

**State of Wisconsin/Department of Transportation**  
**RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: March 31, 2006**

<b>Program: SPR-0010(36) FFY99</b>	<b>Part: II Research and Development</b>
<b>Project Title:</b> Vehicle Classification from Single Loop Detectors	<b>Project ID:</b> 05-02
<b>Administrative Contact:</b> Nina McLawhorn	<b>Sponsor:</b> MRUTC
<b>WisDOT Technical Contact:</b> Jason Bittner	<b>Approved Starting Date:</b> Oct. 1, 2004
<b>Approved by COR/Steering Committee:</b>	<b>Approved Ending Date:</b> Aug. 30, 2006
<b>Project Investigator (agency &amp; contact):</b> Ohio State University, Benjamin Coifman	

**Description:** The goal of this research is to utilize the advances in velocity and length estimation from single loop detectors to develop a vehicle classification methodology. It is envisioned that the classification work will also improve length-based classification at dual loop detectors. The research promises to extend vehicle classification to existing stations using only single loop detectors and offers viable options in the event that one of the loops in a dual loop detector fails.

- Task 1: Meet with ODOT engineers and potentially teleconference with other state departments of transportation (DOT's) in the MRUTC to establish properties of existing classification systems and desired properties of the classification system, e.g., number of bins and length thresholds between bins.
- Task 2: Collect additional detector data. Particular emphasis will be on stations with significant truck demand. Each location will need an external measure for verification. ODOT will be the primary source to log individual vehicle data from several of their stations. The researchers will collect concurrent video at several stations to manually verify the vehicle class.
- Task 3: Develop and test the single loop detector classification against the Weigh in Motion or axle classification. In parallel, the researchers will further improve the length estimation techniques from single loop detectors.
- Task 4: Use the manually extracted vehicle class from video to verify the methodology.
- Task 5: Work with ODOT and other state DOT's to deploy the resulting length-based classification methodology for single loop detectors.

Total study budget	Current FFY budget	Expenditures for current quarter	Total Expenditures to date	Percent Complete
<b>\$39,998</b>	<b>\$39,998</b>	<b>\$4,635</b>	<b>\$4,635</b>	<b>11.5%</b>

**Progress This Quarter:**

(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

On January 17th we met with the following ODOT engineers: Dave Gardner, David Stewart, Steven Jessberger, and Tony Manch. The main goals of the meeting were to (1) gain an understanding of how ODOT collects and uses vehicle classification data at present, (2) investigate how classification from single loops could complement their existing program (extending classification to detectors deployed for real time traffic monitoring or as a temporary solution when a detector fails at a more advanced classification station), and (3) to investigate the possibility of collecting ground truth data at an existing classification station. These goals were met, with the most important caveat being the potential willingness to collect field data but no firm commitment was sought at the meeting and was left as a task for the following quarter. In the mean time, ODOT provided a two hour long sample of the individual vehicle records that they can collect at the classification stations. Several additional items came up, including an interest in the data we have archived from the real time system in Columbus, both in terms of classification and simply in terms of counts. Both of these items were provided a week or two after the meeting.

On the development side, our methodology uses detector on-time from each vehicle, a parameter that is not available in the ODOT per-vehicle records. So we had to back calculate this metric from individual vehicle measured length and speed. We then took the synthetic on-times to estimate vehicle length from on-time calculation and classified the measurements using the ODOT dual loop length based classification bins. We compared the resulting classification against the original classification from the ODOT sample with good results.

However, the ODOT sample comes from an uncongested period and was only two hours long. So much of our development progressed using data collected from dual loops in the real time traffic monitoring system, using the dual loop measured lengths as the ground truth (as noted above and below, subsequent analysis will use stronger ground truth). The key step in estimating vehicle length for classification is accurately estimating vehicle speed. To improve performance we investigated several potential improvements to estimate speed using different estimation schemes. The first of which uses the moving median on-time to estimate speed, the second seeks out sequential on-times that would come from the shortest and longest vehicles (20 ft and 80 ft, respectively, so the ratio of successive on-times would either

be 1:4 or 4:1). The results of each estimation scheme were then compared with the measured vehicle length and vehicle classification from the ODOT dual loop classification scheme. Various performance measures were developed and the analysis is being extended to all of the available dual loop detectors.

Finally, an abstract based on this work was submitted to the Ohio Transportation Engineering Conference (OTEC) for consideration for possible presentation in the fall, 2006.

**Work Next Quarter:**

Develop a hybrid between the two single loop detector speed (and thus length) estimation algorithms.

Collect field ground truth data, ideally from an ODOT classification station, but we could use video collected concurrently at a loop detector station if need be. Continue developing the classification algorithms.

**Circumstances affecting progress/budget:**

The original proposal consisted of two companion proposals submitted, each approximately \$20,000, submitted independently to MRUTC and ODOT, with the remaining funds and matching coming from OSU. It took considerably longer for the red tape to be worked through than anticipated.

At the current rate of progress, we will likely want to seek a no cost extension if possible.

