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 #	**Transportation Pooled Fund Program - Report Period:**
TPF-5(164)	☐Quarter 1 (January 1 – March 31) 2013 ☐Quarter 2 (April 1 – June 30) 2013 ☐Quarter 3 (July 1 – September 30) 2013 √Quarter 4 (October 1 – December 31) 2013

Project Title: *Fish Passage in Large Culverts with Low Flows*		
Name of Project Manager(s): *Kornel Kerenyi*	**Phone Number:** *(202) 493-3142*	**E-Mail** *kornel.kerenyi@fhwa.dot.gov*
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**

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**

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**

Project Description:

A primary objective of this aspect of the fish passage study is to determine the local velocities and flow distributions in corrugated metal pipes and pipe arches. This information is proposed for use to supplement the guidance in the publication FHWA- NHI 01-020 Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5. Conventional open-channel culvert hydraulics provides the tools and software needed to compute the average velocity of flow at any culvert cross-section for higher flows, given the culvert shape, roughness, slope and boundary conditions. In order to more accurately evaluate the ability of fish to traverse corrugated metal culverts, it is desirable to look at the changes in the local average velocity of the flow adjacent to the culvert wall under low flow conditions. Other studies have documented the tendency of fish to seek out a swimming location with the lowest velocity of flow. The location of lowest velocity can generally be found immediately adjacent to the culvert wall.
The specific objectives of this task order are to develop local average velocity design charts for various hydraulic conditions in support of the "Fish Passage in large Culverts for low Flows" study, which will be incorporated into the FHWA publication HEC-26 "Culvert Design for Aquatic Organism Passage".

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

- Several equations for calculating composite roughness of various culvert flow conditions were considered and compared using CFD results. This includes linear composition, exponential composition, and linear composition with wall shape coefficient.
- The results from the simulations listed in the test matrix in the previous report were used to test the select equations. While all equations predicted the composite roughness with certain level of accuracy, it was found that the exponential equation combining with a factored HDS-5 bed roughness prediction gave the best results. The comparisons are shown in Table 1. The prediction from the preferred equations is compared with CFD result in Figure 1.

Table 1 Summary of composite Manning's n analyses

Blodgett Multiplier	Culvert Wall Manning's n	RMS Difference: Linear	RMS Difference: Exponential	RMS Difference: Linear with Wall Coefficient
1.0	0.0344	0.0046	0.0047	0.0040
1.0	0.0325	0.0044	0.0044	0.0042
0.93	0.0325	0.0041	0.0041	0.0040

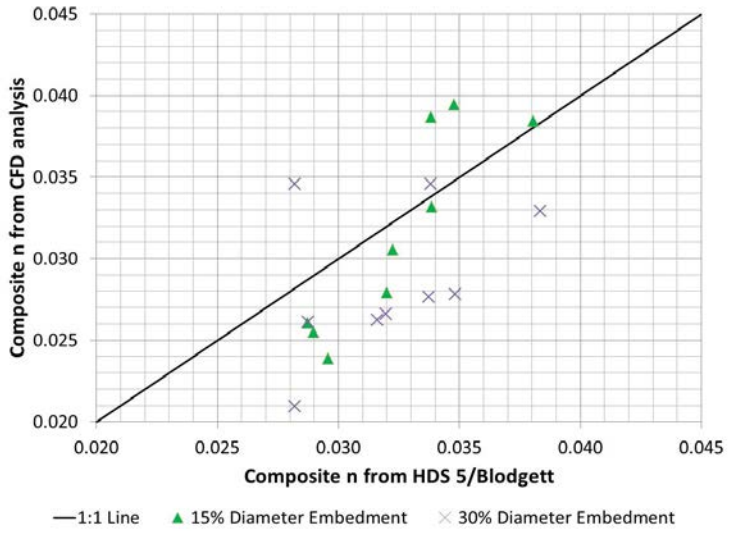

Figure 1 Comparison of composite Manning's n

Anticipated work next quarter:

- Circulate the report again for potential further comments.
- Report publication
- Potential recommendation for guidelines update

Significant Results:

Recommended equations for Manning's roughness coefficient.
Draft report

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).

Potential Implementation:

Additional design aids that may be incorporated into FHWA HEC-26 "Culvert Design for Aquatic Organism Passage".