Final Report[*]
EXECUTIVE SUMMARY

Reporting Period: December 2003 – August 2006

Reference: *Executed contract - Research Project Work Order #6 -- Federal Aid Project CFDA-20.205 / Contract No. BD543, "Standards Research, Testing & Training Development for the Traffic Engineering Research Lab."*

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Faculty

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Past

Graduate – Jamie Meeks, Michael Case, Mandar Ambre, Zhaoning Jiang.
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This project has involved a total of **16** student assistants over the reporting period.

FDOT Managers:

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[*] The complete final report is in a CD, which is also submitted.

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1. BACKGROUND

1.1 Intelligent Transportation Systems

The ultimate mission of a public transportation agency is to provide safe, efficient, effective, and environmentally sound transit services. Such mission is becoming more and more difficult to accomplish because of the exponentially increasing demand for mobility with the growth of population. Unfortunately, the inability to cope this skyrocketing demand will likely translate into serious potential for congestion, unsafe conditions, and the deterioration of the natural environment. An obvious solution is to expand the existing thoroughfares. However, this option is unattractive mainly because of (1) lack of readily available land for additional roadways; (2) mounting construction costs; and (3) environmental concerns. Instead, the traffic engineers are convinced that the most attractive and yet logical approach for improving the transportation resources is to use the existing facilities more effectively.

The vision of *intelligent transportation systems* (*ITS*) is a conceptual framework committed to utilizing advanced communications technologies throughout the multi-modal transportation system. It represents a paradigm shift to the transportation-information infrastructure. The goal is to improve safety, reduce congestion, enhance mobility, minimize environmental impact, save energy, and promote economic productivity in the U.S. transportation system and abroad.

ITS programs are evolving rapidly and gaining momentum in the United States and other industrialized nations. Currently, the ITS efforts are focused on: (1) Improvement to highway infrastructure. (2) Adaptations to both private and mass-transit vehicles in order to increase the capacity of the present transportation network and improve traffic safety.

1.2 FDOT Traffic Engineering Research Laboratory

With the advent of ITS incentives and ISTEA resources for the advancement of transportation systems in the United States, coupled with the rapid advances made in the microelectronics and communications industries, there has been very significant improvement and development in traffic control devices and systems. These new and improved technologies will ultimately provide operational and safety enhancement to the existing roadways across the country.

Over seven years ago, the FDOT traffic engineers recognized the need to maintain the current knowledge of new equipment system and software advancements in order to attain the most effective and efficient highway system operation in Florida. In particular, they envisioned the combined efforts of research and testing should assure that FDOT maintains a strong technical support for the current ITS initiatives.

In May of 1997, the Traffic Engineering Research Laboratory (TERL) was established to develop the state-of-the-art traffic engineering evaluation and testing facilities. The core mission of TERL is twofold:

- To conduct and nurture applied research pertaining to traffic engineering technologies.
- To provide technical support for Florida ITS initiatives so as to ensure Florida stay competitive and poised for the emerging information and ITS age.

This research laboratory is managed by the FDOT State Traffic Operations Office. The strength of TERL stems from the unique composition of its staff, which consists of FDOT personnel and a research team consisting of faculty and students from the Department of Electrical and Computer Engineering and the Department of Industrial Engineering at the FAMU-FSU College of Engineering (FAMU-FSU COE). This unique arrangement facilitates an interactive but coordinated problem-solving process in which the urgent and important research issues identified by FDOT engineers are addressed by the FAMU-FSU COE research team in a timely manner. The direct benefit is the FAMU-FSU COE researchers are able to focus its expertise on relevant problems to produce results that FDOT can use immediately.

2. RESEARCH OBJECTIVES

The principal objective of virtually all projects at TERL is to conduct and support applied research, testing, standards, and specifications development. The main research efforts include the evaluation and testing of components involved in the operation of the *Traffic Control Device Certification Program* and the implementation of *Advanced Traffic Engineering and ITS Systems.* By working closely with the FDOT Traffic Operations Office over an extended period, the FAMU-FSU COE investigators have come to understand and identify the near-term as well as the long-term objectives envisioned by FDOT. These objectives subsequently define the framework for various TERL research programs.

2.1 Near-Term Objectives

The current and near-term objectives are identified as follows:

- To advance the *Traffic Control Device Certification Program* initiated by the Traffic Operations Office.
- To update and develop standards and specifications to keep pace with the rapidly advancing fields pertinent to traffic engineering.
- To establish guidelines for testing and evaluating ITS and traffic engineering technologies.
- To advance the development and implementation of the NTCIP requirements.
- To advance the FDOT Quality Control Program.

2.2 Long-Term Objectives

It is envisioned that TERL will provide facilities and staff accessible to the federal and other state transportation agencies for characterization, testing, and evaluation of ITS

equipment and components. These public transportation agencies will have open access to an ITS and traffic engineering database maintained by TERL. Equally important is the educational and training component of the TERL development plan. It is anticipated that undergraduate and graduate education in transportation technologies and systems will be coordinated through the FSU Department of Electrical and Computer Engineering. To be specific, the main long-term objectives are described below:

- To strengthen the role of FDOT as a leader in providing comprehensive standards, specifications and technical documents on new traffic systems and devices.
- To educate a new breed of transportation engineers with specialized skill and knowledge in microelectronics, communications systems, control systems, and computer engineering to cope with the planning, design, selection, testing, and maintenance of various ITS technologies for the next generation of transportation systems in Florida and the United States as well.

3. AREAS OF WORK: 2004 - 2006

The work of this project was performed during the two-year period from 2004 to 2006. The key areas of work alongside their objectives are tabulated as follows (**Table 1**):

Table 1: *Areas of work and objectives*

Area of Work	Objectives
NTCIP standards development, testing and training	1. Maintaining the capability to test a manufacturer's Dynamic Message Sign for compliance to the Florida Specific NTCIP requirements. 2. Continue the development and implementation of the NTCIP requirements with other devices such as Actuated Signal Control. 3. Continue to serve as a "resident expert" for the FDOT Districts whenever they require help concerning the NTCIP.
Quality research engineering	1. Complete the implementation and enhancement of the Vendor Qualification program. 2. Complete the implementation of the QA evaluation portion of the DMS Manufacturer Qualification Program.
Display properties testing for LED traffic signals and DMS	1. Implementation of the LED signal monitoring program developed during earlier phases of this project (used for removing and testing LED vehicle traffic signals for intensity degradation for signals that have been installed in the field for a length of time). 2. Continue the testing of Dynamic Message Signs for conformance to FDOT standards.

Vehicle detection	1. Continue the maintenance and enhancement of our current detector standards. 2. Maintenance and enhancement our real-time testing set-up in the lab area (mast arm to lab detection system.)
Traffic engineering applications	1. A Traffic Engineering Consultant that will be working on an as-needed basis on Traffic Engineering issues.
Technology transfer	1. Maintain the TERL project internet web site located at http://rite.eng.fsu.edu, including the Approved Product List (APL). 2. Publish the TERL quarterly newsletter, *Technology Lab Notes*, which highlights a specific activity each quarter.

4. RESULTS AND PRODUCTS

All the results and products of this research project conducted during in the two-year period, 2004 – 2006, are compiled and stored in the accompanying compact disc (CD). The summary of result and products is presented in **Table 2**.

Table 2: *Results and products*

Area of Work	Results and Products
NTCIP standards development, testing and training	• Nine manufacturers/vendors of DMS qualified on NTCIP - compliance test.
Quality research engineering	• QA evaluation program. • QA evaluation manual. • An M.S. Thesis: An Agency Approach to Analyze and Improve a Photometric Device Test Procedure Using Design of Experiments Methodology, by Sivam Ramalingam.
Display properties testing for LED traffic signals and DMS	• An M.S. Thesis: Application and Development of Luminous Intensity Measurement for LED Related Traffic Signals and Signs, by Zhaoning Jiang
Vehicle detection	• The guideline for maintenance of traffic signal actuation at signalized intersections with non-intrusive technologies. • The specs for o acoustic vehicle detectors o infrared vehicle detectors o magnetic vehicle detectors o microwave vehicle detectors o ultrasonic vehicle detectors o video vehicle detectors. • The guideline for collecting and analyzing of travel time studies data of Florida roadways using GPS Technology.
Traffic engineering applications	• No consultant was hired during the life of the project. The budget allocated for the consultant was used for a 5-month extension of the project.
Technology transfer	• Maintain the TERL project internet web site located at http://potentia.eng.fsu.edu/terl/index.htm, including the Approved Product List (APL). • Presentation and exhibition at March ITS Working Group Annual Meeting, 2006.