RFP Solicitation Number: 2020-01

Research Title: Annulus Void Fill Material for Rehabilitated Sliplined Culverts

Problem Statement
Culvert sliplining is a common rehabilitation method that inserts a smaller conduit into a larger host conduit with annulus void fill material placed between the conduits. This rehabilitation method requires care when placing the fill material to ensure the liner conduit does not float or deform due to hydrostatic pressure and that it completely fills the annulus void. Different placement methods and fill materials are employed by contractors performing this work, often tailored to the specific site conditions. Bulkheads are typically placed at the upstream and downstream ends to contain the void fill material and a variety of different methods are used by contractors to place the void fill material. Current Supplemental Specification 837 (SS 837) requires the void to be completely filled by the contractor and it specifies use of either: low strength mortar backfill (CMS 613), mortar (CMS 602), or cellular grout (ASTM C869 or modified CMS 499).

Current void fill operations have been found to not completely fill the annulus between the host and liner pipe; however, this is not always detected during construction. ODOT Districts have reported an absence of annulus void fill material in previously rehabilitated culverts that were discovered several years after construction when a bulkhead had been displaced or removed. A verification process that confirms complete filling of the annulus void does not currently exist.

Goals and Objectives
The goal of the research project is to develop a construction and material specification for annulus void fill material and void fill operations. Specific project objectives include the following:

- Provide a material specification for the void fill materials and identify when the different materials would be applicable to different characteristics of site conditions or liner pipe type.
- Include a high strength and low strength void fill material in the specification and detail when the chosen material is applicable in the designer note.
- Create a construction specification detailing methodology that is applicable to the chosen void fill material.
- Ensure the methodology considers all available liner material options as listed in SS837 and that it includes a practicable verification process to ensure the annulus is filled.

Proposed Research
This research is expected to include (at a minimum) the activities listed below. Additional activities may be included at the researcher’s discretion in order to achieve the stated goals and objectives of the study.

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<tr>
<th>Task</th>
<th>ODOT Contribution</th>
<th>Deliverable</th>
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<tbody>
<tr>
<td>Perform literature search to document current practices (include other DOTs, materials and research.)</td>
<td></td>
<td>Summarize the findings in the final report.</td>
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<tr>
<td>Perform survey of conduit manufacturers used for sliplining under SS 837. Identify recommendations of void fill material and procedures recommended by conduit manufacturers.</td>
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<td>Summary of survey, recommendations, and procedures in a matrix.</td>
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<tr>
<td>Identify void fill materials available in Ohio and provide cost/performance analysis (pro and con).</td>
<td>Matrix</td>
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<td>Perform survey of contractors specializing in conduit rehabilitation. Document current methodologies and materials used to fill voids in slip lining or pipe abandoning.</td>
<td>Will provide a list of contractors specializing in conduit rehabilitation.</td>
<td>Summary of findings in the final report.</td>
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<tr>
<td>Perform survey of ODOT Districts to identify previously slip lined culvert locations.</td>
<td>Will provide a list of Districts</td>
<td>Summarize the findings in the final report.</td>
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At this point, an in-person review session will be held at ODOT. Researcher will discuss findings thus far and details will be finalized for moving forward with the next tasks.

Perform field inspections at 5 sites per ODOT district (60 sites total) to previously installed slip lined culverts; interview ODOT construction staff and contractors that performed the work. Include enough field inspections to confirm statistical significance of findings.

Develop a material specification for the void fill and a construction specification for a practicable method to install fill material within the void between the host and liner conduit for varying sizes and lengths. Include an annulus void fill verification process.

Construction specification document.

**Requirements of the Research Team**
The research team requires participation from a contractor that has performed slip lining projects for ODOT within the past 5 years in collaboration with a design consultant and/or a university. The team must also be capable of the following:

- Confined space entry
- Culvert inspection
- Specification writing
- Slip lining construction
- Physical material testing of void fill material
- An understanding of soil-structure interaction pipe mechanics
- Experience coordinating data gathering from multiple entities (e.g.: districts)

The proposal must demonstrate that these requirements are met in the “Qualifications of the Research Team” section as well as in the attached resumes. Contracting requirements of the State of Ohio require the inclusion of an Ohio-based entity on the research team.

**Assistance from ODOT**

- ODOT will provide input and assistance to the researchers as needed.
- ODOT will provide a list of sites as a starting point for coordination with the districts. The researcher should strive to include sites completed from various contractors during inspections.

**Project Specific Deliverables**

- Draft material specification for void fill materials
- Monthly status calls
- Color poster that summarizes the project and findings. Poster must include graphics/pictures to help illustrate the research.
Research Contract Deliverables

- Quarterly Progress Reports (due one month after each quarter ending date);
- Electronic Word version of the draft final report and draft fact sheet shall be submitted 120 days prior to the contract completion date;
- PDF and MS Word version for both documents shall be submitted by the contract completion date;
- An article for the Research newsletter (to be provided upon request); and
- Participation in the following meetings: project start-up, research review sessions, monthly meetings as requested, and research results presentation (if requested)

Benefits
This project will create a construction and material specification that could lead to improved service life of the culverts, thereby resulting in cost savings of materials and labor.

Preliminary Literature Search Results
A preliminary literature search identified various publications pertaining to this topic. Researchers are expected to perform a more in-depth literature search to ensure this research does not duplicate existing efforts.

- ASTM F585-16 Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers

Duration
The total duration of this research is 24 months. This includes the 4-month review and publication period for the final report.

Specific Assurances with Respect to Federally-Assisted Projects
The Ohio Department of Transportation in accordance with Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, all bidders including disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin, sex, age, disability, low-income status, or limited English proficiency in consideration for an award.