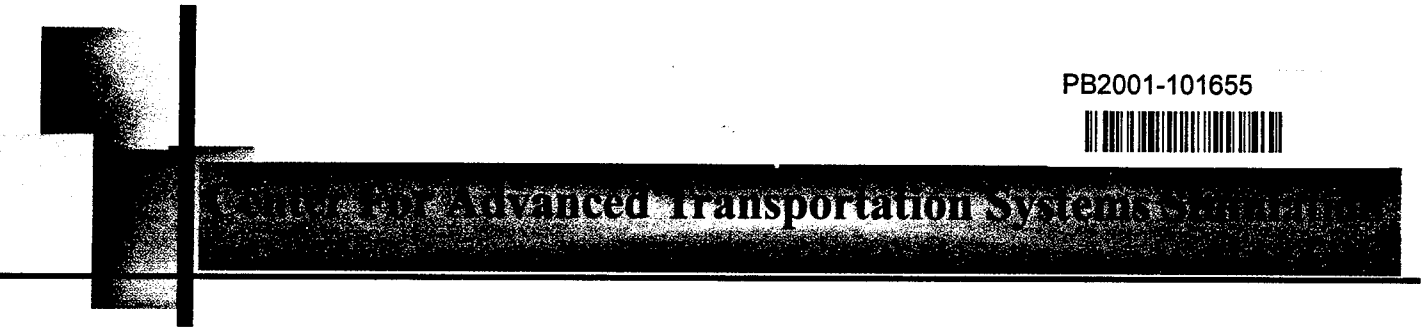


EVALUATION OF "AUTOSENSE-III" LASER DETECTION TECHNOLOGY FOR TRAFFIC APPLICATIONS ON I-4 AND FACILITIES OF THE ORLANDO ORANGE COUNTY EXPRESSWAY AUTHORITY (OOCEA) PROJECT ID# 5

Final Report for CATSS Project
YEAR1
Submitted to CATSS

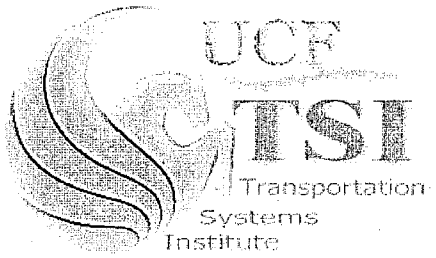
EVALUATION OF "AUTOSENSE-III" LASER DETECTION TECHNOLOGY FOR TRAFFIC APPLICATIONS ON I-4 AND FACILITIES OF THE ORLANDO ORANGE COUNTY EXPRESSWAY AUTHORITY (OOCEA)
PROJECT ID# 5

Project Period

March 1, 1999 - December 1, 1999

By

Haitham Al-Deek, Ph.D., P.E.
Associate Professor and Director of the Transportation System Institute (TSI)
Department of Civil & Environmental Engineering
University of Central Florida
Orlando, FL 32816
Phone: (407) 823-2988
Fax: (407) 823-3315
E-mail: haldeek@pegasus.cc.ucf.edu
http://www.catss.ucf.edu/tsi



August 2000

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16. Abstract

The goal of this research is to investigate applications of Autosense-III, the latest generation of a laser based vehicle sensor that was developed by Schwartz Electro-Optics, Inc. (SEO), an Orlando based company. This report documents findings of the first year in this multi-year research program.
The major tasks of the first year included procuring the two Autosense III units, selecting a site on I-4 for installation of the units, installing the units successfully on I-4, and establishing a remote communication link through cellular data line to download data form the units. All these tasks were accomplished successfully during the first year. Future research will conduct in-depth comparison of Autosense III speed and volume data with data collected from the nearest working magnetic loop detector station to the selected site on I-4 and/or comparison with data collected from tapes of closed circuit television cameras on I-4.

17. Key Words	18. Distribution Statement
Autosense, laser detection, loop detectors, incident detection, travel time measurement	

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EXECUTIVE SUMMARY

The major tasks of YEAR1 include procuring the two Autosense III units, selecting a site on I-4 for installation of the units, installing the units successfully on I-4, and establishing a remote communication link through cellular data line to download data form the units. All these tasks were accomplished successfully during the first nine months of this project.

DETAILED SUMMARY OF ACTIVITIES

The UCF-CATSS funds were used to purchase two Autosense III units from SEO in April 1999. The UCF-TSI research team, FDOT, and SEO agreed on the appropriate location for installation of the two units on I-4, this was next to the Lake Ivanhoe interchange. Selection of this location was based on incident history, availability of sign structure for mounting the units, and presence of loop detector data as well as CCTV video cameras operated by the FDOT Regional Traffic Management Center (RTMC) located in Orlando. The FDOT cameras and adjacent loop detector stations would be used for comparison with traffic data collected from the Autosense III units.

SEO had to secure an installation permit from FDOT permit's office in Deland to install the two Autosense III units on I-4 sign structure at Lake Ivanhoe. In addition, an AT&T wireless agreement had to be signed between UCF legal council and AT&T so that data from the two units can be accessed through a website and cellular data line. This legal process took about 5 months. SEO hired a subcontractor to close I-4 lanes during two consecutive nights while the Autosense III units are being installed on the sign structure. Finally, the two units were installed in September 1999 and are currently operational.

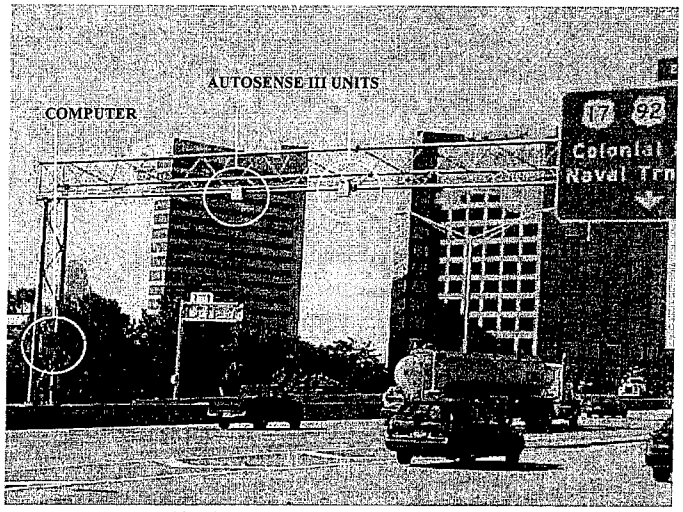

Figure 1: Autosense III Installation on I-4. Two Autosense III Units Installed on the Interstate 4 Sign Structure at the Lake Ivanhoe Interchange on Westbound I-4

Figure 1 shows the installation on Interstate 4 where the two Autosense III units sense the traffic in three westbound traffic lanes. The two sensors and the NEMA enclosure

containing the computer and wireless modem were mounted on a sign structure of I-4. Note that a NEMA enclosure is beside the roadway. The Autosense units detect and classify each vehicle that passes through the traffic lanes, and the processing computer processes and stores the data. In addition to information about each vehicle, aggregate traffic information such as average speed, traffic volume, traffic volume by class of vehicle, headway and occupancy can be calculated for each traffic lane in each direction of the roadway. This aggregate information can be recorded at intervals specified by the user, and new data files can be written on a daily basis.

The wireless modem attached to the processing computer makes the traffic data available in near-real-time. Using a data modem with the AT&T Internet connection, traffic data can be accessed merely by using a web browser. Summaries of traffic data can be viewed on a minute-by-minute basis and daily traffic data files can be downloaded for analysis. Currently, the UCF Intelligent Transportation Systems Lab in the Research Pavilion can access this AT&T website and download the data at any time during the day.

COMPARISON BETWEEN AUTOSENSE III AND LOOP DETECTOR DATA

Since Autosense III units were installed on I-4 and became operational in September 1999, there have been a number of problems with the loop detector station and the FDOT CCTV camera near that site. Loop failures occurred for an extensive amount of time and also the camera stopped working. Another complicating factor is that AT&T disconnected the Internet site due to UCF's delay in monthly payments of the IP address bill. The PI of this project, Dr. Al-Deek, made an extensive effort to bridge the communication gap between UCF's Finance and Accounting office and AT&T. Finally, the problem was resolved and the Internet site has been reinstated recently. However, the CCTV camera still does not work at this time and we understand that FDOT is working to fix this problem. Due to the aforementioned real life problems, a very limited set of data was obtained from Autosense III. However, work on validation of this technology is still on going.

The preliminary analysis was conducted to compare the data collected by the magnetic loop detectors, currently installed on I-4, and the new laser detection technology, Autosense III. The comparison results are based on data collected on December 5th, 1999 and during the times when both devices were operational. Four charts were generated as shown in Figure 2 (a to d). Figure 2(a) and 2(b) show the volume comparisons for the morning and evening periods, respectively. Figures 2(c) and 2(d) show the occupancy comparisons for the morning and evening periods, respectively. The results indicate that the Autosense III data is consistently higher than the loop detector data. However, the patterns generated from each seem to be very similar. It should be noted here that the results could have improved had the time on both Autosense III and the loop detectors been synchronized. Also, areas on the charts where there appear to be a significant difference between the two curves are primarily caused by failure in the loop detectors and thus should not be indicative of the performance of Autosense III units. Due to the inconsistencies observed between the two sources, video cameras are needed to verify the data visually and test the accuracy of each independently.

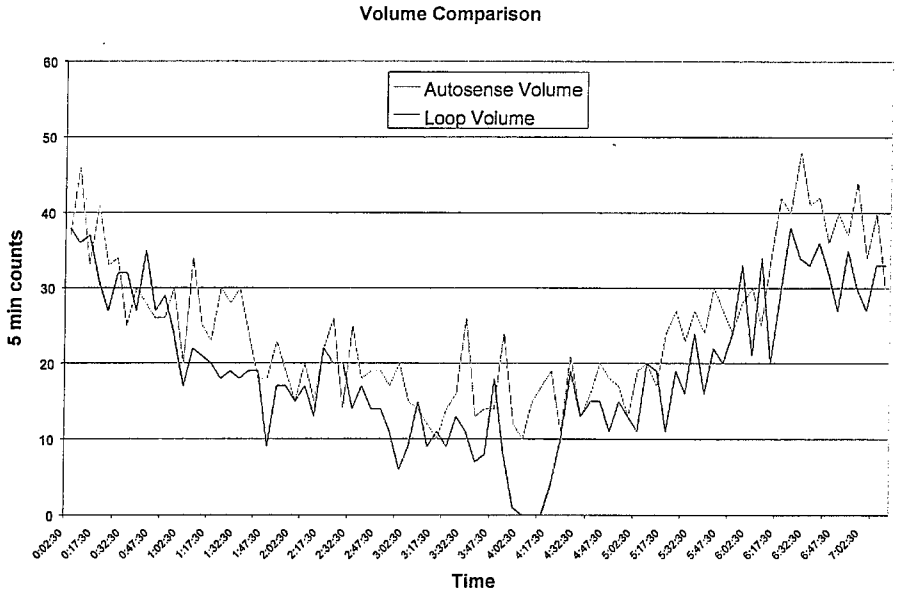

Figure 2(a) Morning Period

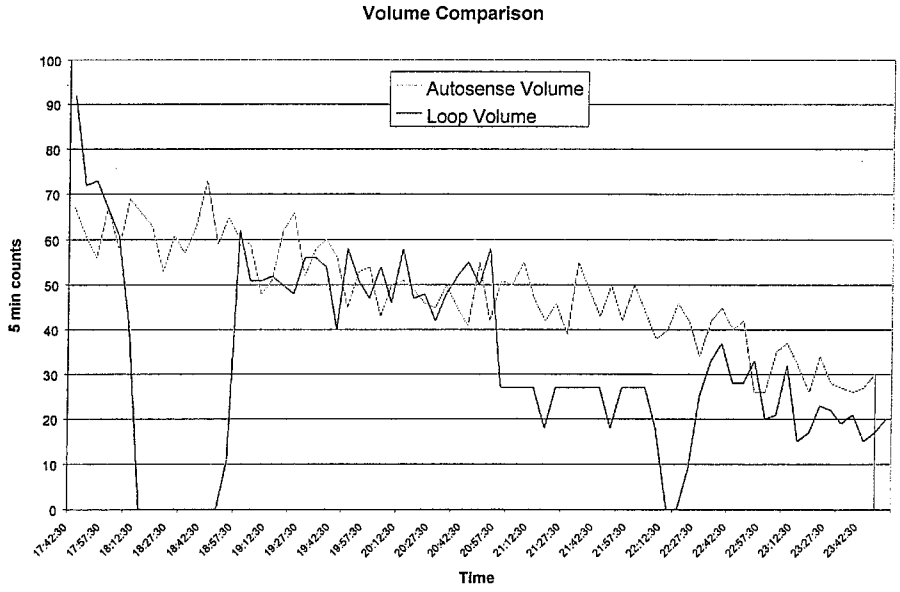

Figure 2(b) Evening Period

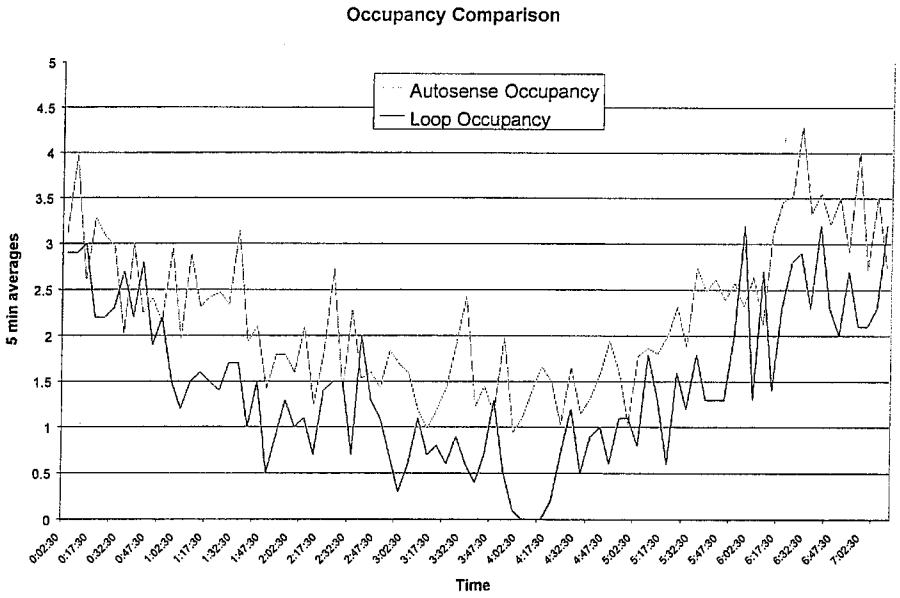

Figure 2(c) Morning Period

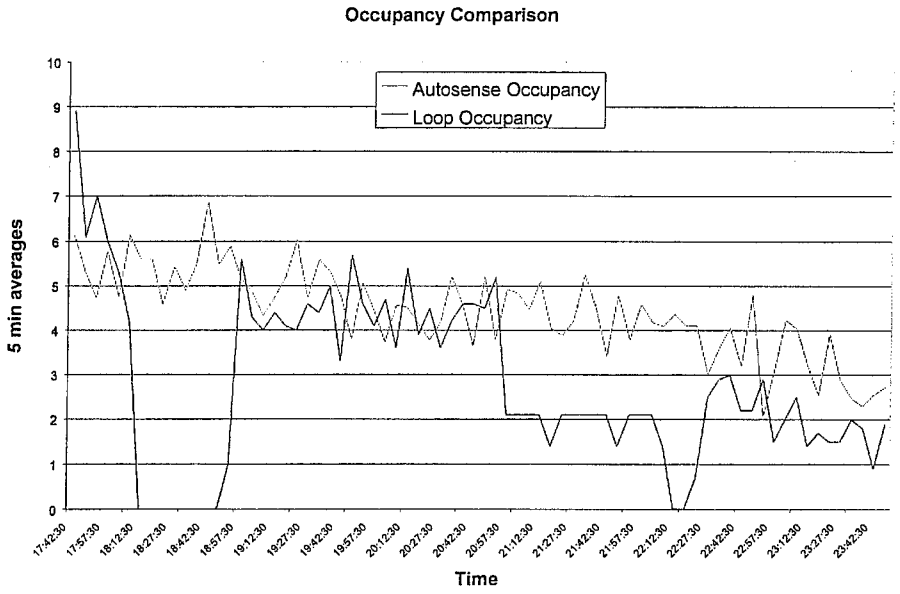

Figure 2(d) Evening Period

The comparison of Autosense III speed data with data collected from the nearest working magnetic loop detector station to the above site on I-4 indicates that there is a good correlation, see Figure 3 below. While it is difficult to make definitive conclusions about Autosense III performance on I-4 at the time of writing this progress report, we intend to conduct more in-depth comparisons in the future once the FDOT video camera is fixed.

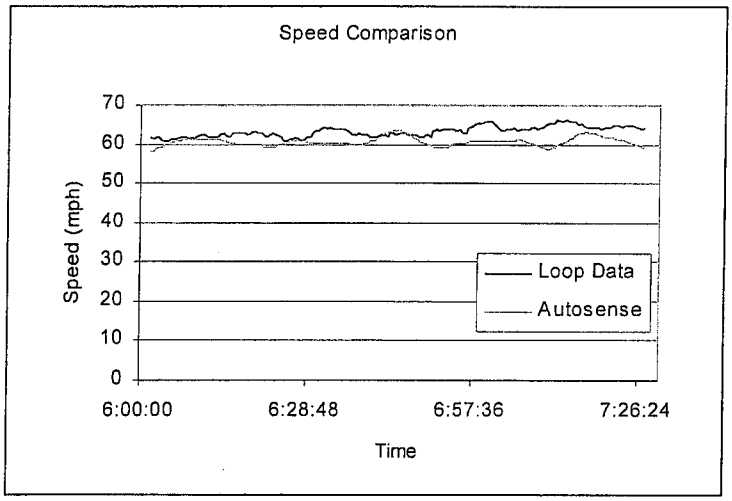

Figure 3: Comparison of speed data from Autosense and loops on I-4.

PRESENTATIONS

The PI, Dr. Al-Deek during the first CATSS meeting at UCF in May 1999, made one presentation on Autosense III project.

PLANNED ACTIVITIES AND FUTURE RESEARCH

This project has an important mission: to examine whether or not the maintenance free Autosense is technically feasible and whether or not it is a sound economic alternative to the loop detectors that are embedded in the pavement at every ½ mile on I-4. The electro-magnetic loop detection is a 1962 technology that suffers from frequent failures. Also, the real potential of this Autosense laser-based sensor is in travel time measurements and incident detection, i.e., detection of accidents and disabled vehicles on the highway in a timely fashion. Early detection and removal of incidents reduce congestion. However, this important application can never be evaluated unless there are at least four Autosense III units installed at two locations on I-4, so that data from the two locations can be matched. Each location requires two units to cover three lanes. As such, to achieve the real potential of this UCF major investment on I-4, it is critical to purchase two more units of Autosense III and develop incident detection algorithms based on Autosense III data.