:55	00:03
78	44:09	45:03	00:54			
79	44:14	45:07	00:53			
80	44:18	45:08	00:50			
81	44:21	45:15	00:54			
82	44:29	45:21	00:52			
83	44:30	45:23	00:53			
84	44:33	45:24	00:51			
85	44:35	45:25	00:50			
86	44:37	45:28	00:51			
87	44:38	45:30	00:52			
88	44:41	45:31	00:50			
89	44:44	45:36	00:52			
90	44:46	45:37	00:51			
91	44:49	45:41	00:52			
92	44:51	45:43	00:52			
93	44:52	45:43	00:51			
94	44:57	45:48	00:51	17	00:52	00:01
95	45:02	45:58	00:56			
96	45:11	46:06	00:55			
97	45:19	46:16	00:57			
98	45:25	46:17	00:52			
99	45:26	46:18	00:52			
100	45:30	46:20	00:50			
101	45:34	46:23	00:49			
102	45:50	46:37	00:47			
103	45:51	46:39	00:48			
104	45:55	46:41	00:46			
105	46:04	46:48	00:44			
106	46:06	46:57	00:51	12	00:51	00:04
107	46:07	47:07	01:00			
108	46:12	47:17	01:05			
109	46:19	47:20	01:01			
110	46:35	47:17	00:42			
111	46:39	47:26	00:47			
112	46:40	47:27	00:47			
113	46:43	47:30	00:47			
114	46:44	47:35	00:51			
115	46:45	47:37	00:52			
116	46:47	47:44	00:57			
117	46:51	47:46	00:55			
118	46:52	47:48	00:56			
119	46:54	47:51	00:57			
120	46:56	47:54	00:58			
121	46:58	47:55	00:57			
122	47:01	47:57	00:56			
123	47:03	47:59	00:56	17	00:54	00:06
124	47:04	48:00	00:56			
125	47:09	48:02	00:53			
126	47:10	48:03	00:53			
127	47:13	48:05	00:52			
128	47:16	48:08	00:52			
129	47:28	48:17	00:49			
130	47:30	48:21	00:51			
131	47:32	48:23	00:51			
132	47:42	48:30	00:48			

10-10-lane1-overcast

133	47:47	48:35	00:48			
134	47:48	48:37	00:49			
135	47:49	48:40	00:51			
136	47:55	48:43	00:48			
137	48:01	48:50	00:49			
138	48:02	48:51	00:49			
139	48:04	48:53	00:49			
140	48:08	48:58	00:50	17	00:50	00:02
141	48:22	49:17	00:55			
142	48:24	49:18	00:54			
143	48:25	49:21	00:56			
144	48:30	49:23	00:53			
145	48:32	49:29	00:57			
146	48:33	49:31	00:58			
147	48:34	49:32	00:58			
148	48:38	49:36	00:58			
149	48:44	49:37	00:53			
150	48:46	49:42	00:56			
151	48:48	49:45	00:57			
152	48:51	49:45	00:54			
153	48:54	49:48	00:54			
154	49:01	49:53	00:52			
155	49:04	49:55	00:51	15	00:55	00:02
156	49:12	50:03	00:51			
157	49:17	50:09	00:52			
158	49:22	50:12	00:50			
159	49:23	50:13	00:50			
160	49:26	50:15	00:49			
161	49:28	50:18	00:50			
162	49:29	50:20	00:51			
163	49:31	50:23	00:52			
164	49:33	50:25	00:52			
165	49:37	50:29	00:52			
166	49:39	50:33	00:54			
167	49:41	50:34	00:53			
168	49:59	50:49	00:50			
169	50:01	50:50	00:49			
170	50:04	50:53	00:49			
171	50:05	50:55	00:50	16	00:51	00:01
172	50:09	51:00	00:51			
173	50:09	51:00	00:51			
174	50:13	51:03	00:50			
175	50:17	51:05	00:48			
176	50:20	51:16	00:56			
177	50:30	51:23	00:53			
178	50:36	51:25	00:49			
179	50:40	51:29	00:49			
180	50:47	51:35	00:48			
181	50:48	51:38	00:50			
182	50:49	51:48	00:59			
183	51:02	51:51	00:49			
184	51:10	51:54	00:44	13	00:51	00:04
185	51:17	52:06	00:49			
186	51:20	52:08	00:48			
187	51:29	52:17	00:48			
188	51:31	52:20	00:49			
189	51:39	52:29	00:50			
190	51:41	52:30	00:49			
191	51:42	52:32	00:50			
192	51:43	52:33	00:50			
193	51:49	52:39	00:50			
194	51:50	52:41	00:51			
195	51:51	52:42	00:51			
196	51:52	52:43	00:51			
197	51:54	52:45	00:51			
198	51:55	52:47	00:52			
199	51:56	52:49	00:53			
200	52:04	52:55	00:51			
201	52:07	52:58	00:51			

10-10-lane1-overcast

202	52:08	52:59	00:51	18	00:50	00:01
203	52:10	53:02	00:52			
204	52:11	53:05	00:54			
205	52:13	53:06	00:53			
206	52:14	53:08	00:54			
207	52:18	53:10	00:52			
208	52:21	53:13	00:52			
209	52:32	53:21	00:49			
210	52:36	53:22	00:46			
211	52:37	53:34	00:57			
212	52:39	53:39	01:00			
213	52:47	53:42	00:55			
214	52:50	53:46	00:56			
215	52:52	53:47	00:55			
216	52:53	53:49	00:56			
217	52:54	53:50	00:56			
218	52:56	53:53	00:57			
219	53:00	53:59	00:59	17	00:54	00:03
220	53:12	54:03	00:51			
221	53:12	54:04	00:52			
222	53:24	54:12	00:48			
223	53:24	54:15	00:51			
224	53:25	54:17	00:52			
225	53:27	54:19	00:52			
226	53:28	54:21	00:53			
227	53:31	54:22	00:51			
228	53:36	54:27	00:51			
229	53:38	54:28	00:50			
230	53:41	54:35	00:54			
231	53:47	54:39	00:52			
232	53:47	54:44	00:57			
233	54:01	54:49	00:48			
234	54:03	54:54	00:51			
235	54:07	54:56	00:49			
236	54:08	54:58	00:50			
237	54:11	54:59	00:48	18	00:51	00:02
238	54:12	55:01	00:49			
239	54:12	55:04	00:52			
240	54:15	55:04	00:49			
241	54:16	55:06	00:50			
242	54:18	55:07	00:49			
243	54:21	55:12	00:51			
244	54:24	55:15	00:51			
245	54:25	55:16	00:51			
246	54:28	55:17	00:49			
247	54:30	55:19	00:49			
248	54:32	55:21	00:49			
249	54:42	55:29	00:47			
250	54:50	55:37	00:47			
251	54:51	55:35	00:44			
252	54:53	55:39	00:46			
253	55:03	55:47	00:44	16	00:49	00:02
254	55:13	56:04	00:51			
255	55:15	56:04	00:49			
256	55:17	56:07	00:50			
257	55:20	56:09	00:49			
258	55:26	56:14	00:48			
259	55:27	56:17	00:50			
260	55:28	56:18	00:50			
261	55:31	56:21	00:50			
262	55:36	56:27	00:51			
263	55:40	56:32	00:52			
264	55:44	56:39	00:55			
265	55:51	56:43	00:52			
266	55:56	56:49	00:53			
267	55:57	56:51	00:54			
268	55:58	56:52	00:54			
269	56:02	56:55	00:53			
270	56:04	56:57	00:53			

10-10-lane1-overcast

271	56:06	56:58	00:52	18	00:51	00:02
272	56:15	57:04	00:49			
273	56:20	57:05	00:45			
274	56:22	57:11	00:49			
275	56:25	57:13	00:48			
276	56:34	57:19	00:45			
277	56:44	57:32	00:48			
278	56:45	57:35	00:50			
279	56:46	57:36	00:50			
280	56:47	57:38	00:51			
281	56:51	57:41	00:50			
282	56:52	57:42	00:50			
283	56:54	57:43	00:49			
284	57:00	57:48	00:48			
285	57:01	57:50	00:49			
286	57:05	57:58	00:53	15	00:49	00:02
287	57:07	58:00	00:53			
288	57:10	58:01	00:51			
289	57:17	58:05	00:48			
290	57:18	58:07	00:49			
291	57:19	58:08	00:49			
292	57:24	58:13	00:49			
293	57:26	58:18	00:52			
294	57:28	58:19	00:51			
295	57:33	58:24	00:51			
296	57:35	58:28	00:53			
297	57:44	58:31	00:47			
298	57:48	58:35	00:47			
299	57:51	58:36	00:45			
300	57:53	58:40	00:47			
301	57:59	58:48	00:49			
302	58:01	58:50	00:49			
303	58:05	58:59	00:54	17	00:50	00:02
304	58:09	59:01	00:52			
305	58:12	59:03	00:51			
306	58:13	59:05	00:52			
307	58:17	59:08	00:51			
308	58:19	59:11	00:52			
309	58:23	59:14	00:51			
310	58:28	59:22	00:54			
311	58:31	59:24	00:53			
312	58:40	59:29	00:49			
313	58:47	59:36	00:49			
314	58:48	59:38	00:50			
315	58:50	59:39	00:49			
316	58:52	59:42	00:50			
317	58:54	59:44	00:50			
318	58:57	59:48	00:51			
319	59:02	59:52	00:50			
320	59:08	59:58	00:50	17	00:51	00:01
321	59:11	00:00	00:49			

AVERAGE: 00:51

Travel Time Lane 3 (10/10/94)

Time: 15:40:00 - 16:00:00
Conditions: OVERCAST, LOW FLOW

	Start Time on 117th	Stop Time on 130th	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	39:16	40:02	00:46					
2	39:18	40:03	00:45					
3	39:21	40:04	00:43					
4	39:26	40:09	00:43					
5	39:33	40:20	00:47					
6	39:34	40:22	00:48					
7	39:37	40:22	00:45					
8	39:40	40:25	00:45					
9	39:44	40:29	00:45					
10	39:48	40:32	00:44					
11	39:50	40:33	00:43					
12	39:51	40:34	00:43					
13	39:54	40:37	00:43					
14	39:57	40:42	00:45					
15	39:58	40:44	00:46					
16	39:59	40:45	00:46					
17	40:01	40:46	00:45					
18	40:01	40:48	00:47					
19	40:02	40:49	00:47					
20	40:03	40:50	00:47					
21	40:06	40:54	00:48					
22	40:06	40:55	00:49					
23	40:08	40:56	00:48					
24	40:14	40:59	00:45	24	00:46	00:01.8		
25	40:15	41:01	00:46					
26	40:16	41:02	00:46					
27	40:18	41:04	00:46					
28	40:19	41:05	00:46					
29	40:21	41:06	00:45					
30	40:22	41:08	00:46					
31	40:24	41:09	00:45					
32	40:26	41:11	00:45					
33	40:26	41:12	00:46					
34	40:32	41:17	00:45					
35	40:34	41:18	00:44					
36	40:35	41:19	00:44					
37	40:36	41:22	00:46					
38	40:39	41:23	00:44					
39	40:41	41:26	00:45					
40	40:50	41:30	00:40					
41	40:52	41:40	00:48					
42	40:53	41:41	00:48					
43	40:55	41:42	00:47					
44	41:01	41:46	00:45					
45	41:02	41:47	00:45					
46	41:05	41:48	00:43					
47	41:06	41:49	00:43					
48	41:08	41:51	00:43					
49	41:10	41:53	00:43					
50	41:11	41:53	00:42					
51	41:15	41:57	00:42	27	00:45	00:01.8		
52	41:17	42:00	00:43					
53	41:19	42:03	00:44					
54	41:24	42:09	00:45					
55	41:25	42:11	00:46					

56	41:28	42:13	00:45			
57	41:30	42:14	00:44			
58	41:31	42:17	00:46			
59	41:33	42:20	00:47			
60	41:35	42:22	00:47			
61	41:38	42:25	00:47			
62	41:40	42:25	00:45			
63	42:02	42:46	00:44			
64	42:03	42:48	00:45			
65	42:06	42:55	00:49			
66	42:08	42:56	00:48			
67	42:10	42:57	00:47			
68	42:12	42:59	00:47	17	00:46	00:01.6
69	42:13	43:00	00:47			
70	42:02	43:01	00:59			
71	42:15	43:03	00:48			
72	42:16	43:07	00:51			
73	42:20	43:08	00:48			
74	42:21	43:10	00:49			
75	42:23	43:11	00:48			
76	42:24	43:18	00:54			
77	42:30	43:19	00:49			
78	42:32	43:21	00:49			
79	42:33	43:25	00:52			
80	42:35	43:29	00:54			
81	42:41	43:33	00:52			
82	42:44	43:36	00:52			
83	42:45	43:38	00:53			
84	42:52	43:45	00:53			
85	42:53	43:47	00:54			
86	43:03	43:54	00:51			
87	43:08	43:58	00:50			
88	43:09	43:59	00:50	21	00:51	00:02.8
89	43:11	44:01	00:50			
90	43:13	44:02	00:49			
91	43:15	44:04	00:49			
92	43:19	44:11	00:52			
93	43:20	44:12	00:52			
94	43:22	44:13	00:51			
95	43:27	44:16	00:49			
96	43:43	44:29	00:46			
97	43:49	44:37	00:48			
98	43:50	44:39	00:49			
99	43:52	44:40	00:48			
100	43:53	44:40	00:47			
101	43:56	44:44	00:48			
102	43:59	44:47	00:48			
103	44:07	44:52	00:45			
104	44:10	44:55	00:45	16	00:48	00:02.1
105	44:12	45:02	00:50			
106	44:13	45:03	00:50			
107	44:14	45:04	00:50			
108	44:15	45:06	00:51			
109	44:17	45:08	00:51			
110	44:25	45:12	00:47			
111	44:29	45:15	00:46			
112	44:31	45:18	00:47			
113	44:32	45:19	00:47			
114	44:35	45:23	00:48			
115	44:39	45:28	00:49			
116	44:43	45:33	00:50			

10-10-lane3-overcast

117	44:45	45:39	00:54			
118	44:47	45:37	00:50			
119	44:48	45:42	00:54			
120	44:54	45:43	00:49			
121	45:00	45:47	00:47			
122	45:02	45:50	00:48			
123	45:03	45:52	00:49			
124	45:04	45:54	00:50			
125	45:08	45:58	00:50			
126	45:09	45:59	00:50	22	00:49	00:02.0
127	45:12	46:00	00:48			
128	45:15	46:01	00:46			
129	45:19	46:06	00:47			
130	45:21	46:10	00:49			
131	45:26	46:14	00:48			
132	45:32	46:16	00:44			
133	45:35	46:21	00:46			
134	45:38	46:22	00:44			
135	45:39	46:24	00:45			
136	45:43	46:26	00:43			
137	45:48	46:30	00:42			
138	45:49	46:33	00:44			
139	45:59	46:46	00:47			
140	46:01	46:48	00:47			
141	46:03	46:51	00:48			
142	46:07	46:54	00:47	16	00:46	00:02.0
143	46:18	47:03	00:45			
144	46:19	47:04	00:45			
145	46:22	47:07	00:45			
146	46:24	47:10	00:46			
147	46:25	47:11	00:46			
148	46:28	47:13	00:45			
149	46:32	47:18	00:46			
150	46:35	47:23	00:48			
151	46:35	47:23	00:48			
152	46:39	47:25	00:46			
153	46:41	47:26	00:45			
154	46:47	47:36	00:49			
155	46:48	47:38	00:50			
156	46:49	47:38	00:49			
157	46:50	47:39	00:49			
158	46:52	47:42	00:50			
159	46:53	47:43	00:50			
160	46:55	47:44	00:49			
161	46:57	47:45	00:48			
162	47:00	47:47	00:47			
163	47:01	47:48	00:47			
164	47:09	47:56	00:47			
165	47:10	47:56	00:46			
166	47:11	47:59	00:48	23	00:47	00:01.7
167	47:16	48:03	00:47			
168	47:18	48:05	00:47			
169	47:21	48:08	00:47			
170	47:25	48:10	00:45			
171	47:27	48:12	00:45			
172	47:29	48:13	00:44			
173	47:33	48:15	00:42			
174	47:34	48:17	00:43			
175	47:35	48:18	00:43			
176	47:37	48:20	00:43			
177	47:38	48:23	00:45			

178	47:41	48:27	00:46			
179	47:42	48:29	00:47			
180	47:43	48:30	00:47			
181	47:47	48:34	00:47			
182	47:48	48:36	00:48			
183	47:50	48:37	00:47			
184	47:53	48:41	00:48			
185	47:56	48:45	00:49			
186	47:57	48:46	00:49			
187	48:11	48:55	00:44			
188	48:13	48:59	00:46	22	00:46	00:02.0
189	48:15	49:01	00:46			
190	48:19	49:02	00:43			
191	48:21	49:06	00:45			
192	48:22	49:06	00:44			
193	48:24	49:09	00:45			
194	48:26	49:11	00:45			
195	48:27	49:12	00:45			
196	48:31	49:18	00:47			
197	48:43	49:29	00:46			
198	48:44	49:30	00:46			
199	48:47	49:36	00:49			
200	48:49	49:36	00:47			
201	48:51	49:38	00:47			
202	48:55	49:42	00:47			
203	48:58	49:45	00:47			
204	49:00	49:46	00:46			
205	49:05	49:51	00:46			
206	49:10	49:57	00:47	18	00:46	00:01.3
207	49:14	50:02	00:48			
208	49:16	50:03	00:47			
209	49:20	50:05	00:45			
210	49:22	50:07	00:45			
211	49:23	50:08	00:45			
212	49:26	50:11	00:45			
213	49:31	50:14	00:43			
214	49:31	50:16	00:45			
215	49:34	50:19	00:45			
216	49:38	50:21	00:43			
217	49:40	50:23	00:43			
218	49:43	50:30	00:47			
219	49:47	50:31	00:44			
220	49:49	50:33	00:44			
221	49:50	50:35	00:45			
222	49:53	50:39	00:46			
223	49:54	50:41	00:47			
224	49:56	50:42	00:46			
225	50:00	50:43	00:43			
226	50:03	50:49	00:46			
227	50:04	50:50	00:46			
228	50:05	50:51	00:46			
229	50:07	50:55	00:48			
230	50:10	50:56	00:46			
231	50:12	50:57	00:45	24	00:45	00:01.4
232	50:17	51:02	00:45			
233	50:17	51:04	00:47			
234	50:18	51:05	00:47			
235	50:21	51:06	00:45			
236	50:25	51:13	00:48			
237	50:28	51:15	00:47			
238	50:29	51:16	00:47			

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239	50:32	51:18	00:46			
240	50:37	51:23	00:46			
241	50:38	51:24	00:53			
242	50:43	51:30	00:50			
243	50:44	51:31	00:50			
244	50:46	51:33	00:49			
245	50:48	51:34	00:52			
246	50:49	51:35	00:52			
247	50:57	51:40	00:47			
248	51:00	51:41	00:47			
249	51:01	51:44	00:48			
250	51:02	51:47	00:49			
251	51:04	51:49	00:48			
252	51:05	51:51	00:50			
253	51:06	51:52	00:50			
254	51:09	51:55	00:48			
255	51:10	51:56	00:48			
256	51:12	51:57	00:48			
257	51:13	51:58	00:51	25	00:49	00:02.0
258	51:14	52:00	00:51			
259	51:18	52:04	00:48			
260	51:20	52:05	00:56			
261	51:22	52:06	00:54			
262	51:30	52:16	00:48			
263	51:31	52:16	00:59			
264	51:33	52:18	01:02			
265	51:43	52:30	00:59			
266	51:48	52:35	00:54			
267	51:53	52:42	00:50			
268	51:54	52:42	00:50			
269	51:55	52:43	00:51			
270	51:56	52:44	00:51			
271	51:58	52:46	00:51			
272	51:59	52:47	00:51			
273	52:01	52:49	00:51			
274	52:03	52:50	00:51			
275	52:50	52:52	00:05			
276	52:06	52:54	00:54			
277	52:08	52:55	00:58	19	00:53	00:03.9
278	52:14	53:00	00:54			
279	52:21	53:06	00:50			
280	52:25	53:08	00:49			
281	52:27	53:11	00:44			
282	52:29	53:14	00:45			
283	52:34	53:19	00:45			
284	52:39	53:23	00:44			
285	52:43	53:27	00:44			
286	52:46	53:29	00:43			
287	52:47	53:30	00:43			
288	52:48	53:33	00:45			
289	52:51	53:36	00:45			
290	52:52	53:38	00:46			
291	52:54	53:39	00:45			
292	52:56	53:41	00:45			
293	52:57	53:42	00:45			
294	52:58	53:43	00:45			
295	52:58	53:44	00:46			
296	53:01	53:45	00:44			
297	53:02	53:46	00:44			
298	53:03	53:48	00:45			
299	53:06	53:49	00:43			

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300	53:08	53:50	00:42				
301	53:12	53:57	00:45				
302	53:13	53:53	00:40				
303	53:14	53:59	00:45	26	00:45	00:02.6	
304	53:17	54:01	00:44				
305	53:21	54:03	00:42				
306	53:22	54:05	00:43				
307	53:30	54:14	00:44				
308	53:33	54:15	00:42				
309	53:34	54:17	00:43				
310	53:36	54:21	00:45				
311	53:37	54:21	00:44				
312	53:38	54:24	00:46				
313	53:42	54:27	00:45				
314	53:47	54:31	00:44				
315	53:48	54:33	00:45				
316	53:52	54:38	00:46				
317	53:53	54:40	00:47				
318	53:55	54:42	00:47				
319	53:58	54:44	00:46				
320	54:03	54:48	00:45				
321	54:05	54:50	00:45				
322	54:07	54:52	00:45				
323	54:10	54:54	00:44				
324	54:12	54:56	00:44				
325	54:13	54:58	00:45	22	00:45	00:01.3	
326	54:16	55:02	00:46				
327	54:20	55:06	00:46				
328	54:22	55:07	00:45				
329	54:25	55:08	00:43				
330	54:28	55:11	00:43				
331	54:29	55:13	00:44				
332	54:32	55:15	00:43				
333	54:33	55:16	00:43				
334	54:35	55:18	00:43				
335	54:37	55:18	00:41				
336	54:39	55:24	00:45				
337	54:41	55:25	00:44				
338	54:44	55:30	00:46				
339	54:46	55:31	00:45				
340	54:49	55:35	00:46				
341	54:50	55:37	00:47				
342	54:54	55:38	00:44				
343	54:58	55:42	00:44				
344	55:06	55:46	00:40				
345	55:11	55:54	00:43				
346	55:12	55:55	00:43				
347	55:13	55:57	00:44				
348	55:14	55:57	00:43	23	00:44	00:01.6	
349	55:16	56:00	00:44				
350	55:21	56:04	00:43				
351	55:26	56:07	00:41				
352	55:27	56:09	00:42				
353	55:31	56:16	00:45				
354	55:32	56:16	00:44				
355	55:34	56:19	00:45				
356	55:36	56:22	00:46				
357	55:36	56:23	00:47				
358	55:37	56:24	00:47				
359	55:49	56:32	00:43				
360	55:55	56:41	00:46				

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361	55:56	56:43	00:47			
362	56:04	56:52	00:48			
363	56:06	56:54	00:48			
364	56:08	56:55	00:47			
365	56:09	56:55	00:46			
366	56:12	56:58	00:46			
367	56:13	56:59	00:46	19	00:45	00:01.9
368	56:15	57:01	00:46			
369	56:15	57:01	00:46			
370	56:17	57:03	00:46			
371	56:17	57:04	00:47			
372	56:22	57:05	00:43			
373	56:24	57:09	00:45			
374	56:30	57:12	00:42			
375	56:32	57:23	00:51			
376	56:43	57:28	00:45			
377	56:46	57:31	00:45			
378	56:49	57:33	00:44			
379	56:50	57:34	00:44			
380	56:51	57:35	00:44			
381	56:52	57:38	00:46			
382	56:55	57:39	00:44			
383	56:57	57:40	00:43			
384	57:04	57:49	00:45			
385	57:07	57:51	00:44			
386	57:09	57:51	00:42			
387	57:10	57:54	00:44			
388	57:11	57:55	00:44			
389	57:14	57:56	00:42	22	00:45	00:01.9
390	57:17	58:00	00:43			
391	57:19	58:01	00:42			
392	57:20	58:02	00:42			
393	57:21	58:03	00:42			
394	57:25	58:05	00:40			
395	57:33	58:22	00:49			
396	57:38	58:26	00:48			
397	57:46	58:32	00:46			
398	57:49	58:34	00:45			
399	57:50	58:36	00:46			
400	57:52	58:37	00:45			
401	57:53	58:39	00:46			
402	57:54	58:40	00:46			
403	57:57	58:41	00:44			
404	57:58	58:42	00:44			
405	57:59	58:43	00:44			
406	58:02	58:47	00:45			
407	58:03	58:48	00:45			
408	58:04	58:52	00:48			
409	58:08	58:54	00:46			
410	58:10	58:55	00:45	21	00:45	00:02.2
411	58:15	59:02	00:47			
412	58:18	59:04	00:46			
413	58:22	59:06	00:44			
414	58:23	59:09	00:46			
415	58:29	59:12	00:43			
416	58:29	59:13	00:44			
417	58:31	59:16	00:45			
418	58:33	59:17	00:44			
419	58:36	59:19	00:43			
420	58:37	59:22	00:45			
421	58:40	59:26	00:46			

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422	58:43	59:32	00:49			
423	58:47	59:35	00:48			
424	58:51	59:43	00:52			
425	58:54	59:44	00:50			
426	58:57	59:45	00:48			
427	58:58	59:47	00:49			
428	59:02	59:48	00:46			
429	59:04	59:49	00:45			
430	59:05	59:50	00:45			
431	59:07	59:51	00:44			
432	59:11	59:56	00:45			
433	59:15	59:58	00:43	23	00:46	00:02.3

Average: 00:55

LTE 1 (4)

TT10-100				
MINUTE	OUT		TRAVEL TIME	30
	MINUTE	SECOND		
1	39	25	37	
	40	23	65	
	39	52	51	
	40	21	54	
	39	53	47	
	39	50	47	
2	41	14	40	
	41	15	53	
	40	58	54	
	40	47	68	
	40	45	48	
3	41	47	49	
	42	19	49	
	41	42	50	
	42	1	50	
	42	14	50	
4	42	53	53	
	42	47	56	
5	43	33	10	
6				
7	45	59	52	
	45	32	53	
8				
9	47	27	47	
	48	11	66	
10	48	41	50	
	48	47	44	
11	50	3	49	
	49	33	60	
12	50	26	47	
	50	45	78	
13	51	50	48	
	52	24	63	
	51	54	41	
14	52	42	61	
	53	16	47	
	52	38	55	
15	54	10	42	
	54	6	53	
	54	9	42	
16	55	18	47	
	55	17	52	
	54	53	57	
	54	28	49	
	55	23	57	
17	55	36	49	
18	57	0	59	
	57	14	48	
	56	46	47	
	56	44	53	
19	58	20	43	
20	58	29	47	

LTE 2 (3)

MINUTE	SOURCE	MEASURE	IN		OUT		TRAVEL TIME	30
			MINUTE	SECOND	MINUTE	SECOND		
1								
2	595.68	641.16	39	56	40	41	45.48	
	596.97	635.18	39	57	40	35	38.21	
	615.23	678.74	40	15	41	19	63.51	
	601.08	664.72	40	1	41	5	63.64	
3	685.59	734.22	41	26	42	14	48.63	
	655	705.34	40	55	41	45	50.34	
4	700.66	754.2	41	41	42	34	53.54	
	698.64	749.1	41	39	42	29	50.46	
	702.28	747.2	41	42	42	27	44.92	
	717.95	761.37	41	58	42	41	43.42	
5	779.26	851.62	42	59	44	12	72.36	
6	842.5	893.55	44	2	44	54	51.05	
7	900.6	949.72	45	1	45	50	49.12	
8	955.25	1002	45	55	46	42	46.75	
	984.52	1034.02	46	25	47	14	49.50	
	982.71	1032.21	46	23	47	12	49.50	
9								
10								
11	1161.05	1206.75	49	21	50	7	45.70	
	1170.06	1224.7	49	30	50	25	54.64	
	1125.38	1175.68	48	45	49	36	50.30	
	1165.34	1211.05	49	25	50	11	45.71	
	1124.48	1178.73	48	44	49	39	54.25	
	1173.97	1215.83	49	34	50	16	41.86	
12	1181.52	1230.09	49	42	50	30	48.57	
	1212.55	1257.75	50	13	50	58	45.20	
13	1239.96	1294.1	50	40	51	34	54.14	
14								
15								
16	1428.51	1476.48	53	49	54	36	47.97	
	1484.87	1521.34						
17								
18	1557.02	1618.4	55	57	56	58	61.38	
	1581.11	1630.82	56	21	57	11	49.71	
	1566.57	1621.8	56	7	57	2	55.23	
	1548.57	1596.75	55	49	56	37	48.18	
	1576.11	1620.77	56	16	57	1	44.66	
	1573.47	1619.8	56	13	56	60	46.33	
19	1612.63	1662.06	56	53	57	42	49.43	
20	1673.11	1722.44	57	53	58	42	49.33	
	1668.62	1739.17	57	49	58	59	70.55	

LTE 3 (2)

TT10-100				
MINUTE	OUT		TRAVEL TIME	30
	MINUTE	SECOND		
1				
2	40	45	55	
	41	3	44	
	40	28	42	
	41	10	37	
3	41	49	44	
4	43	10	50	
	42	29	47	
5	43	27	45	
	43	52	54	
6	44	38	45	
7	46	19	38	
8	47	25	32	
	46	34	34	
9	47	59	35	
	47	37	51	
	48	8	46	
	47	48	41	
	48	18	43	
10	48	38	35	
	49	1	42	
11	49	56	48	
12	50	46	52	
	51	21	31	
	50	30	63	
13	52	3	55	
14	52	43	59	
15	54	25	45	
	54	2	49	
	54	23	46	
	54	22	44	
	53	53	44	
	53	51	47	
16	55	19	42	
	55	3	59	
	55	4	46	
	54	55	48	
17	55	32	55	
	55	38	42	
	55	37	54	
	56	17	45	
	56	25	47	
18	57	44	65	
	56	49	41	
	57	13	55	
	56	28	50	
	56	36	42	
19	57	38	45	
	58	23	48	
20	58	32	46	
	58	46	46	
	58	44	41	

TRAVEL TIME TABLE(MAIN)

DATE: OCTOBER 10, 1994
TIME: 15:40:00 - 16:00:00
CONDITION: OVERCAST, LOW FLOW TO MODERATE FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME		DIFFERENCE IN HITS	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference	Percentage of Hits	Percentage of Valid Hits
1 - MIN DATA										
1	1	15	49	6	50.3	0	1.3	2.7	40.0	0.0
	2	21	50	5	50.6	2	0.6	1.2	23.8	9.5
	3	19	51	5	50.5	4	-0.5	-1.0	26.3	21.1
	4	16	53	2	51	1	-2	-3.8	12.5	6.3
	5	8	55	1	51	0	-4	-7.3	12.5	0.0
	6	17	52	0	51	0	-1	-1.9	0.0	0.0
	7	12	51	2	51.3	1	0.3	0.6	16.7	8.3
	8	17	54	0	50.5	0	-3.5	-6.5	0.0	0.0
	9	17	50	2	50.4	1	0.4	0.8	11.8	5.9
	10	15	55	2	50.4	1	-4.6	-8.4	13.3	6.7
	11	16	51	2	50.3	2	-0.7	-1.4	12.5	12.5
	12	13	51	2	49.6	0	-1.4	-2.7	15.4	0.0
	13	18	50	3	49.3	1	-0.7	-1.4	16.7	5.6
	14	17	54	3	50.4	0	-3.6	-6.7	17.6	0.0
	15	18	51	3	49.8	1	-1.2	-2.4	16.7	5.6
	16	16	49	5	49.5	2	0.5	1.0	31.3	12.5
	17	18	51	1	49.5	1	-1.5	-2.9	5.6	5.6
	18	15	49	4	49.7	2	0.7	1.4	26.7	13.3
	19	17	51	1	48.4	0	-2.6	-5.1	5.9	0.0
	20	17	51	1	48.1	1	-2.9	-5.7	5.9	5.9

Population, Sample, Tracks reported in # of vehicles Travel Time reported in seconds

COMMENT:

TRAVEL TIME TABLE(MAIN)

DATE: OCTOBER 10, 1994
TIME: 15:40:00 - 16:00:00
CONDITION: OVERCAST, LOW FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME		DIFFERENCE IN HITS	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference	Percentage of Hits	Percentage of Valid Hits
1 - MIN DATA										
3	1	24	46	0	46.6	0	0.6	1.3	0.0	0.0
	2	27	45	4	46	1	1	2.2	14.8	3.7
	3	17	46	1	45.5	1	-0.5	-1.1	5.9	5.9
	4	21	51	2	45.8	1	-5.2	-10.2	9.5	4.8
	5	16	48	2	45.6	0	-2.4	-5.0	12.5	0.0
	6	22	49	1	45.5	1	-3.5	-7.1	4.5	4.5
	7	16	46	1	44.1	0	-1.9	-4.1	6.3	0.0
	8	23	47	2	42.2	0	-4.8	-10.2	8.7	0.0
	9	22	46	5	42.4	3	-3.6	-7.8	22.7	13.6
	10	18	46	2	42.4	0	-3.6	-7.8	11.1	0.0
	11	24	45	1	42.4	1	-2.6	-5.8	4.2	4.2
	12	25	49	3	42.2	0	-6.8	-13.9	12.0	0.0
	13	19	53	1	42.2	1	-10.8	-20.4	5.3	5.3
	14	26	45	1	42.2	0	-2.8	-6.2	3.8	0.0
	15	22	45	6	44.5	0	-0.5	-1.1	27.3	0.0
	16	23	44	4	45	2	1	2.3	17.4	8.7
	17	19	45	5	45.7	3	0.7	1.6	26.3	15.8
	18	22	45	5	45.7	0	0.7	1.6	22.7	0.0
	19	21	45	4	45.6	2	0.6	1.3	19.0	9.5
	20	23	46	3	45.6	2	-0.4	-0.9	13.0	8.7

Population, Sample, Tracks reported in # of vehicles Travel Time reported in seconds

COMMENT:

TRAVEL TIME TABLE (LOW)

DATE: OCTOBER 10, 1994
TIME: 15:40:00 - 15:50:00
CONDITION: OVERCAST, LOW FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference
1 - MIN DATA								
1	1	15	49	6	50.3	0	1.3	2.7
	2	21	50	5	50.6	2	0.6	1.2
	3	19	51	5	50.5	4	-0.5	-1.0
	4	16	53	2	51	1	-2	-3.8
	5	8	55	1	51	0	-4	-7.3
	6	17	52	0	51	0	-1	-1.9
	7	12	51	2	51.3	1	0.3	0.6
	8	17	54	0	50.5	0	-3.5	-6.5
	9	17	50	2	50.4	1	0.4	0.8
	10	15	55	2	50.4	1	-4.6	-8.4
3	1	24	46	0	46.6	0	0.6	1.3
	2	27	45	4	46	1	1	2.2
	3	17	46	1	45.5	1	-0.5	-1.1
	4	21	51	2	45.8	1	-5.2	-10.2
	5	16	48	2	45.6	0	-2.4	-5.0
	6	22	49	1	45.5	1	-3.5	-7.1
	7	16	46	1	44.1	0	-1.9	-4.1
	8	23	47	2	42.2	0	-4.8	-10.2
	9	22	46	5	42.4	3	-3.6	-7.8
	10	18	46	2	42.4	0	-3.6	-7.8

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds

TRAVEL TIME TABLE (MODERATE)

DATE: OCTOBER 10, 1994
TIME: 15:50:00 - 16:00:00
CONDITION: OVERCAST, MODERATE FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME		DIFFERENCE IN HITS	
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference	Percentage of Hits	Percentage of Valid Hits
1 - MIN DATA										
1	1	16	51	2	50.3	2	-0.7	-1.4	12.5	12.5
	2	13	51	2	49.6	0	-1.4	-2.7	15.4	0.0
	3	18	50	3	49.3	1	-0.7	-1.4	16.7	5.6
	4	17	54	3	50.4	0	-3.6	-6.7	17.6	0.0
	5	18	51	3	49.8	1	-1.2	-2.4	16.7	5.6
	6	16	49	5	49.5	2	0.5	1.0	31.3	12.5
	7	18	51	1	49.5	1	-1.5	-2.9	5.6	5.6
	8	15	49	4	49.7	2	0.7	1.4	26.7	13.3
	9	17	51	1	48.4	0	-2.6	-5.1	5.9	0.0
	10	17	51	1	48.1	1	-2.9	-5.7	5.9	5.9
3	1	24	45	1	42.4	1	-2.6	-5.8	4.2	4.2
	2	25	49	3	42.2	0	-6.8	-13.9	12.0	0.0
	3	19	53	1	42.2	1	-10.8	-20.4	5.3	5.3
	4	26	45	1	42.2	0	-2.8	-6.2	3.8	0.0
	5	22	45	6	44.5	0	-0.5	-1.1	27.3	0.0
	6	23	44	4	45	2	1	2.3	17.4	8.7
	7	19	45	5	45.7	3	0.7	1.6	26.3	15.8
	8	22	45	5	45.7	0	0.7	1.6	22.7	0.0
	9	21	45	4	45.6	2	0.6	1.3	19.0	9.5
	10	23	46	3	45.6	2	-0.4	-0.9	13.0	8.7

Population, Sample, Tracks reported in # of vehicles Travel Time reported in seconds

COMMENT:

average:	389	49	58	47	21	-2	-3	15	6

Travel Time of Tape 3 Lane 1 (10/10/94)

* Overcast, Light Rain, Low Flow
* Time: 11:15 - 11:25 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	14:15	15:00	00:45					
2	14:16	15:02	00:46					
3	14:17	15:04	00:47					
4	14:26	15:06	00:40					
5	14:29	15:24	00:55					
6	14:46	15:37	00:51					
7	14:48	15:39	00:51					
8	14:50	15:41	00:51					
9	14:54	15:43	00:49					
10	14:55	15:44	00:49					
11	14:59	15:47	00:48					
12	14:59	15:48	00:49					
13	15:02	15:49	00:47					
14	15:04	15:52	00:48					
15	15:05	15:53	00:48	15	00:48	00:03.2		
16	15:12	16:04	00:52					
17	15:13	16:08	00:55					
18	15:17	16:09	00:52					
19	15:28	16:12	00:44					
20	15:47	16:19	00:32					
21	15:31	16:24	00:53					
22	15:32	16:25	00:53					
23	15:33	16:26	00:53					
24	15:36	16:28	00:52					
25	15:50	16:29	00:39					
26	15:46	16:35	00:49					
27	15:47	16:37	00:50					
28	15:51	16:38	00:47					
29	15:53	16:40	00:47					
30	15:57	16:43	00:46					
31	16:02	16:49	00:47					
32	16:06	16:53	00:47	17	00:48	00:05.6		
33	16:13	17:01	00:48					
34	16:12	17:11	00:59					
35	16:22	17:15	00:53					
36	16:23	17:18	00:55					
37	16:27	17:20	00:53					
38	16:37	17:21	00:44					
39	16:48	17:36	00:48					
40	16:52	17:39	00:47					
41	16:56	17:41	00:45					
42	17:11	17:56	00:45					
43	17:12	17:57	00:45	11	00:49	00:04.7		
44	17:17	18:02	00:45					
45	17:17	18:02	00:45					
46	17:19	18:04	00:45					

47	17:20	18:06	00:46			
48	17:25	18:11	00:46			
49	17:34	18:20	00:46			
50	17:37	18:23	00:46			
51	17:41	18:27	00:46			
52	17:42	18:34	00:52			
53	17:59	18:47	00:48	10	00:47	00:02.0
54	18:10	19:01	00:51			
55	18:14	19:04	00:50			
56	18:16	19:06	00:50			
57	18:23	19:12	00:49			
58	18:31	19:17	00:46			
59	18:39	19:23	00:44			
60	18:41	19:33	00:52			
61	18:43	19:36	00:53			
62	18:51	19:37	00:46			
63	18:53	19:41	00:48			
64	19:04	19:54	00:50			
65	19:05	19:56	00:51			
66	19:07	19:58	00:51			
67	19:03	19:57	00:54	14	00:50	00:02.7
68	19:11	20:01	00:50			
69	19:13	20:03	00:50			
70	19:17	20:08	00:51			
71	19:19	20:09	00:50			
72	19:20	20:11	00:51			
73	19:22	20:13	00:51			
74	19:23	20:14	00:51			
75	19:24	20:15	00:51			
76	19:35	20:23	00:48			
77	19:37	20:25	00:48			
78	19:55	20:39	00:44			
79	19:59	20:45	00:46			
80	20:04	20:49	00:45			
81	20:11	20:57	00:46	14	00:49	00:02.4
82	20:16	21:03	00:47			
83	20:23	21:11	00:48			
84	20:26	21:13	00:47			
85	20:28	21:16	00:48			
86	20:30	21:22	00:52			
87	20:33	21:25	00:52			
88	20:36	21:31	00:55			
89	20:57	21:50	00:53			
90	20:58	21:57	00:59	9	00:51	00:03.9
91	21:17	22:01	00:44			
92	21:24	22:06	00:42			
93	21:29	22:13	00:44			
94	21:30	22:15	00:45			
95	21:35	22:16	00:41			

96	21:39	22:25	00:46			
97	21:42	22:29	00:47			
98	21:48	22:31	00:43			
99	21:52	22:39	00:47			
100	21:57	22:43	00:46			
101	22:02	22:47	00:45			
102	22:04	22:49	00:45			
103	22:10	22:54	00:44			
104	22:15	22:56	00:41	14	00:44	00:01.9
105	22:22	23:09	00:47			
106	22:23	23:10	00:47			
107	22:25	23:12	00:47			
108	22:26	23:14	00:48			
109	22:42	23:34	00:52			
110	22:49	23:36	00:47			
111	22:53	23:46	00:53			
112	22:54	23:47	00:53			
113	22:56	23:49	00:53			
114	22:57	23:50	00:53			
115	23:03	23:53	00:50	11	00:50	00:02.7
116	23:20	24:03	00:43			
117	23:24	24:10	00:46			
118	23:28	24:13	00:45			
119	23:31	24:22	00:51			
120	23:38	24:26	00:48			
121	23:48	24:35	00:47			
122	23:54	24:39	00:45			
123	24:02	24:44	00:42			
124	24:03	24:51	00:48			
125	24:06	24:52	00:46			
126	24:08	24:54	00:46	11	00:46	00:02.4

Average = 14:52

Travel Time of Tape 3 Lane 3 (10/10/94)

* Overcast, Light Rain, Low Flow
* Time: 11:15 - 11:25 10 minutes count

	Start Time	Finish Time	Travel Time	POP	MEAN	STD	SIZE AT 0.05	SIZE AT 0.1
1	14:16	15:03	00:47					
2	14:22	15:06	00:44					
3	14:24	15:12	00:48					
4	14:27	15:14	00:47					
5	14:27	15:15	00:48					
6	14:29	15:16	00:47					
7	14:34	15:19	00:45					
8	14:36	15:21	00:45					
9	14:37	15:22	00:45					
10	14:39	15:24	00:45					
11	14:44	15:27	00:43					
12	14:45	15:28	00:43					
13	14:51	15:37	00:46					
14	14:53	15:38	00:45					
15	15:00	15:44	00:44					
16	15:02	15:46	00:44					
17	15:11	15:54	00:43					
18	15:13	15:55	00:42					
19	15:17	15:59	00:42	19	00:45	00:01.8		
20	15:20	16:02	00:42					
21	15:23	16:04	00:41					
22	15:24	16:08	00:44					
23	15:28	16:14	00:46					
24	15:31	16:16	00:45					
25	15:36	16:24	00:48					
26	15:38	16:27	00:49					
27	15:44	16:29	00:45					
28	15:46	16:31	00:45					
29	15:52	16:34	00:42					
30	15:56	16:39	00:43					
31	16:02	16:45	00:43					
32	16:03	16:47	00:44					
33	16:05	16:49	00:44					
34	16:06	16:50	00:44					
35	16:08	16:51	00:43					
36	16:14	16:56	00:42	17	00:44	00:02.1		
37	16:16	17:03	00:47					
38	16:23	17:11	00:48					
39	16:32	17:15	00:43					
40	16:38	17:20	00:42					
41	16:42	17:25	00:43					
42	16:52	17:33	00:41					
43	16:54	17:38	00:44					
44	16:56	17:39	00:43					
45	17:07	17:50	00:43					
46	17:08	17:51	00:43	10	00:44	00:02.1		
47	17:12	18:01	00:49					
48	17:16	18:02	00:46					
49	17:19	18:03	00:44					
50	17:22	18:07	00:45					
51	17:24	18:08	00:44					
52	17:28	18:10	00:42					
53	17:32	18:16	00:44					
54	17:34	18:18	00:44					
55	17:37	18:19	00:42					

56	17:40	18:34	00:54			
57	17:50	18:34	00:44			
58	17:53	18:38	00:45			
59	17:57	18:42	00:45			
60	18:09	18:51	00:42			
61	18:13	18:57	00:44			
62	18:14	18:59	00:45	16	00:45	00:02.9
63	18:16	19:01	00:45			
64	18:28	19:10	00:42			
65	18:31	19:13	00:42			
66	18:32	19:14	00:42			
67	18:33	19:16	00:43			
68	18:38	19:20	00:42			
69	18:42	19:26	00:44			
70	18:44	19:28	00:44			
71	18:47	19:31	00:44			
72	19:00	19:43	00:43			
73	19:01	19:45	00:44			
74	19:06	19:49	00:43			
75	19:09	19:51	00:42			
76	19:15	19:59	00:44	14	00:43	00:01.0
77	19:18	20:02	00:44			
78	19:21	20:05	00:44			
79	19:25	20:11	00:46			
80	19:31	20:13	00:42			
81	19:34	20:15	00:41			
82	19:38	20:21	00:43			
83	19:41	20:25	00:44			
84	19:46	20:28	00:42			
85	19:56	20:35	00:39			
86	19:58	20:39	00:41			
87	20:07	20:49	00:42			
88	20:05	20:51	00:46			
89	20:13	20:53	00:40			
90	20:16	20:54	00:38	14	00:42	00:02.3
91	20:27	21:10	00:43			
92	20:29	21:12	00:43			
93	20:31	21:14	00:43			
94	20:34	21:16	00:42			
95	20:36	21:19	00:43			
96	20:38	21:22	00:44			
97	20:43	21:26	00:43			
98	20:48	21:30	00:42			
99	20:50	21:33	00:43			
100	20:52	21:34	00:42			
101	21:00	21:41	00:41			
102	21:03	21:47	00:44			
103	21:04	21:48	00:44			
104	21:11	21:55	00:44	14	00:43	00:00.9
105	21:19	22:00	00:41			
106	21:22	22:08	00:46			
107	21:24	22:09	00:45			
108	21:25	22:10	00:45			
109	21:27	22:12	00:45			
110	21:31	22:14	00:43			
111	21:34	22:16	00:42			
112	21:36	22:19	00:43			

113	21:41	22:24	00:43			
114	21:44	22:26	00:42			
115	21:45	22:27	00:42			
116	21:51	22:33	00:42			
117	21:53	22:34	00:41			
118	21:55	22:39	00:44			
119	22:00	22:43	00:43			
120	22:02	22:45	00:43			
121	22:03	22:46	00:43			
122	22:05	22:47	00:42			
123	22:05	22:48	00:43			
124	22:07	22:49	00:42			
125	22:11	22:51	00:40			
126	22:13	22:53	00:40			
127	22:16	22:55	00:39	23	00:43	00:01.7
128	22:26	23:07	00:41			
129	22:31	23:14	00:43			
130	22:34	23:15	00:41			
131	22:44	23:28	00:44			
132	22:47	23:31	00:44			
133	22:51	23:33	00:42			
134	22:55	23:37	00:42			
135	22:56	23:44	00:48			
136	23:02	23:45	00:43			
137	23:03	23:47	00:44			
138	23:06	23:50	00:44			
139	23:08	23:51	00:43			
140	23:09	23:53	00:44			
141	23:14	23:56	00:42			
142	23:16	23:58	00:42	15	00:43	00:01.7
143	23:19	24:03	00:44			
144	23:23	24:06	00:43			
145	23:25	24:08	00:43			
146	23:29	24:12	00:43			
147	23:33	24:15	00:42			
148	23:40	24:24	00:44			
149	23:42	24:25	00:43			
150	23:47	24:30	00:43			
151	23:49	24:33	00:44			
152	23:54	24:36	00:42			
153	23:55	24:37	00:42			
154	23:57	24:38	00:41			
155	24:02	24:45	00:43			
156	24:06	24:47	00:41			
157	24:13	24:56	00:43			
158	24:15	24:57	00:42			
159	24:17	24:59	00:42	17	00:43	00:00.9

Average = 00:43

LTE LANE 1 (4)

TT-10-10				
MINUTE	OUT		TRAVEL TIME	7
	MINUTE	SECOND		
1				
2	16	5	52	
3	16	14	35	
	16	20	34	
4	18	12	45	
	18	4	45	
	17	49	63	
	17	57	53	
	17	38	44	
5	18	29	62	
	18	48	31	
	19	13	50	
	19	8	41	
6	20	4	39	
7	20	26	48	
	20	31	61	
8	21	46	35	
	21	47	53	
	22	7	80	
	22	2	19	
9	22	40	41	
10	7	0	0	
11	25	11	28	
	7	0	0	
	7	0	0	
	7	0	0	
	7	0	0	
	7	0	0	

LTE LANE 3 (2)

TT-10-10				
MINUTE	OUT		TRAVEL TIME	7
	MINUTE	SECOND		
1	14	21	50	
2	15	45	52	
	15	51	64	
3	16	22	52	
4	17	16	50	
	17	40	43	
	18	6	52	
5	18	18	44	
6	20	12	50	
	19	44	43	
	19	28	49	
7	20	22	43	
	20	31	41	
	20	17	42	
	21	8	71	
8	21	43	79	
	21	47	47	
9	22	34	41	
10	23	41	38	
11	24	57	43	
	24	24	42	
	24	46	43	
	24	51	44	
	24	18	52	

DATE: OCTOBER 10, 1994
TIME: 11:15:00-11:25:00
CONDITION: RAIN, LOW FLOW

	REFERENCE DATA			MOBILIZER DATA			DIFFERENCE IN TRAVEL TIME		
Lane	Period	Population	Mean Travel Time	Hits	Mean Travel Time	Valid Hits	Raw Difference	Percentage Difference	abs % hit
1 - MIN DATA									
1	1	15	48	0	45	0	-3	-6.3	0.0
	2	17	48	1	45	1	-3	-6.3	5.9
	3	11	49	2	42.9	1	-6.1	-12.4	9.1
	4	10	47	6	43.7	2	-3.3	-7.0	20.0
	5	14	50	4	44.1	1	-5.9	-11.8	7.1
	6	14	49	1	43	0	-6	-12.2	0.0
	7	9	51	2	44.1	1	-6.9	-13.5	11.1
	8	14	44	4	44.1	0	0.1	0.2	0.0
	9	11	50	1	43.5	0	-6.5	-13.0	0.0
	10	11	46	0	43.5	0	-2.5	-5.4	0.0
3	1	19	45	1	49.2	0	4.2	9.3	0.0
	2	17	44	2	49.9	0	5.9	13.4	0.0
	3	10	44	1	50.3	0	6.3	14.3	0.0
	4	16	45	3	50.3	1	5.3	11.8	6.3
	5	14	43	1	49	1	6	14.0	7.1
	6	14	42	3	48.9	1	6.9	16.4	7.1
	7	14	43	4	47.6	2	4.6	10.7	14.3
	8	23	43	2	47.4	0	4.4	10.2	0.0
	9	15	43	1	46.2	0	3.2	7.4	0.0
	10	17	43	1	44.6	0	1.6	3.7	0.0

Population, Hits and Valid Hits Reported in Number of Vehicles Travel Time Reported in Seconds