TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): __Iowa DOT_____

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(445)*	**Transportation Pooled Fund Program - Report Period:** Quarter 1 (January 1 – March 31) Quarter 2 (April 1 – June 30) X Quarter 3 (July 1 – September 30), 2021 Quarter 4 (October 1 – December 31)
Project Title: **Design Guidelines and Mitigation Strategies for Reducing Sedimentation of Multi-barrel Culverts**	

Name of Project Manager(s):	**Phone Number:**	**E-Mail**
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Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:** **February 1, 2020**
Original Project End Date: January 31, 2023	**Current Project End Date:** January 31, 2023	**Number of Extensions:**

Project schedule status:

X☐ On schedule ☐ On revised schedule ☐ Ahead of schedule X Behind schedule (see comments)

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$300,000	$63,989	50%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$ 8,434	%

Project Description:

The overall goal of the TPF-5(445) project is to leverage the extensive research conducted in Iowa though a multi-state research effort leading to design guidelines and specifications for mitigation measures for reducing sedimentation at existing and proposed multi-barrel culvert locations. The guiding principles and best practices for mitigating sedimentation will complement the existing hydraulic design guidelines. The project entails laboratory, numerical, and field monitoring and analysis to determine the overall effect of the sedimentation-reduction designs on the hydrology and transport of sediment at culverts. The project outcomes will be assembled in a web-based platform with interactive parameters that can uniquely support the routine activities related to culverts.

The TPF-5(445) project objectives are:

1. Assemblage of data and knowledge on sedimentation at culverts and mitigation measures
2. Synthesis of the practical knowledge in guidelines for design and operations for reducing or eliminating sedimentation at culverts
3. Development of a web-based platform that will embed the formulated guidelines in easy to use interactive interfaces that will facilitate to retrieve design and operation information and to guide in the selection of a self-cleaning culvert design fit for the local flow and sediment transport conditions.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):
For the reference period (July 1 – September 30, 2021), the research was focused on the following tasks:

T#2. An additional inquiry to project partners was created (Survey #4). The goal of the survey was to get input from partners on the alternative designs involving upstream curtain walls. The long-tapered curtain wall performed very well in the laboratory experiments, in the August 30, 2021 meeting was proposed to check additional geometries (e.g., tapered medium and short, and equal-height short). The equal-height short weir design was inspired by the the New Mexico team. Survey #4 also requested prioritization of the sequence of testing.

T#3. Two questions from Survey #3 that were incompletely answered by the project partners were included in Survey #4. The incomplete input refers the request for culvert-related data resources (e.g., aerial photos, culvert National Bridge Inventory databases, etc) for assessment of the degree of sedimentation at culverts located in the project partnering states. The compilation of data for the state of Iowa revealed interesting new information on the dependence of sedimentation patterns on local factors (e.g., stream-to-culvert ratio, various culvert setting angles)
Note: Tasks #2 and #3 were originally planned to be discussed in the annual project meeting scheduled for the Summer of 2020. Due to the circumstances created by the COVID-19 pandemic, the scheduling of the in-person meeting has been continuously postponed. Instead, 4 surveys were used to acquire the needed information.

T#4. Ensuing from the priority for testing of the self-mitigating designs derived from Survey #3 and #4, we executed the following set of laboratory experiments (for each set we carried out runs with uniform and non-uniform sediment):

- Tapered curtain walls long
- Tapered curtain wall short

Currently, we continue the laboratory tests for the other 3 alternative self-mitigation designs.

Despite the unforeseen circumstances created by the COVID-19 pandemic (i.e., total interruption of the laboratory work and issues found in the debugging stage of the model), the last year allowed us to recover almost integrally the delay in project progress.

Anticipated work next quarter:

- Finalization of the production testis for all the proposed self-mitigation designs.
- Organization and delivery of the first in-person meeting for the TPF project. The meeting will be held in Iowa City from November 30 to December 2. Four partnering states confirmed in-person participation. Missouri will participate remotely.

Significant Results:

The comparison of the self-mitigation configuration with the reference (i.e., the "as is" culvert design) showed that all solutions are improving the overall operations of the culverts in terms of initiation of the sediment deposits and limiting their growth for all tested hydrologic scenarios. The best performance so far is delivered by the long tapered curtain wall positioned at the culver inlet.

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 COVID-19 pandemic adversely affected the project developments in multiple ways:

- We could not held the 1st face-to-face meeting. Besides the importance of having live meeting rather than virtual communication, the initial meeting (planned to be held in Iowa City, IA) was supposed to include a site visit to the four demonstration culverts investigated by the Iowa research team during 2017-2020.
- The IIHR shop was closed for two weeks (from November 9 to 20) due to facility infestation with COVID. The shop personnel was available only partially.

During the debugging stage of the project, the model showed a flow instability due to the formation of the "Stall-flow regime", a very rare situation in hydraulic modeling. The modeling problem was solved by delayed the initial scheduling of the project.

Through intensification of the effort, we were able to recover the time lost due to COVID pandemic and additional modeling issues, therefore we do not ask for any change in the project scheduling at this time.

Potential Implementation: