

# Quarterly Research Progress Report

For Quarter 4 FY 14/15

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**Caltrans Project Manager:** Asfand Siddiqui

**Project Designation:** Task Order 002

**Contract Number:** 65A0529

**1.0 Title of Project:** Developing an agent based On-Line Adaptive Signal Control (ASC) framework using Connected Vehicle (CV) technology

## **2.0 Describe last quarter's task/deliverables.**

**Task 1.** The research team has finished the development of prediction model for the time-of-arrival (TOA) of each individual vehicle agent once it enters the V2I communication range (e.g., 300 meter). Simulation tests have been conducted to further tune the model parameters to account for different vehicle types (e.g., light duty vehicle and heavy duty truck). For comparison purpose, the research team are also developing other MOE models including the queue length at the lane group level, "current delay" of each VA (i.e., the amount of delay a VA has currently experienced relative to the speed limit), and predicted green utilization rate profile (i.e., predicted number of passing vehicles divided by the potentially available green time). The impacts of these MOE models on the proposed adaptive signal control framework will be evaluated later in this study.

**Task 2.** The research team is developing the agent-based on-line adaptive signal control framework. The logics of some sub-agents including signal-head sub-agent (SH-SA) and information processing sub-agent (IP-SA), have been completed and coded in Paramics by using the application programming interface (API). It should be pointed out that Paramics restricts the user's capability to flexibly modify the signal timing (which is the key feature of the proposed ASC strategy) through APIs. A significant amount of time has been spent to overcome this drawback. With the help from Dr. Lianyu Chu with UC Irvine, the research team uses the "priority" functions rather than "signal control" function to mimic the adaptive signal control.

**Task 3.** Although the framework has not been completed yet, a hypothetical isolated signalized intersection has been coded in Paramics for future testing. If the resource is available, the research team also plans to model a real-world signalized intersection in the simulation and use it as a testbed.

**Task 4.** Not yet

**Task 5.** Not yet

## **Meetings/Presentations (if any)**

A kick-off meeting was held on March 16<sup>th</sup> to go over the proposed tasks, deliverables, key deadlines and other concerns.

## **Reports (if any)**

Quarterly report as is.

## **3.0 Describe next quarter's task/deliverables and their due date.**

### **Task 1.**

To complete the development of other MOE prediction models.

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## Task 2.

To complete the first version (theoretical portion) of agent-based on-line adaptive signal control framework. It appropriate, further iteration will be conducted as more in-depth insight could be obtained during the simulation study.

## Task 3.

To finish the coding of API for the proposed ASC framework and to conduct more simulation tests to evaluate the functionality of each sub-agent and aggregate performance of the proposed framework. Sensitivity analyses on a variety of system parameters (such as congestion level and vehicle mix) will be conducted. A simulation model with API code will be documented as one of required deliverables and sent to Caltrans engineers by October 31th, 2015. And a briefing of preliminary simulation results will be available by then, too.

## Task 4.

To start considering the potential issues for future deployment.

## Task 5.

Not yet

## 4.0 Describe Project Status

Are you on-time? No Are you on budget? Yes

If the answer to any of the above is NO, please explain below.

It is recognized by Caltrans and the PI that the official start of this project was delayed for about 2 months. Currently, the research is capturing the original schedule with the full gear and plans to complete this project at the end of Year 2015.

5.0 Estimated percentage of work completed. 40% Estimated percentage of budget expended. 40%

## 6.0 What are your expenditure projections for the next four (4) quarters?

\$	\$	\$36000	\$35000
FY 14/15; Q 3 (Jan-Mar)	FY 14/15; Q 4 (Apr-Jun)	FY 15/16; Q 1 (Jul-Sep)	FY 15/16; Q2 (Oct-Dec)

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