

Appendix A

SURVEY QUESTIONNAIRE

Highway stakeholders recognize the overwhelming need for effective technologies in both the structural and functional stormwater facility renewal while minimizing negative impacts and maximizing cost benefits. Trenchless technologies are replacing traditional techniques to accomplish stormwater system renewal.

This questionnaire is part of the effort in National Cooperative Highway Research Program (NCHRP) Synthesis Topic 48-05 to gather information on agency, municipalities, and special districts as well as private sector perspectives on successful practices for trenchless stormwater system renewal. We are interested in the experience and opinions of agencies regardless of whether they have used trenchless technologies for stormwater systems renewal. The questionnaire has only 26 questions, and you will only need to complete a subset of these based upon your agency's experience with trenchless stormwater system renewal.

The following definitions are used in this questionnaire:

- **Trenchless Renewal:** Upgrading, rehabilitating, repairing, and renovating the performance and increasing the design life of existing stormwater facilities using trenchless technology.
- **Trenchless Installation:** Constructing a new stormwater conveyance system to replace an existing stormwater facility along a new alignment using trenchless technology such as pipe ramming, pipe jacking, auger boring, microtunneling, or horizontal directional drilling.
- **Trenchless Technology:** Techniques for underground storm water conveyance system installation, rehabilitation, renovation, renewal, and replacement that minimize excavation and disturbance at the ground surface.
- **Stormwater Systems:** Culverts, storm sewers, and drainage structures.
- **Cure-in-place Pipe:** Insertion, expansion, and curing of a flexible fabric and a thermosetting resin lining system.
- **Sliplining:** Insertion of new smaller diameter pipe into the existing pipe. Typically includes grouting the annular gap.
- **Modified Sliplining:** Construction of a new liner for existing pipes 48-inch-diameter or larger and noncircular shapes. Includes spiral wound lining, pipe panels, pipe segments, and split-can liner.
- **Close-fit Pipe:** Installation of a new liner using the fold and formed, drawdown, rolldown, or similar process.
- **In-place Replacement:** In situ replacement of the existing pipe. Common methods include pipe bursting, pipe reaming, pipe eating, and pipe ejection/extraction.
- **Spray-in-place Pipe:** Sprayed cementitious or polymer liner for existing pipes. Includes lining for structural and non-structural renewal.

QUESTIONNAIRE INSTRUCTIONS

If your agency has experience with trenchless renewal of stormwater systems, please answer questions 1 through 21 and question 26.

If your agency does not have experience with trenchless renewal of stormwater systems, please answer question 1 and questions 22 through 26.

Experience

- 1. Does your agency have experience with trenchless technologies for renewal of stormwater systems? Yes No **If "No", Skip to Question 22.**

Methods Used and Satisfaction

- 2. Provide the approximate percent of stormwater system projects you conduct using open-cut installation, trenchless installation, and trenchless renewal.

Open-Cut Installation	_____ %
Trenchless Installation	_____ %
Trenchless Renewal	_____ %

- 3. Provide the approximate percent of projects you conduct where renewal of manholes/vaults is included. Round to the nearest 10 percent. _____ percent
- 4. Provide the approximate percent of trenchless renewal projects you conduct where the renewal is used to temporarily defer replacement with a new stormwater conveyance system. Round to the nearest 10 percent. _____ percent
- 5. Provide the approximate percent of trenchless renewal projects you conduct where the renewal is primarily to correct non-structural defects versus structural defects. Round to the nearest 10 percent. _____ percent
- 6. What types of trenchless technologies have you used? (Check all that apply.)

Method (Examples)
<input type="checkbox"/> Cure-In-Place Pipe: (Inversion; pull-in)
<input type="checkbox"/> Sliplining: (Continuous; segmental)
<input type="checkbox"/> Modified Sliplining: (Spiral wound; pipe panels; pipe segments; Split-Can Liner)
<input type="checkbox"/> Close-Fit Pipe: (fold and formed; drawdown; rolldown)
<input type="checkbox"/> In-Line Replacement: (Pipe bursting; pipe reaming; pipe eating)

Method (Examples)
<input type="checkbox"/> Spray-In-Place Pipe: (Cementitious; polymer; epoxy; polyurea/polyurethane; polyester)
<input type="checkbox"/> Other _____

7. Provide an approximate percentage of projects you completed using the following trenchless renewal. Round to the nearest 10 percent.

Method	(percent)
Cure-In-Place Pipe	_____
Sliplining	_____
Modified Sliplining	_____
Close-Fit Pipe	_____
In-Line Replacement	_____
Spray-In-Place Pipe	_____
Other _____	_____

8. Provide an approximate success/satisfaction percentage rate for the methods used. Round to the nearest 10 percent.

Method	Success/ Satisfaction Rate (percent)
Cure-In-Place Pipe	_____
Sliplining	_____
Modified Sliplining	_____
Close-Fit Pipe	_____
In-Line Replacement	_____

Spray-In-Place Pipe _____

Other _____

Defects Mitigated and Satisfaction

9. On your projects, which defects do you mitigate using trenchless renewal?

Defect Type
<input type="checkbox"/> Alignment offsets
<input type="checkbox"/> Loose or open joints
<input type="checkbox"/> Flattened or oval pipes
<input type="checkbox"/> Sags
<input type="checkbox"/> Cracks, breaks, or splits
<input type="checkbox"/> Cavitation/erosion
<input type="checkbox"/> Corrosion
<input type="checkbox"/> Leaks/infiltration
<input type="checkbox"/> Other _____

10. For your projects, categorize the relative frequency with which you attempt to mitigate the following defects using trenchless renewal. Use the following categories "Never" "<10%", "10% to 40%", "40% to 60%", "60% to 90%", "Always"

Defect Type	Relative Frequency
Alignment offsets	_____
Loose or open joints	_____
Flattened or oval pipes	_____
Sags	_____
Cracks, breaks, or splits	_____
Cavitation/erosion	_____
Corrosion	_____
Leaks/infiltration	_____
Other _____	_____

11. Describe your satisfaction mitigating the following defects using trenchless renewal on projects you perform. Use "Very Dissatisfied", "Dissatisfied", "Neutral", "Satisfied", and "Very Satisfied"

Defect Type	Degree of Satisfaction
Alignment offsets	_____
Loose or open joints	_____
Flattened or oval pipes	_____
Sags	_____
Cracks, breaks, or splits	_____
Cavitation/erosion	_____
Corrosion	_____
Leaks/infiltration	_____
Other _____	_____

Case Studies and Available Cost Data

12. Do you have a case history for a successful trenchless renewal project that you would be willing to share? Yes No

13. Do you have a case history for an unsuccessful trenchless renewal project that you would be willing to share? Yes No

14. Do you track and/or have trenchless renewal projects costs you would be willing to share? Yes No

Decision Criteria

15. Does your organization follow a standardized decision criteria for selecting the trenchless renewal method? Yes No

If Answer to Question #15 is **Yes**, would you be willing to provide a copy of your criteria as an example? Yes No

If Answer to Question #15 is **No**, which of the following best describes your process.

-
- Decision Criteria
-
- Input from Outside Consultant
-
- In-House Expert/Consultation
-
- Experience-Based
-
- Own Equipment/Crews
-
- Other _____
-

Reasons for not using trenchless renewal when technically feasible

16. For projects you conduct, select your common reasons for not using trenchless renewal when trenchless renewal is technically feasible. Check all that apply.

Reasons

Limited organization experience

Lack of local experienced contractors

Prior unfavorable experience

Preference for new construction

Uncertainty regarding design life/performance of trenchless methods

Faster to open-cut

Economics\Costs

Environmental considerations (e.g. pH, existing fish/wildlife, required habitat improvement [fish passage])

Potential damage to existing, adjacent facilities or pavement

Presence of laterals

Flow bypass difficulties

Site access limitations (e.g. limited staging area)

Condition of existing pipe (e.g. offset joints, collapse)

Reduction in hydraulic capacity not acceptable

Other _____

Reasons for using trenchless renewal

17. Rank your top five reasons for using trenchless renewal. Please rank from 1 to 5 where 1 is the most common.

Reasons	Rank
Commonly used/standard practice	_____
Outcome from formalized decision process	_____
Height of fill (cover) over structure	_____
Outcome from formalized cost benefit analysis	_____
Lots of local experienced contractors	_____
Own the equipment and have the crews	_____
Limit surface disturbance	_____
Temporary or permanent deferral of constructing a larger replacement pipe.	_____
Favorable past experience	_____
Faster than open-cut	_____
Perceived economic\cost benefit	_____
Environmental considerations (e.g. existing fish/wildlife, wetland impact)	_____
Other _____	_____

Project Cost Exceedance and Claims

18. How frequently (percent of the time) do you experience the following ranges of cost overruns on trenchless renewal projects you conduct? Use the comment space to provide the most common reason for cost overruns on your trenchless renewal projects

Cost Exceedance Range (percent)	Percent of trenchless renewal projects (round to nearest 10%)
0 to 10% Cost Overrun	_____
10 to 20% Cost Overrun	_____
20 to 30% Cost Overrun	_____
Greater than 30% Cost Overrun	_____

Comments _____

19. Select the common sources of construction claims on trenchless renewal projects you conduct.

- Safety
- Third-party damage\disruption
- Differing groundwater/soil conditions
- Existing pipe Condition
- Other _____

What is the most common reason for construction claims on trenchless renewal projects you conduct? _____

Additional Information

20. What information would be useful to your agency in considering using trenchless renewal for stormwater systems more frequently? (Check all that apply.)

- All of the following information would be useful

- Agency experience with the applicable methods (case studies)

- Typical cost information

- Sources of claims and mitigation methods

- Settlement/heave/vibration impacts and mitigation methods

- Decision criteria used by facility owners

- Limiting factors to the applicability of specific methods

- Emergent technologies

- Other _____

- None of this information would be useful

21. Are here trenchless renewal methods that you have not used but are interested in learning more about? Yes No

Your agency has not used or rarely uses trenchless renewal for stormwater systems but is perhaps interested in using or increasing the use of them.

22. What information would be useful to your agency in considering using trenchless renewal for stormwater systems? (Check all that apply.)

All of the following information would be useful

Agency experience with the applicable methods (case studies)

Typical cost information

Sources of claims and mitigation methods

Settlement/heave/vibration impacts and mitigation methods

Decision criteria used by facility owners

Limiting factors to the applicability of specific methods

Emergent technologies

Other _____

None of this information would be useful

23. Rank your top five reasons for using trenchless renewal. Please rank from 1 to 5 where 1 is the most common.

Reason	Rank
Limited organization experience	_____
Lack of local experienced contractors	_____
Prior unsuccessful experience	_____
Preference for new construction	_____
Uncertainty regarding design life/performance of trenchless methods	_____
Faster to open-cut	_____
Economics/costs	_____
Environmental considerations	_____
Potential damage to existing, adjacent facilities, or pavement	_____
Presence of laterals	_____
Flow bypass difficulties	_____
Site access limitations (e.g., limited staging area)	_____
Condition of existing pipe (e.g., offset joints and/or collapse)	_____
Reduction in hydraulic capacity not acceptable	_____
Other _____	_____

24. Are here trenchless renewal methods that you have not used but are interested in learning more about? Yes No

25. If Answer to Question #24 is Yes, please describe?

26. Would you like to be notified when the final report is complete? If you would prefer not to be notified, please select "No" below. Yes No

Thank You for taking our survey.