Condition Survey of Corrugated Steel Pipe Detention Systems

An Interim Report
March, 1999
National Corrugated Steel Pipe Association (NCSPA), in cooperation with the American Iron and Steel Institute (AISI), undertook this study to evaluate the condition of CSP stormwater management detention structures in the Washington, D.C. metro area. All inspections were performed by Parsons Brinkerhoff located in Baltimore, Maryland.

CSP detention structures have been in use in this area since as far back as the early 1970’s. The objective was to perform a qualitative condition survey to assess the overall performance of these systems. This Interim Report contains the findings from the initial inspections. A Final Report will be issued when additional inspections have been completed.

SITE SELECTION
All sites identified and inspected in Montgomery County, Maryland; Fairfax City, Virginia; and Alexandria, Virginia, were determined and located by the government official. In most cases, this was an Inspector, which eliminated any potential bias in site selection. The Inspector was told to supply the oldest structures in place and also to include various coatings (Galvanized, Aluminized, and Bituminous Coated).

Of the twenty-one sites inspected, eleven were galvanized coated; three were aluminized coated type 2; three were fully bituminous coated; and three were aluminum. One of the galvanized sites had saw cuts in the invert to promote infiltration of the runoff into the ground in a similar manner as perforated CSP. Three sites contained sand filters for water quality purposes.

PROCEDURES
The inspection procedures consisted of a qualitative survey of pipe conditions. This included identifying the coating type, corrugation profile, general dimensions of the system, type of release structure, lockseam condition, joint condition, coating condition for the top, sides, and invert, land use, and any other items of interest.

The firm of Parsons Brinkerhoff was contracted to perform the inspections using a Professional Engineer, Dan O’Leary. In addition, a safety consultant was employed to oversee all confined space issues.

The coating condition was evaluated on a visual rating scale shown below in Table 1. This same criteria was used in a condition survey of CSP performed by Corrpro Companies in 1986. Environmental conditions (pH, resistivity) were outside the scope of this study.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100–95</td>
<td>Galvanizing Intact</td>
</tr>
<tr>
<td>90</td>
<td></td>
</tr>
<tr>
<td>80–85</td>
<td>Galvanizing Partly Gone, Some Rust</td>
</tr>
<tr>
<td>75</td>
<td></td>
</tr>
<tr>
<td>60–55</td>
<td>Galvanizing Gone, Significant Metal Loss</td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>45–40</td>
<td>Deep Pits, Heavy Metal Loss, Perforation</td>
</tr>
<tr>
<td>35–30</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
</tr>
<tr>
<td>20–15</td>
<td></td>
</tr>
<tr>
<td>10–5</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Major Metal Loss</td>
</tr>
</tbody>
</table>

FINDINGS
The condition survey findings are illustrated in the tables at right, and in the detailed site conditions that follow. Overall, the systems were found to be performing extremely well. From a durability standpoint, most systems still had all zinc intact after up to twenty five years. Only one site showed any signs of metal loss.

There were no signs of visible deflection in the pipes with the exception of mechanical damage during installation at one location. This damage was not significant enough to require any maintenance activity. Most joints were believed to be soil tight with one exception.

PRELIMINARY CONCLUSIONS
The results of the condition survey indicate that CSP systems provide a reliable and durable solution for stormwater detention. Based on the observations on the older systems (25 years), it would be reasonable to expect these systems to continue service for two to four times (or longer) without any repair being necessary. In addition, a study performed by Corrpro Companies in 1986 found that, “93.2% of plain galvanized CSP installations have a soil-side service life in excess of 75 years, while 81.5% have a soil-side service life in excess of 100 years.” The Corrpro finding is consistent with this investigation.
CONDITION RATING -- ALL SITES.

Top

Sides

Invert

Average Rating

CONDITON RATING
Sites 4, 10, 11, and 19 were aluminum structures which were not intended for study and were not evaluated.
**Condition Rating**
- Top ................95/100
- Sides ..............95/100
- Invert.............75/90*

**Avg. Rating**.....**92.5**

**Age:** 25 years  
**Coating Type:** Galvanized  
**Diameter:** 60"  
**Corrugation:** 1x3" Helical  
**Land Use:** Industrial  
**Location:** Montgomery County, Maryland

**Comments:**  
*18" standing water; could not see invert; rating based on probing.*
Condition Rating:
Top ..................90/95
Sides .................90/95
Invert...............70*
Avg. Rating........85

Age: 25 years
Coating Type: Galvanized
Diameter: 48"
Corrugation: 1x5" Helical
Land Use: Industrial
Location: Montgomery County, Maryland

Comments:
*Isolated pitting invert.
Condition Rating:
Top ................. 90/95
Sides ............... 90/95
Invert ............... 75
Avg. Rating...... 86.7

Age: 25 years
Coating Type: Galvanized
Diameter: 48"
Corrugation: 1x5" Helical
Land Use: Industrial
Location: Montgomery County, Maryland

Comments:
36" saw-cuts in every corrugation to promote infiltration; stone backfill.
Condition Rating:
Top ...................... 100
Sides ..................... 100
Invert ..................... 90
Avg. Rating ...... 96.7

Age: 20 years
Coating Type: Galvanized
Diameter: 60"
Corrugation: 1x5" Helical
Land Use: Industrial
Location: Montgomery County, Maryland

Comments:
Oil grit separator at entrance.
### Condition Rating:

<table>
<thead>
<tr>
<th>Top</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sides</td>
<td>70</td>
</tr>
<tr>
<td>Invert</td>
<td>60</td>
</tr>
<tr>
<td><strong>Avg. Rating</strong></td>
<td><strong>73.3</strong></td>
</tr>
</tbody>
</table>

### Age:
- 20 years

### Coating Type:
- Galvanized

### Diameter:
- 96"

### Corrugation:
- 1x5" Helical

### Land Use:
- Commercial

### Location:
- Montgomery County, Maryland

### Comments:
- 6" low orifice clogged;
- 24" standing water;
- Red rust on sides with coating loss.
<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Age: 20 years</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top ......................100</td>
<td>Coating Type: Galvanized</td>
<td>Limited staining in invert.</td>
</tr>
<tr>
<td>Sides ....................90/95</td>
<td>Diameter: 96&quot;</td>
<td>___________________________</td>
</tr>
<tr>
<td>Invert ....................80/85</td>
<td>Corrugation: 1x5&quot; Helical</td>
<td>___________________________</td>
</tr>
<tr>
<td>Avg. Rating ......91.7</td>
<td>Land Use: Commercial</td>
<td>___________________________</td>
</tr>
<tr>
<td></td>
<td>Location: Montgomery County, Maryland</td>
<td>___________________________</td>
</tr>
</tbody>
</table>

Detention System

SITE 7
Detention System

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Age: 20 years</th>
<th>Coating Type: Fully Bituminous Coated</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top ..................</td>
<td>100</td>
<td>Diameter: 72&quot;</td>
<td>Bituminous coating intact; no rust on exposed galvanized surface.</td>
</tr>
<tr>
<td>Sides ...............</td>
<td>100</td>
<td>Corrugation: 1x5&quot; Helical</td>
<td></td>
</tr>
<tr>
<td>Invert ..............</td>
<td>100</td>
<td>Land Use: Commercial</td>
<td></td>
</tr>
<tr>
<td><strong>Avg. Rating</strong> ......</td>
<td><strong>100</strong></td>
<td>Location: Montgomery County, Maryland</td>
<td></td>
</tr>
</tbody>
</table>
Condition Rating

Top .......................95
Sides .....................95
Invert ...................85

Avg. Rating......91.2

Age: 20 years
Coating Type: Galvanized
Diameter: 108"
Corrugation: 1x5" Helical
Land Use: Commercial
Location: Montgomery County, Maryland

Comments:

Oil grit separator at entrance;
minor soil trough joints;
no sign of gaskets with joints.
Condition Rating

Top .......................90
Sides ..............90/100
Invert ..............80/85

Avg. Rating......88.3

Age: 14 years
Coating Type: Aluminum Coated Type 2
Diameter: 48"
Corrugation: ½" x 2½" Helical
Land Use: Commercial
Location: Montgomery County, Maryland

Comments:
____________________________________
____________________________________
____________________________________
____________________________________
<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Age: 10 years</th>
<th>Coating Type: Aluminum Coated Type 2</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top ...............95</td>
<td>Diameter: 108”</td>
<td>Corrugation: 1x5” Helical</td>
<td>Oil grit separator at entrance.</td>
</tr>
<tr>
<td>Sides ..............95</td>
<td>Land Use: Commercial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invert .............95</td>
<td>Location: Montgomery County, Maryland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. Rating .......95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Condition Rating**

- Top: 95
- Sides: 95
- Invert: 95
- Avg. Rating: 95
Condition Rating
Top .....................100
Sides ..................100
Invert ............95/100
Avg. Rating......99.2

Age: 5 years
Coating Type: Fully Bituminous Coated
Diameter: 67"x104"
Corrugation: 1x5" Helical
Land Use: Residential
Location: Fairfax City, Virginia

Comments:
- Asphalt coating removed in sections of invert.
- No signs of rust on exposed galvanizing.
Condition Rating
Top ..................... 100  
Sides .................. 100  
Invert ................. N/A  
Avg. Rating ........... 100  

Age: Less than 3 years  
Coating Type: Galvanized with Painted Coating  
Diameter: 120"  
Corrugation: 1x5" Helical  
Land Use: Residential  
Location: Fairfax City, Virginia  

Comments:
Well drained;  
no signs of sediment clogging.  

SITE: 15.
Condition Rating
Top ..................... 100
Sides ................... 100
Invert ............ 95/100
Avg. Rating ...... 99.2

Age: Minimum 10 years
Coating Type: Aluminum Coated Type 2
Diameter: 80"
Corrugation: 1x5" Helical
Land Use: Residential (SFH)
Location: Fairfax City, Virginia

Comments:
- Light staining in invert.

- Site.16.
**Condition Rating**

Top ..................... 100
Sides ..................... 100
Invert ............95/100

**Avg. Rating** ...... **99.2**

**Age:** 5 years
**Coating Type:** Fully Bituminous Coated
**Diameter:** 65"x107"
**Corrugation:** 1x5" Helical
**Land Use:** Residential
**Location:** Fairfax City, Virginia

**Comments:**
Asphalt removed in some areas; no rust on exposed galvanized surface.
Condition Rating
Top ..................95/100
Sides ................95/100
Invert .................95
Avg. Rating......96.7

Age: 10 years
Coating Type: Galvanized
Diameter: 60"
Corrugation: 1x5" Helical
Land Use: Commercial
Location: Alexandria, Virginia

Comments:
   Oil grit separator at entrance.
   Non-woven geotextile inside pipe to minimize clogging of backfill stone.
<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Age: 5 years</th>
<th>Coating Type: Galvanized</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top ..................95/100</td>
<td>Coefficient: Diameter: 120”</td>
<td>Little to no debris; no signs of clogging; return valve open.</td>
<td></td>
</tr>
<tr>
<td>Sides ..............95/100</td>
<td>Corrugation: 1x5” Helical</td>
<td>________________________</td>
<td></td>
</tr>
<tr>
<td>Invert ................N/A</td>
<td>Land Use: Residential</td>
<td>________________________</td>
<td></td>
</tr>
<tr>
<td>Avg. Rating......97.5</td>
<td>Location: Alexandria, Virginia</td>
<td>________________________</td>
<td></td>
</tr>
</tbody>
</table>
Condition Rating

Top ........................................ 95
Sides ................... 95
Invert ................... 95
Avg. Rating ......................... 95

Age: 5 years
Coating Type: Galvanized
Diameter: 144"
Land Use: Residential
Location: Alexandria, Virginia

Comments:
Detention system with sand filter.
The NCSPA would like to thank the following people for their assistance in this study:

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