

# OHIO DEPARTMENT OF TRANSPORTATION OFFICE OF TECHNICAL SERVICES RESEARCH IMPLEMENTATION PLAN

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**Title:** Off-Road Axle Detection Sensor (ORADS)

**State Job Number:** 14710

**PID Number:**

**Research Agency:** Spectra Research, Inc.

**Researcher(s):** Mike Johnson and Jerry Capozzi

**Technical Liaison(s):** Tony Manch

**Research Manager:** Monique Evans

**Sponsor(s):** Howard Wood, Jim McQuirt

**Study Start Date:** 8/11/1998

**Study Completion Date:** 2/11/2001

**Study Duration:** 30 Months

**Study Cost:** \$377,157.00

**Study Funding Type:** 80 Federal / 20 State, ODOT SPR (2)

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## **STATEMENT OF NEED:**

To collect various types of traffic data to meet the Federal Requirements, field technicians have to enter the roadway to anchor the road sensors while traffic is moving at highway speeds. On high volumes routes this can be a very time consuming task, and cold wet pavements will not permit the use of existing sensors that use tape to stick to the pavement. The requirements for the off road sensors are: collecting 3 or 4 lanes of data from the side of the road, needs to be in place for 48 hours, portable and set up within one-half hour, set 60 to 75 locations per week, and low power consumption so that they can operate on a small gel cell battery. The traffic data required are: FHWA thirteen (13) vehicle classifications by axle type, speed by vehicle type, and total volume.

## **RESEARCH OBJECTIVES:**

To develop and field test a low cost, portable, prototype traffic monitoring system. This system will be capable of collecting and storing data for vehicle classification, speed, and traffic volume over multiple lane highways. The ORADS will eliminate the exposure of ODOT field technicians to dangerous highway environments associated with setup of available traffic monitors. This is achieved by replacing existing road sensors (road tubes, piezo, magnetic loops, etc.) with a safe, accurate, cost effective, and non-intrusive sensors system.

## **RESEARCH TASKS:**

To develop a LADAR sensor system based on the trip wire concept demonstrated to ODOT in October 1995. This design will be more rugged to withstand storage, handling, and transportation to and from portable sites. The design will also minimize field alignment and setup times to less than 30 minutes.

To design the microprocessor electronics and software to perform the required functions, i.e., axle count, speed, vehicle classification, lane locations, etc. The system will be road tested in various weather conditions alongside existing sensors to verify performance and accuracy.

- 1- Literature review.
- 2- Review the various off ORADS sensors commercially available to decide the best suited one for ODOT traffic data collection.
- 3- Work with ODOT staff to refine an off road sensor.
- 4- Develop a prototype for field testing.
- 5- Field demonstration of installation and data collection.
- 6- Field accuracy checks and documentation.

**RESEARCH DELIVERABLES:**

Build and give to ODOT three non intrusive sensors for field data collection and evaluation. Also provide training and operating instructions and operating manual.

**RESEARCH RECOMMENDATIONS:**

The field test demonstrated the capability of applying laser radar technology to traffic monitoring. These tests determined that ORADS technology offers the following specific advantages over sensor designs:

- 1- Non-intrusive set-up and operation; it does not block traffic.
- 2- Precise measurements of travel lane, vehicle velocity, and axle wheelbase.
- 3- Minimizes hazardous exposure to field technicians and engineers.
- 4- Easily deployed with a minimum setup time (30 minutes).
- 5- Compatible with existing traffic monitoring processing and instrumentation protocols.
- 6- Self contained system with a modular construction.
- 7- Cost effective compared to other multi-lane measurement schemes.

**PROJECT PANEL COMMENTS:**

Safety of our field staff when setting traffic counters is one of our highest goals. The continued research for using non-intrusive sensors such as ORADS is important for all people in the business of collecting traffic data. With the increase of traffic on our highways and streets, it is becoming more and more difficult for our staff to put road sensors on multi-lane highways (more than 3 lanes in each direction) in a safe manner. Use of non-intrusive sensors will help to keep our staff achieve their goals.

**IMPLEMENTATION STEPS & TIME FRAME:**

1. During the first 12 months of the ORADS 30 month research program, the following items were completed:
  - Designed a portable LADAR sensor capable of accurately measuring the velocity of the vehicular traffic.
  - Demonstrated a setup time of less than 30 minutes and the capability to accurately measure vehicle type, travel lane, and lane position.
  - Developed processing electronics and software to interface raw data signals to a commercial traffic recorder (Diamond Phoenix)
  - Developed design compliant with eye safety regulations for Class 1 lasers.
  - Provided a successful hardware demonstration.
2. At the completion of the project the researcher has delivered three ORADS units to ODOT test for accuracy and production field data collection. The accuracy testing is planned to be complete by December 31, 2005.
3. Our office has taken delivery of the ORADS units and they are presently being field tested for accuracy. Once testing is concluded, The Office of Technical Services will utilize ORADS units on as needed basis depending on the situation applicability. This item will be in effect once accuracy is confirmed.

**EXPECTED BENEFITS:**

The major benefit of using non-intrusive sensors is that our field staff does not need to work in the traveled lane on multi-lane highways. Thereby avoid the exposure to oncoming traffic.

This will speed up data collection efforts on high volume multi-lane highways and contribute to a safer work environment. They can be used under some adverse weather conditions and will improve accuracy of the short term traffic counts because there will be nothing in the roadway to be damaged by vehicles or some foreign object dragging in the roadway.

Providing worker safety is one of our important goals. Minimizing property damage to the traveling public is an expected benefit of this research.

**EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM:**

- 1- Unit calibration and accuracy prediction. To overcome, train staff for proper use.
- 2- The delivered units are prototypes; they will be hard to fix if they malfunctioned. To overcome, ask the researcher to train specialized ODOT staff to fix them. Seek to obtain a vendor list of electronic technicians who are able to fix the units.
- 3- Data liability can be maximized by performing routine data quality checks until reaching a full understanding of system limits.

**OTHER ODOT OFFICES AFFECTED BY THE CHANGE:**

Collecting accurate data is important to almost all ODOT functions. Traffic data is used extensively by ODOT Planning, Design, and Safety, and Highway Management. The District Offices and Consultants developing plans also use traffic data. Real Estate developers and business owners also need traffic data to make decisions.

**PROGRESS REPORTING & TIME FRAME:**

There will be a quarterly progress report to report on the completion of the implementation steps; and an annual report for detailing costs and benefits of the implementation. The annual report will continue for a minimum of three years.

**TECHNOLOGY TRANSFER METHODS TO BE USED:**

Wright Laboratory, Wright-Patterson AFB OH Sept. 1995

Wright Laboratory's Avionics Directorate through the Small Business Technology Transfer (STTR) program (complement to the Small Business Innovation Research Program) designed, developed, tested and demonstrated an advanced traffic monitoring system for ODOT. This new system uses laser sensors that are installed on the roadside to count and monitor traffic. It can be used at permanent locations, or as a portable unit at remote sites for short term traffic data collection.

**IMPLEMENTATION COST & SOURCE OF FUNDING:**

The cost of implementation is very minimal; it will come from office overhead to train staff and field technicians to use in upcoming projects.

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**Approved By:** (attached additional sheets if necessary)

Office Administrator(s):

Signature: James McQuirt Office: Tech. Services Date: 8/22/2005

Division Deputy Director(s):

Signature: Howard Wood Division: Planning Date: 8/24/2005