

APPENDIX B—INFORMATIONAL SURVEY



---

# Culvert Pipe Liners:

## Development of Guidelines and Specifications Survey

---

Name of Agency/DOT/Organization: \_\_\_\_\_

Location of Agency/DOT/Organization (city, state): \_\_\_\_\_

Name: \_\_\_\_\_

Position/Title: \_\_\_\_\_

Will you allow us to contact you for more information if needed?

YES  NO

*If yes, please fill in your Phone #, Fax # and E-mail for future contact purposes.*

Phone #: \_\_\_\_\_

Fax #: \_\_\_\_\_

E-mail: \_\_\_\_\_

Are you interested in receiving a copy of the summary of the survey results?

YES  NO

---

This survey is intended to provide Colorado State University, in conjunction with the Federal Highway Administration (FHWA), information for the development of guidelines and specifications for the use of culvert pipe liners. This survey will focus on five (5) current methods of lining existing pipes for rehabilitation purposes. These methods include: Sliplining (SL), Close-fit Lining (CFL), Spirally Wound Lining (SWL), Cured-In-Place Lining (CIPPL) and Spray-On Lining (SOL).

For survey purposes, each method is defined:

**Sliplining (SL):** Sliplining involves the process of inserting a flexible, usually thermoplastic, liner of smaller diameter directly into the deteriorated pipe. Liners are inserted into the host pipe by either pulling or pushing the liner into place. After insertion, the annular space between the existing culvert and liner is generally grouted with a cementitious material to provide a watertight seal. The liner can be installed in segments (segmental sliplining) or by one continuous liner (continuous sliplining).

**Close-Fit Lining (CFL):** Sometimes referred to as modified sliplining, close-fit lining involves the insertion of a thermoplastic pipe with an outside diameter the same or slightly larger than the inside diameter of the host culvert. As a result, the liner must be temporarily modified in cross section prior to installation. The modified liner is then winched into place and reformed/re-rounded to provide a close-fit with the existing culvert. Liner diameters can be temporarily reduced with a static die or series of compression rollers or folded into a “C”, “U” or “H”-shape.

**Spirally Wound Lining (SWL):** This technique utilizes interlocking profile strips, most commonly made from PVC, to line the deteriorated pipe. The coiled, interlocking profile strips are fed through a winding machine that mechanically forces the strips to interlock and form a smooth, continuous, spirally wound liner. During the interlocking process, a sealant is applied to each joint to form a watertight seam. As the material is wound and snapped together, it is spirally wound into the existing pipe.

**Cured-In-Place Pipe Lining (CIPPL):** Cured-in-place pipe lining, also known as “in-situ lining”, involves the insertion of a flexible fiber tube coated with a thermosetting resin into the existing pipe. The tube is inserted by hydrostatic inversion, air inversion or by mechanically pulling the liner in place. Once installed, the resin is cured under ambient conditions or through applied heat provided by circulating steam or hot water throughout the tube.

**Spray-On-Lining (SOL):** Spray-on-lining techniques utilize a machine that is inserted into an existing culvert. The machine is pulled through the pipe at a constant speed while centrifugally spraying the lining material onto the wall of the existing pipe. Cement-mortar and epoxy are the two most common types of materials used for lining. For man-entry culverts, cement-mortar applications can be reinforced with wire mesh.

## General Information:

1. Has your agency/DOT/organization been involved with the design or installation of pipe liners? YES  NO  *if No, please go to 16*

2. When was the first time your agency/DOT/organization became familiar with the practice of lining pipes for rehabilitation purposes? Year \_\_\_\_\_

3. Which types of pipe liners has your agency/DOT/organization designed or installed:

- SL      Approximately how much pipe \_\_\_\_\_ Feet  Meters
- CFL      Approximately how much pipe \_\_\_\_\_ Feet  Meters
- SWL      Approximately how much pipe \_\_\_\_\_ Feet  Meters
- CIPPL      Approximately how much pipe \_\_\_\_\_ Feet  Meters
- SOL      Approximately how much pipe \_\_\_\_\_ Feet  Meters

4. What standards/specifications/guidelines were used for the design and installation of the pipe liners?

Manufacturers      Please list sources \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

ASTM      Please list specific standards \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Government/State      Please list sources \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Own Please list sources \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other Please list sources \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. Which types of pipe liners have proven to be the easiest to install?

- SL                       SWL                       SOL  
 CFL                       CIPPL

Why?: \_\_\_\_\_  
\_\_\_\_\_

6. Which types of pipe liners have proven to be the most successful?

- SL                       SWL                       SOL  
 CFL                       CIPPL

Why?: \_\_\_\_\_  
\_\_\_\_\_

7. Which types of pipe liners have proven to be the most unsuccessful?

- SL                       SWL                       SOL  
 CFL                       CIPPL

Why?: \_\_\_\_\_  
\_\_\_\_\_

8. Which types of pipe liners have proven to be the most expensive?

- SL                       SWL                       SOL  
 CFL                       CIPPL

Why?: \_\_\_\_\_  
\_\_\_\_\_

9. Which types of pipe liners have proven to be the least expensive?

- SL                       SWL                       SOL  
 CFL                       CIPPL

Why?: \_\_\_\_\_  
\_\_\_\_\_

10. Can you provide an average general cost associated with any lining method?

YES  NO

*if No, please go to 11*

- SL Average General Cost \_\_\_\_\_ Per Linear Foot  Per Linear Meter
- CFL Average General Cost \_\_\_\_\_ Per Linear Foot  Per Linear Meter
- SWL Average General Cost \_\_\_\_\_ Per Linear Foot  Per Linear Meter
- CIPPL Average General Cost \_\_\_\_\_ Per Linear Foot  Per Linear Meter
- SOL Average General Cost \_\_\_\_\_ Per Linear Foot  Per Linear Meter

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

11. Can you provide a design life generally associated with any lining method?

YES  NO

*if No, please go to 12*

- SL General Design Life \_\_\_\_\_ Years
- CFL General Design Life \_\_\_\_\_ Years
- SWL General Design Life \_\_\_\_\_ Years
- CIPPL General Design Life \_\_\_\_\_ Years
- SOL General Design Life \_\_\_\_\_ Years

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

12. Do you currently have any maintenance procedures for installed liners?

YES  NO

*if No, please go to 13*

If yes, please specify: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



15. Can you provide any project specific information (i.e. project description, type of liner used, cost) associated with any documented case studies? YES  NO

*If yes to 15, please fill out the project specific information section on the following page.*

16. Are you interested in receiving a copy of the specifications and guidelines for culvert pipe liners?  
YES  NO

*We appreciate and thank you for your time and effort.*

17. Additional Comments? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Project Specific Information:

Project Name (if applicable) \_\_\_\_\_

Published Source (if applicable) \_\_\_\_\_

Project Description \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Indicate the type of pipe liner used for this project:

- SL                       SWL                       SOL  
 CFL                       CIPPL                       Other \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

2. Year in which project was completed \_\_\_\_\_

3. Time to complete installation \_\_\_\_\_ days \_\_\_\_\_ hours

4. Total cost of project \_\_\_\_\_

5. Length of pipe lined \_\_\_\_\_ ft  m  Original size of lined pipe \_\_\_\_\_ in  mm

6. Material of lined pipe:

- Steel                       Concrete                       Copper                       Corrugated Metal  
 Iron                       PVC                       Other \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

7. Was more than one type of pipe liner investigated prior to installation?

YES  NO

*if No, please go to 9*

If yes, what were they?

- SL                       SWL                       SOL  
 CFL                       CIPPL                       Other \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

8. What was the deciding factor(s) in choosing the type of pipe liner? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9. Additional project comments? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. Can you provide information pertaining to additional projects?

YES  NO

*If yes, can we contact you regarding these additional projects*      YES  NO

*We appreciate and thank you for your time and effort.*

