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Quarterly Progress Report

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|--|--|--|--|
| Project Title: | Highway Repair Consolidation Feasibility | | |
| NJDOT PROJECT NUMBER: 2012-08 | | NJDOT RESEARCH PROJECT MANAGER: Mac Rashid | |
| TASK ORDER NUMBER: 283 | | PRINCIPAL INVESTIGATOR: Dr. Hao Wang / Dr. Kaan Ozbay | |
| Project Starting Date: 9/17/2012 Project Ending Date: 9/17/2014 | | Period Starting Date: 01/01/2014 Period Ending Date: 03/31/2014 | |

1. Project Progress Summary

| <u>Task No.</u> | <u>Task Description</u> | <u>Percent of Total Project Budget</u> | <u>Cost of Task</u> | <u>% of task this quarter</u> | <u>Cost this quarter</u> | <u>% of task to date</u> | <u>Total Cost to date</u> |
|-----------------|---|--|---------------------|-------------------------------|--------------------------|--------------------------|---------------------------|
| 1 | Conduct a Review of Existing Resources | 5.24% | \$ 16,848.84 | 0% | \$0.00 | 100% | \$16,848.84 |
| 2 | Determine the Current NJDOT Work Zone Practice | 10.47% | \$ 33,697.68 | 0% | \$0.00 | 100% | \$33,697.68 |
| 3 | Develop a Benefit Cost Analysis Process | 10.24% | \$ 32,939.80 | 10% | \$3,293.98 | 60% | \$19,763.88 |
| 4 | Develop a Framework for Managing and Coordinating Workzone Projects | 27.38% | \$ 88,121.32 | 20% | \$17,624.26 | 60% | \$52,872.79 |
| 5 | Develop an Interface for Work Zone Coordination and Management | 29.76% | \$ 95,787.85 | 10% | \$9,578.79 | 35% | \$33,525.75 |
| 6 | Training and Technology Transfer | 9.53% | \$ 30,666.14 | 0% | \$0.00 | 0% | \$0.00 |
| 7 | Project Management, Final and Quarterly Reports | 7.38% | \$ 23,757.49 | 10% | \$2,375.75 | 45% | \$10,690.87 |
| Total | | 100% | \$321,819.12 | 10.21% | \$32,872.78 | 52.02% | \$167,399.81 |

2. Project Overview

Project Abstract

New Jersey's aging highway transportation infrastructure constantly requires reconstruction, maintenance and expansion to meet the ever-increasing demand for travel. As travel demand increases with little growth in roadway capacity, a large number of work zones are expected in order to keep the existing highway system operable. The increasing number of work zones adversely affects the mobility and safety of travelers on the already congested roadways. Drivers are constantly faced unfavorable road conditions and unexpected delays due to work zones.

Faced with the growing number of work zones, the challenge for transportation agencies is to effectively manage the impacts of work zones to alleviate congestion and maintain the safety of motorists without disrupting project schedules.

The NJDOT wants to minimize the negative impacts of work zones through successful project coordination. The major goal of this research is the development of an understanding of the types of work zones that can be coordinated, in terms of construction compatibility, design completion, and construction schedules. The goal also includes a quantitative analysis of the effectiveness of coordinating short- and, when possible, long-term projects to measure the efficiency of various combinations of projects relative to each other and the status quo.

Project Objectives

The objectives of this research are:

1. To develop a documented and vetted process, within the NJDOT, which delineates the appropriate stakeholders who will determine and prioritize which projects and/or problem statements can be coordinated for a consolidated work zone approach.
2. To develop and/or refine a data management process / interface, with current inter- and intra-agency data resources, that can be incorporated into the existing NJDOT's in-house automated data management system.

Various tasks have to be completed to achieve these objectives. The most important steps are:

- Conduct brief interviews with representatives from other state DOTs who have been practicing the coordination of various types of work zones.
- Assemble a panel comprised of representatives from the NJDOT who are involved in the work zone decision making process to identify various types of projects put forth by the NJDOT that require short-term or long-term work zones.
- Work closely with the NJDOT contacts to utilize TRANSCOM and its existing regional structure to improve the communication and collaboration in terms of coordinating various repair activities in the region.
- Through one-on-one and/or panel interviews with the identified key personnel, understand the organizational flow within the NJDOT for communicating, collaborating, and scheduling of various types of work zones.
- Determine, through expert interviews with the NJDOT engineers and staff, what type of projects can be coordinated, the anticipated challenges for coordinating various combinations of these projects, and the appropriate steps to eliminate such challenges.
- Collaborate closely with the assembled panel and develop a framework for managing and coordinating work zone projects.
- Develop a user-friendly interface or modify / refine an existing one that will be used to estimate the effectiveness of various combinations of short-term and long-term work zones based on the developed work zone management and coordination framework.
- Explore the use of emerging web-based communication and collaboration technologies that are inexpensive and easy to deploy and maintain. This can be a solution to maintain a contact list of the identified decision makers from the NJDOT and other agencies with the goal of timely sharing information and plans for work zone activities in the region.

3. Description of Work Completed by Task over This Period

PHASE I— Literature Review

This task is completed. Rutgers team reviewed numerous resources including the FHWA Best Practices Guidebook and several NCHRP reports, which have the latest efforts of coordinating work zone activities and improving communication.



PHASE II

Task 1 — Conduct a Review of Existing Resources

This task is completed.

Task 2 — Determine the Current NJDOT Work Zone Practice

This task is near completion. The project team had a meeting with the Maintenance Operations on March 11, 2014 regarding the maintenance engineering projects. The attendees from NJDOT were Andrew Tunnard, Harish Bhandari, Ahmad Ghorbani, Parth Oza, Gerald Oliveto, and Jaime Oplinger. The research team presented the beta version of the WCS (Work Zone Coordination Spreadsheet) tool and obtained feedback from the NJDOT staff. Attributes of several different maintenance projects were discussed. Maintenance Operations staff agreed to provide the research team a list of projects that will be contracted out in 2014 to input in the WCS tool.

In addition, the research team also contacted Sheryl Grant from Bureau of Program Systems Management to obtain the required CPM data that will be imported to the WCS tool from the PRS database. The dataset is expected to be imported by the quarterly meeting in April 23, 2014.

Finally, the research team will have a separate meeting with Ahmad Ghorbani from Maintenance Operations on various aspects of maintenance projects such as duration, number of lanes closed, time period, etc.

Task 3 — Develop a Benefit Cost Analysis Process

This task is ongoing. The research team obtained the ESRI shape file of the New Jersey Straight Line Diagrams (SLD) from NJDOT in this quarter. The database behind the SLD shape file includes information on the links of major highways and county roads in NJ, such as link length, number of lanes, AADT, zip code, etc. The research team then inserted the start and end X-Y coordinates in this dataset. The information included in this database is also integrated in the WCS tool to estimate the queues as a result of work zone lane closures. Through previous studies, research team has economic models for converting vehicular queues into monetary loss in terms of value of time, accident, and environmental costs. The benefit of coordinating work zones will be realized through reducing the economic costs of vehicular queues.



The essential data when calculating vehicular queues is the hourly volume data at the work zone location. The research team had a meeting with Andrew Ludasi of NJDOT on March 12, 2014 and obtained the hourly volumes at various count locations in NJ as a database. However, since it is a meticulous process to integrate the volume data in the WCS tool, the research team will start using the AADT information already available in the SLD database with an assumed hourly distribution function to calculate preliminary volumes. In the next quarter the hourly volume database will be integrated in the WCS tool.

On the other hand, users can estimate the benefits of rescheduling smaller projects around bigger project and compare this figure with the estimated costs. In this context, the cost of work zone coordination is the “penalty” of delaying one work zone or integrating it into another work zone (consolidation). These numbers are not readily available as they might vary from one work zone to another work zone. During the benefit/cost analysis, this cost estimation will be obtained from the project managers at the NJDOT, since they will have the most accurate numbers.

Task 4 — Develop a Framework for Managing and Coordinating Work Zone Projects

This task is still ongoing. The proposed approach of two-stage coordination framework will be used: 1) Stage 1: long-term coordination that coordinates maintenance engineering projects with CPM projects; 2) Stage 2: short-term coordination that coordinates all other work zones.

The crucial point for the proposed approach is the extended database of CPM projects and maintenance operations projects. So far, the research team has obtained the maintenance engineering projects that are planned to be contracted out in 2014. This information is input in the WCS tool. In addition, the research team has also requested the database of CPM projects, and it will be imported in the WCS tool after received.

During the meeting with the Maintenance Operations group in March 11, 2014, the research team was informed that input and periodic update of each maintenance project in the WCS tool throughout projects’ delivery timeline would be cumbersome due to staff shortage. Due to this limitation, the research team decided to input the planned maintenance projects in the WCS tool, and update it via periodic communication between maintenance operations and traffic



operations. The research team will then determine if there are any conflicts / opportunities between various projects and report to traffic operations.

Task 5 — Develop an Interface for Work Zone Coordination and Management

This task is still ongoing. In the previous quarter the research team developed a beta version of the WCS tool and presented during the quarterly meeting in January 2014. Users can input various projects along with detailed information in the WCS tool. Once a new project is entered, Conflict Analysis module can be run to determine if the new project has any potential conflicts with CPM projects or other maintenance engineering projects in the vicinity. The parameters used to determine conflicts are (1) distance in miles and (2) days overlapped.

The major feedback given by the NJDOT officials was the fact that the database in the WCS was located in Google Documents. It was stated that due to the internet usage regulations at NJDOT, accessing the database would be problematic. Therefore, the research team decided to migrate from Google Documents to a database located in a server to prevent any possible issues in the future.

In addition, a new feature is added to the WCS tool, where users receive e-mail messages if (a) there is a conflict with one of the projects they entered or (b) a periodic update reminder message.

Finally, the research team started working on developing only a database tool that will include all the functionalities of WCS tool except its mapping capabilities. This tool will be desktop based MS Excel program that will conduct data input, editing, conflict analysis, and benefit cost analysis using Excel Macro features. Using this spreadsheet tool, users will be able to:

- Reach the latest database of all CPM and maintenance projects
- Edit the current project database or add new projects
- Query project based on construction time and location
- Conduct conflict analyses based on time, duration, and location
- Make recommendation on coordination based on benefit cost analysis.



This tool is expected to be completed within the next quarter.

Task 6— Training and Technology Transfer

- N/A

Task 7 — Project Management, Final and Quarterly Reports

- 1st quarter report was compiled and submitted in December 2012
- 2nd quarter report was compiled and submitted in March 2013.
- 3rd quarter report was compiled and submitted in June 2013.
- 4th quarter report was compiled and submitted in September 2013.
- 5th quarter report was compiled and submitted in January 2014.
- 6th quarter report was compiled and submitted in April 2014.
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4. Proposed activities for next quarter by task:

Task 1 — Conduct a Review of Existing Resources

- N/A

Task 2 — Determine the Current NJDOT Work Zone Practice

- N/A

Task 3 — Develop a Benefit Cost Analysis Process

- The research team will finalize combining the benefit cost analysis methodology in the WCS tool.

Task 4 — Develop a Framework for Managing and Coordinating Work Zone Projects

- The research team will test, in collaboration with the Maintenance and Traffic Operations, the feasibility of using the WCS tool using the project information obtained from Maintenance Operations and CPM.

Task 5 — Develop an Interface for Work Zone Coordination and Management

- The research team will improve the WCS tool based on the feedback and comments from the NJDOT personnel.

Task 6— Training and Technology Transfer

- N/A

Task 7 —Project Management, Final and Quarterly Reports

- The research team will submit a quarterly report for the June meeting.

5. List of deliverables provided in this quarter by task:

- An improved beta version of the WCS tool.

6. Progress on Implementation and Training Activities:

- N/A

7. Problems/Proposed Solutions:

- N/A

8. Project Summary:

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|------------------------------------|----|------------|
| Authorized Project Budget (Year 1) | \$ | 168,488.40 |
| Total Project Budget (Years 1&2) | \$ | 321,819.12 |
| Total Project Expenditure to date | \$ | 167,399.81 |
| % of Total Project Budget Expended | | 52.02% |

NJDOT Research Project Manager Concurrence: _____



Date: _____

04/23/2014