Grout Integrity Validation of a 30” RCP Slip-Lining Rehabilitation

PROBLEM OVERVIEW
Florida DOT contracted GraniteTech Services, a subsidiary of CUES, in mid-2013, to rehab several sections of a dual storm water pipeline that traverses under SR-19 near LaBelle and Okeechobee, Florida. Each is 30 inch diameter RCP (provided as Figure 1-cross-section), and both were lined with a smaller 24 inch A2000 PCV pipe (A2K). The liner pipes were not secured in any manner, and the structure was back-grouted with flowable fill grout to fill the annular space between the outside of the liner pipe and the inside of the 30 inch host pipe.

CUES APPROACH
Subsequent to the relining and grouting process, CUES performed a field trial to evaluate its recently introduced Future Scan technology. The Future Scan technology is an in-situ pipe technology that utilizes ground penetrating radar and is capable of seeing through pipes into surrounding soil strata. In particular, CUES was interested in determining if Future Scan could meet the following objectives:

1. Image the inner and outer pipe walls of the liner and host pipes.
2. Identify voids and validate the integrity of the grout in the annular space between the host pipe and the liner after back-grouting.
3. Confirm if it would be possible to determine soil voids outside of the host pipe in such a complex arrangement.

RESULTS
All objectives were met, and Future Scan performed well in this complex scenario. Figure 2 shows the scan for the South Pipe and Figure 3 for the North Pipe. Each of these runs is approximately 180 feet long. The host pipe is made up of 3 foot sections. The following bullet points summarize the results of this field trial:

• The A2K Inner Pipe Wall (IPW) and outer wall are clearly visible, along with the joints of the A2K.
• The A2K joints in South pipe are 20 foot long, but only 10 foot long on North pipe, this was due to two different contractors being involved in the rehabilitation.
• Changes in the spatial relationship between the liner pipe and host pipe are clearly visible and on Figure 2 the A2K pipe is documented to have “floated up” due to back grouting procedures.
RESULTS

• Outer Pipe Wall (OPW) is visible on the host pipe, even through a liner pipe and grout, at 33.5 inches effective OD.
• The IPW for A2K is at ~ 100 on the vertical axis for south pipe (refer Figure 2), and 110 for the North pipe (refer Figure 3).
• Looking at the bottom left pane in Figures 2 and 3, we can see the IPW of the host pipe appears at ~ 120 for south, and 145 for north. This difference indicates that there has been some “repositioning” of the liner pipe, probably from the grouting process.
• Looking at top pane of Figures 2 and 3, we can see the IPW of the host pipe fairly clearly. Also evident is the fact that the distance between the A2K and the host pipe changes over the entire run. Calculations indicate that while the ideal distance should be constant at 2.84 inches, it does decrease to less than 1 inch separation.
• No voids were found in the grouting.
• No voids were found in the soil strata outside of the host pipe.
Figure 1: Pipe Cross-Section

Legend:
- 1.58" - A2K Thickness
- 3.0" - Liner OPW to Host IPW (Ideally)
- 3.5" - Host Pipe Thickness
- 6.7" - Antenna to Liner IPW
- " - Transporter + Antenna

Okeechobee Lined Pipe X-Section
Figure 2: South Pipe Data View

- Grout Thickness Variation
- A2K-IPW
- Host Pipe-IPW
Figure 3: North Pipe Data View