TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): FHWA

INSTRUCTIONS:
Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(176) --Traffic Analysis and Simulation Pooled Fund Study	**Transportation Pooled Fund Program - Report Period:** ☑ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☐ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 1 – December 31)	
Project Title: HCM Guidelines for Alternative Intersections		
Name of Project Manager(s): Randy VanGorder	**Phone Number:** 202-493-3266	**E-Mail** Randall.VanGorder@dot.gov
Lead Agency Project ID: DTFH61-12-D-00020-T13002	**Other Project ID (i.e., contract #):**	**Project Start Date:** April 4, 2013
Original Project End Date: October 3, 2015	**Current Project End Date:** April 30, 2017	**Number of Extensions:** 2

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$810,527.00	$709,809.20	99%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$13,922.47	$13,922.47	99%

Project Description:

Over the past decade, the Federal Highway Administration (FHWA) has conducted and developed extensive research, workshops, technical briefs, and other outreach materials about alternative intersections/interchanges. These research efforts and publications have increased interest and rapid adoption of alternative geometric designs across the United States. Of the many alternative intersection/interchange designs, stakeholders showed significant interest in these four:

- Double Crossover Diamond (DCD) interchange (or Diverging Diamond Interchange (DDI)).
- Displaced Left Turn (DLT) intersection.
- Median U-Turn (MUT) intersection.
- Restricted Crossing U-Turn (RCUT) intersection.

Most existing analysis tools supporting the adoption of alternative intersections/interchanges involve the use of complex microscopic simulations that are expensive and time consuming. The Highway Capacity Manual (HCM) and the Highway Capacity Software (HCS) are widely used analytical tools that assess the quality of service for conventional intersections and interchanges. However, they do not assess any of the alternative designs considered in this project.

To support the increased exposure and interest in these designs, FHWA is conducting activities to integrate alternative intersection/interchange guidance into the HCM and HCS. This will help expand the portfolio of design alternatives contained in the HCM and enable a side-by-side assessment of their operations in contrast to traditional designs.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

This project has reached completion. In 2016 the project team developed and submitted a tech brief and four outreach videos. Final chapters 23 & 34 (chapters on ramp terminals and alternative intersections) were reviewed and accepted by the HCQS committee for inclusion in the 6th Edition of the Highway Capacity Manual. Further, the HCM 6th Edition was released to the public in late 2016. The first three computational engines (DLT, RCUT, MUT) were mostly completed by the end of 2016. The DDI computational engine required additional development and testing between January and April of 2017.

Anticipated work next quarter:

None.

Significant Results:

1. Developed specific data entry methods for DDIs, which will be outlined in the users guide and example dataset
   a. Major-street split phasing is achieved by entering lead-lag phasing with no overlap
   b. Off-ramp left turns on to the arterial must be defined as right turns, so they can move concurrently with outbound arterial through movements
   c. Turning radii for the off-ramp left turns must be modified accordingly, because the default right-turn radii will produce incorrect capacities
   d. Arterial left turns on to the freeway must be defined as exclusive lanes even if they are shared lanes, to allow the phasing to work properly (a special checkbox is provided to indicate shared lanes for this case, to achieve the proper lane utilization adjustment factor)
   e. Allowed entry of high start-up lost times, for when off-ramp movements must be held longer
   f. Allowed entry of negative extension of effective green times, for when off-ramp movements must terminate earlier
   g. User inputs are now provided for extra distance travel time (EDTT)
2. Developed example datasets for different DDI phasing options including Two-Critical Mainline Progression, Two-Critical Off-Ramp Progression, Three-Critical Mainline Ramp Progression, Three-Critical Mainline Hold Ramps, and Four Critical Movements
3. Developed a real-world case study for a DDI in Lexington, Kentucky
4. Developed output reports to display DDI origin-destination results and DDI saturation flow rate adjustment factors
5. Implemented special DDI calculations for lane utilization, saturation flow rate, and traffic pressure
6. Developed DDI signal timing optimization logic that can preserve major-street split phasing

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

The alternative intersection and interchange chapters received extra scrutiny from the Highway Capacity Committee (HCQSC), because these chapters are considered by some to be the most important new product to be offered within the HCM 6th Edition. This extra scrutiny led to four rounds of review by the HCQSC, and four rounds of chapter editing by the research team. These four rounds of review and editing led to the initial 6-month project extension.

The DDI computational procedure is more complex than originally anticipated, and required more time for software development than anticipated. This led to the second 6-month project extension.

Potential Implementation:

The procedures and chapters produced by this project were recently published within the Highway Capacity Manual 6th Edition. Some computational engines (RCUT, MUT, DLT) produced by this project have already been released to the public. The DDI computational engine produced by this project will soon be released to the public.