

**NJDOT Bureau of Research
QUARTERLY PROGRESS REPORT**

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| Project Title: | Feasibility of Lane Closures Using Probe Data | | |
| RFP Number: 2012-05 | NJDOT Project Manager: Paul Thomas | | |
| Task Order Number: TO-104 | Consultant: New Jersey Institute of Technology | | |
| Customer: Dhanesh Motiani (former), Bill Kingsland | Principal Investigator: Chien, Steven I-Jy | | |
| Project Starting Date: 4/15/2013 | Period Starting Date: 07/01/2014 | | |
| Original Project Ending Date: 12/15/2014 | Period Ending Date: 09/30/2014 | | |
| Modified Completion Date: 12/31/15 | | | |

| Task | % of Total Budget | Total Budget | % of Task this quarter | Cost this quarter | % of Task to date | Cost To Date |
|---|-------------------|---------------------|------------------------|--------------------|-------------------|---------------------|
| Literature Review | 5.00% | \$22,517.00 | 0.00% | \$0.00 | 100.00% | \$22,517.00 |
| Evaluation of Real Time Surveillance Technologies | 4.00% | \$18,014.00 | 0.00% | \$0.00 | 100.00% | \$18,014.00 |
| Data Sources and Data Collection | 9.00% | \$40,531.00 | 10.00% | \$4,053.10 | 60.00% | \$24,318.60 |
| Database Development | 15.00% | \$67,551.00 | 5.00% | \$3,377.55 | 30.00% | \$20,265.30 |
| NJLCAM Development | 21.00% | \$94,571.00 | 20.00% | \$18,914.20 | 25.00% | \$23,642.75 |
| Case Study | 5.00% | \$22,517.00 | 0.00% | \$0.00 | 0.00% | \$0.00 |
| Benefit/Cost Analysis | 12.00% | \$54,041.00 | 0.00% | \$0.00 | 0.00% | \$0.00 |
| NJLCAM Software Tool | 20.00% | \$90,068.00 | 0.00% | \$0.00 | 0.00% | \$0.00 |
| Presentation, Implementation, and Training | 5.00% | \$22,517.00 | 10.00% | \$2,251.70 | 10.00% | \$2,251.70 |
| Final Report | 4.00% | \$18,014.00 | 0.00% | \$0.00 | 0.00% | \$0.00 |
| TOTAL | 100 % | \$450,341.00 | | \$28,596.55 | | \$111,009.35 |

Project Objectives:

The objective of this research project is to develop a methodology for integrating probe-vehicle data into the traffic impact analysis model, and to develop a user-friendly software tool that would implement the calculation methodology.

Project Abstract:

NJDOT must develop an adequate traffic operations management and congestion mitigation plan for every roadway maintenance and construction project requiring lane closures. To do this properly, NJDOT needs accurate and reliable estimates of traffic impacts associated with pertinent maintenance and

NJDOT Bureau of Research
QUARTERLY PROGRESS REPORT

construction projects, and the corresponding roadway capacity reductions. The current analytical model used by NJDOT for this purpose is based on traditional volume/capacity formulae and deterministic traffic queuing modeling method. NJDOT recognizes the shortcomings of these methods that often result in inaccurate estimates of the impact of lane closures in terms of vehicle delays and queue lengths. These estimates may be significantly improved by utilizing probe-vehicle traffic data. Probe-vehicle traffic data is based on the "actual" vehicle travel times and speeds, measured in reference to roadway segment in question, traveled distance, and time of travel. It is expected that use of this data can significantly improve accuracy of the estimated vehicle delays associated with lane closures. The objective of this research project is to develop a methodology for integrating probe-vehicle data into the traffic impact analysis model, and to develop a user-friendly software tool that would implement the calculation methodology.

1. Progress this quarter by task:

Task 1 – Literature Review:
Completed.

Task 2 – Technologies Evaluation:
Completed.

Task 3 – Data Sources/Collection:

- Collected, processed, and stored additional data required for the model development:

- INRIX freeway and arterial speed data in 2013;
- OpenReach work zone related records in 2013; and
- Plan4Safety crash records in 2013.

Task 4 – Database Development:

- Added data collected in previous and current quarters to the database hosted at CUNY.
- Developed SQL queries for extracting data used for model development.
- Extracted and prepared data of 108 freeway work zone (2012 January ~ June) for model development.

Task 5 – Work zone Interactive Management Application-Planning (WIMAP-P) Model

Development:

- Based on the work zone data conducted in Task 4, the coefficients of the linear regression model developed in previous quarter were calibrated. In addition to the linear regression model, an Artificial Neural Network (ANN)

NJDOT Bureau of Research
QUARTERLY PROGRESS REPORT

model suggested by the research panel was developed. Results indicated that the ANN model outperformed the linear regression model in terms of the accuracy of delay estimation.

- The delay estimation model was implemented into the New Jersey road user cost manual.

Task 6 – Case Study:

- Not started yet.

Task 7 – Benefit/Cost Analysis:

- Not started yet.

Task 8 – WIMAP-P Software Tool:

- Developed a framework of WIMAP-P web-based software tool.

Task 9 – Implement/Training:

- Submitted two papers to 2015 TRB Annual Meeting:

- Short-term Freeway Work Zone Capacity Estimation Using Support Vector Machine Incorporated with Probe-vehicle Data

- WIMAP: Work Zone Interactive Monitoring Application

Task 10 – Final Report:

- Not started yet.

2. Proposed activities for next quarter by task:

Task 3 – Data Sources/Collection:

- Collect, process, and store freeway work zone data in the first quarter of 2014 from available data sources.

Task 4 – Database Development:

- Continue to develop the proposed database that will effectively integrate the

data sets determined in Task 3.

- Extract and prepare data of interstate freeway work zone (2013) for model development.

Task 5 – WIMAP-P Model Development:

- Tune the non-linear model using 2013 interstate freeway work zone data.

Task 6 – Case Study:

- Calibrate and test the RTMS devices on the I-295 Direct Connect construction site when the devices are installed.

Task 8 – WIMAP-P Software Tool:

- WIMAP-P web-based software tool is under development. The software tool will enable users to select roadway segments and work zone schedules on a Google Map interface.

**NJDOT Bureau of Research
QUARTERLY PROGRESS REPORT**

3. List of deliverables provided in this quarter by task (product date):

Task 3&4:

- Presented collected data and database development status.

Task 5:

- Presented proposed delay estimation model.
- Presented a comparison of linear regression model and ANN model.

4. Progress on implementation and training activities:

None yet

5. Problems/proposed solutions:

- Task 4 was delayed due to late arrival of the database server hosted at CUNY. After the database server arrived at CUNY on 7/3/2014, all available datasets were imported and stored in the database server hosted at CUNY.
- Task 6 was delayed due to no real-time data availabilities in I-295 Direct Connect construction site. The research team at NJIT will start working on this task when RTMS devices are installed.
- Based on the problems listed above, the deliverable due dates of Tasks 4 and 6 will be postponed to March 2015.

6. Budget summary:

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|------------------------------------|--------------|
| Total Project Budget | \$231,060.00 |
| Modified Contract Amount | \$450,341.00 |
| Total Project Expenditure to date | \$111,009.35 |
| % of Total Project Budget Expended | 24.65 % |

NJDOT Research Project Manager Concurrence: _____ Date: _____