MECHANICAL REPAIR SLEEVES

Metal Culvert Overview Flowchart
Structural Defects Flowchart (Metal)
Bedding Deficiencies Flowchart (Metal)
Hydraulic Capacity Flowchart (Metal)

1. OVERVIEW

With this method, prefabricated stainless steel or PVC sleeves are positioned inside the pipe while folded and then jacked (snapped) into an expanded shape (Figure 1). The annular space between the sleeve and the pipe is filled with grout. The sleeves offer structural repair to damaged pipes, but can also restore missing pipe sections without excavation and seal the joints against infiltration.

Figure 1. Installing a PVC sleeve into a damaged HDPE pipe (LINK-PIPE, 2008d)

Mechanical repair sleeves come in various diameters and short standard lengths (e.g., 18 in., 24 in., or 36 in.).

2. MATERIALS USED

Sleeves made of stainless steel or rigid PVC can be used. Polyurethane grout is used to fill the annular space between the sleeve and host pipe when the repaired pipe is required to retain flexibility. Cementitious grout offers an economic alternative when joint flexibility is not required.

3. APPLICABILITY

PVC sleeves are applicable in man-entry culvert pipe ranging in diameter from 36 in. to 108 in. Both circular and non-circular pipes (tear-drop, horse-shoe and oval pipes) can be repaired. The sleeves made of rigid PVC can be adapted to most culvert designs except box culvert.

Stainless steel sleeves are applicable in pipes ranging in diameter from 6 in. to 54 in.

4. CONSTRUCTION DETAILS

The general installation procedure of PVC sleeves (Figure 2) involves the following steps (LINK-PIPE, 2008d):

- Position the sleeve inside the pipe to cover either the damaged area or, if used for joint sealing, center it on the joint
- Expand the sleeve using two hydraulic jacks
- Grout the annular space

Two hydraulic jacks (rams) are used for sleeve expansion: the first is used to hold the snap-out sleeve vertically against the top and bottom of the pipe; and the second is positioned horizontally to snap-out the flaps at the springlines and lock them into position (Figure 3). For grouting, liquid grout is pumped through the vent nipple at the invert and into the annular space until dense foam, or liquid grout, starts emerging from the crown vent (Figure 4).

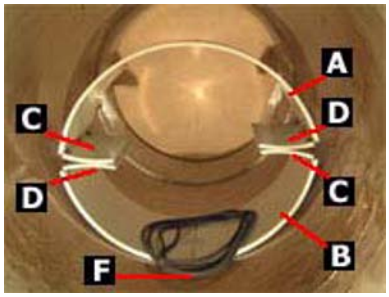

Figure 2. PVC repair sleeve consisting of six segments (LINK-PIPE, 2008d)

Figure 3. Jacks used for sleeve expansion (LINK-PIPE, 2008d)

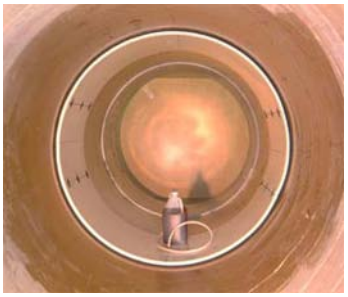

Figure 4. Grouting of annular space (LINK-PIPE, 2008d)

The general installation procedure of stainless steel involves the following steps (Ballinger and Drake, 1995):

- Insert the sleeve into the culvert
- Insert the pneumatic plug into the sleeve and slightly inflate it to hold the sleeve
- Pull the sleeve/plug assembly to the location that needs repair
- Inflate the pneumatic plug to expand the steel sleeve and compress the polyethylene gasket
- Deflate the plug so that the edges of the sleeve snap together
- Grout the annular space

5. EXAMPLE CASE HISTORIES

In Atlanta, GA, a CMP culvert that was 47” in diameter and 60 ft long, was repaired (LINK-PIPE® PVC Sleeve) in 2007 (Figure 5)

Figure 5. PVC sleeve used in Atlanta, GA (http://www.linkpipe.com/culverts.htm)

6. ADVANTAGES AND LIMITATIONS

The main advantage of mechanical repair sleeves is the ability to provide a structural repair with a very quick and simple procedure. Furthermore, no excavation is required, nor is expensive installation equipment, there are short setup and installation times, and a small crew (three people) is needed that can be trained in one day.

7. REFERENCES

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