PICA Pipeline Inspection and Condition Analysis Corp.

Inspection Report

Bracelet™ Probe Inspection

Gwinnett County Force Main Sites

Site # ACDT 16-09B

(254 Springs Road)

PICA USA
Miami, Florida USA

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Reviewer	David Russell
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Inspection Test Site # ACDT 16-09B, (254 Springs Road)

The zero-foot reference (ZFR) was set on the pipe, as shown in Figure 1. Two scans were performed from -9" to 0" and from 0" to +9". Note: further set up details can be found on page 9.

Bracelet Probe (BP) data for all scans are shown starting on page 6. No significant external corrosion was found on the pipe O.D. visually; however, the data showed major wall thickness variations along the pipe length. This indicates internal general corrosion along the length of the pipe.

UT thickness readings at selected locations based on BP scan data are listed in Table 1. The smallest thickness is 0.129", representing 68% wall thickness variation compared to nominal wall thickness of 0.400", (Class 52 pipe) as provided by the client. Note: There are no as-builts for this pipe. We are basing the Class of pipe on previous locations using the measurements found. (Class 50 pipe nominal is 0.340")

Average of all UT readings is 0.197" a 50% variation from nominal of 0.400". If you take 0.400" nominal wall and compare that to the average wall thickness UT measurements found for each footage location of 0.5", 1", 2.5", 5'10", 7', 8.5', 9.5' and 11' you get a wall thickness variations of 39%, 40%, 53%, 43%, 45%, 47%, 48% and 10% respectively.

Summary

The pipe at this site showed major wall thickness variations; significant wall loss was detected for the entire pipe section scanned. Note: some nominal wall was found near the Bell end (12-foot mark) with 0.400" thickness.

Some slight external corrosion was found on the pipe visually.

Locations for UT measurement were chosen at 1, 3.5, 4, 8, and 11 feet based on BP Scan data.

Table 1. UT Thickness Measurements at selected spots at site # ACDT 16-09B

Axial distance from ZFR (feet)	Circumferential distance from 12 o'clock (in)*	UT thickness reading (in)	Axial distance from ZFR (ft)	Circumferential distance from 12 o'clock (in)*	UT thickness reading (in)
0.5	-9	0.209	8' 6"	-9	0.223
0.5	0	0.252	8' 6"	-4.5	0.190
0.5	9	0.271	8' 6"	0	0.171
1	-9	0.250	8' 6"	4.5	0.224
1	0	0.185	8' 6"	9	0.251
1	9	0.282	9' 6"	-9	0.235
2' 5"	-9	0.205	9' 6"	-4.5	0.198
2' 5"	0	0.140	9' 6"	0	0.170
2' 5"	9	0.217	9' 6"	4.5	0.181
5' 10"	-9	0.237	9' 6"	9	0.256
5' 10"	-4.5	0.270	11' 6"	-9	0.375
5' 10"	0	0.240	11' 6"	0	0.327
5' 10"	4.5	0.219	11' 6"	9	0.375
5' 10"	9	0.176			
7	-9	0.211	Added UT Locations		
7	0	0.243	Below		
7	9	0.211			
			3' 5"	0	**0.129**
			4' 5"	0	0.198
			9"	0	0.158

*Negative and positive values were measured CCW and CW from 12 o'clock position, respectively

Note: UT measurements under 0.170" have been highlighted yellow, with the lowest bolded at 0.129"

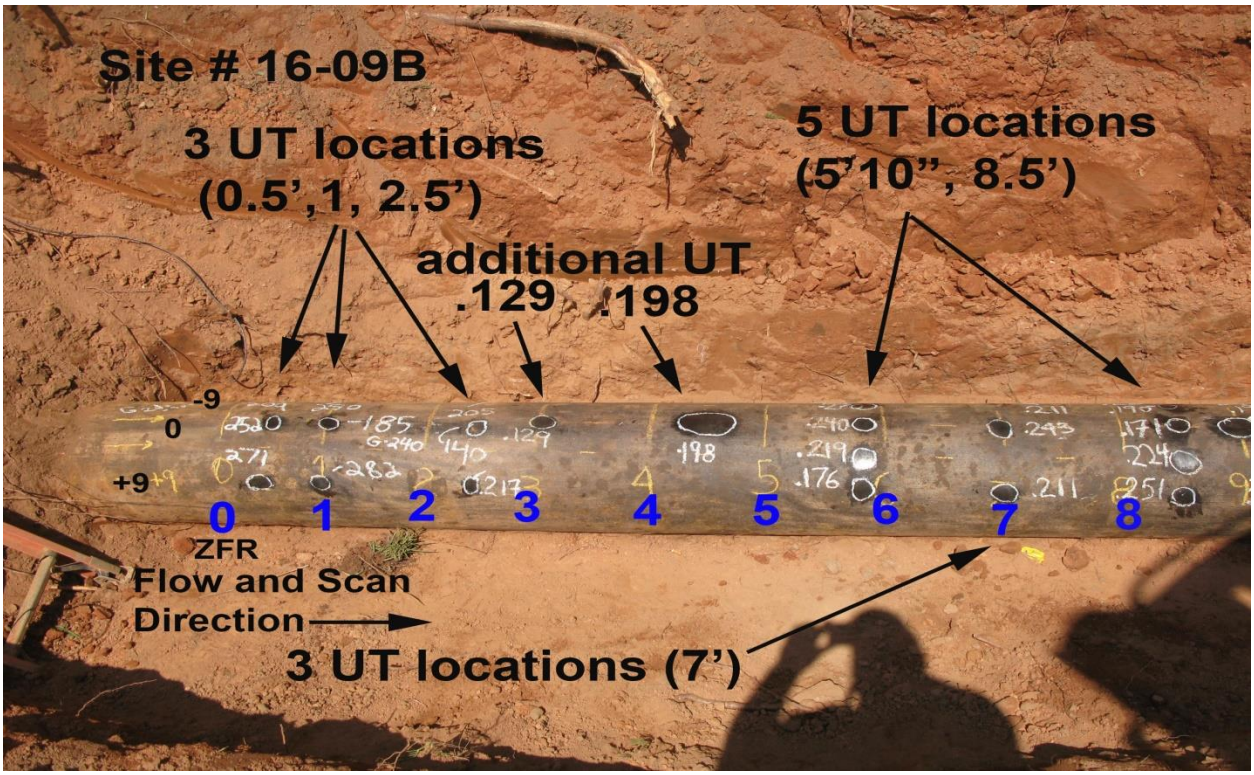

Figure 1. Showing site 16-09B with ZFR, Flow direction and UT locations.

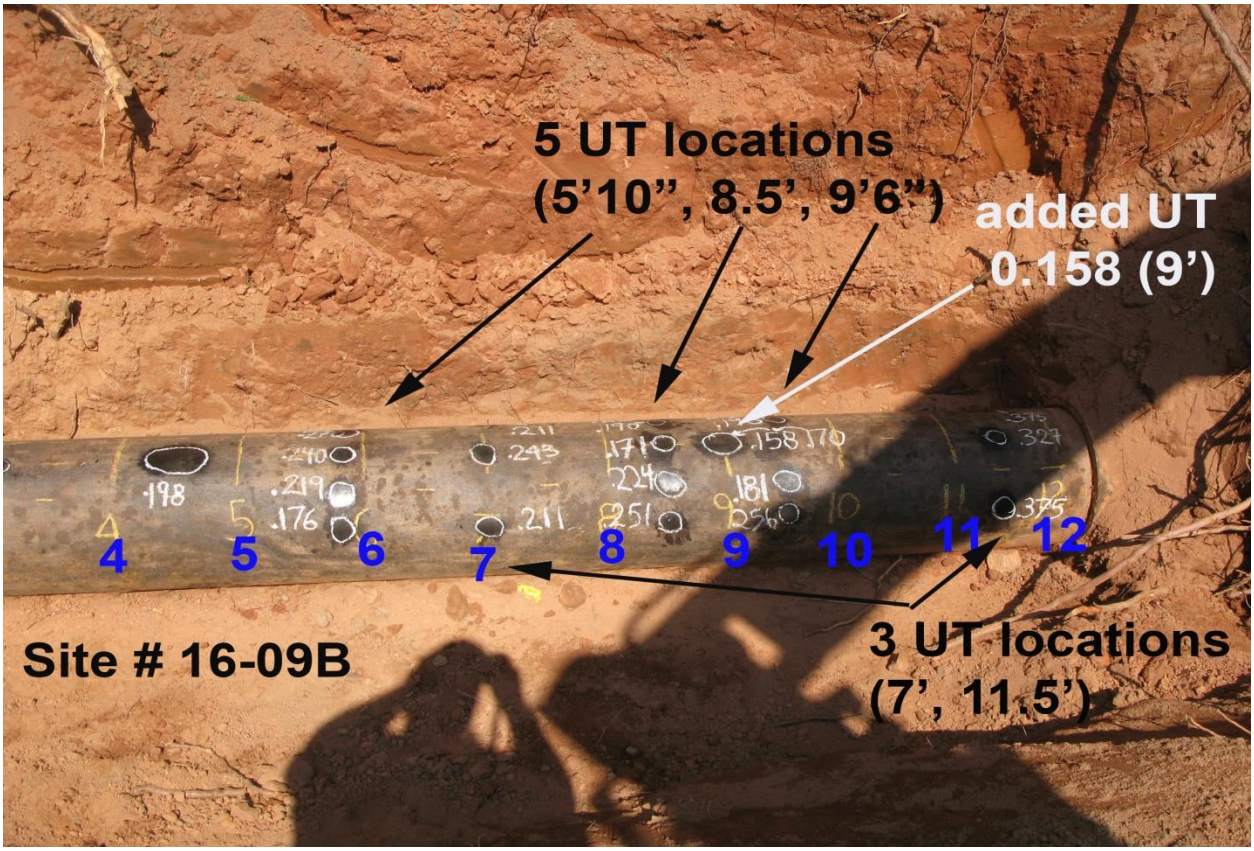

Figure 2 (Scan S01-01) BP data from scan covering -9" to 0" circumference (-9" position), (0" =12 o'clock)

Heavy pitting throughout and wall variations away from nominal.

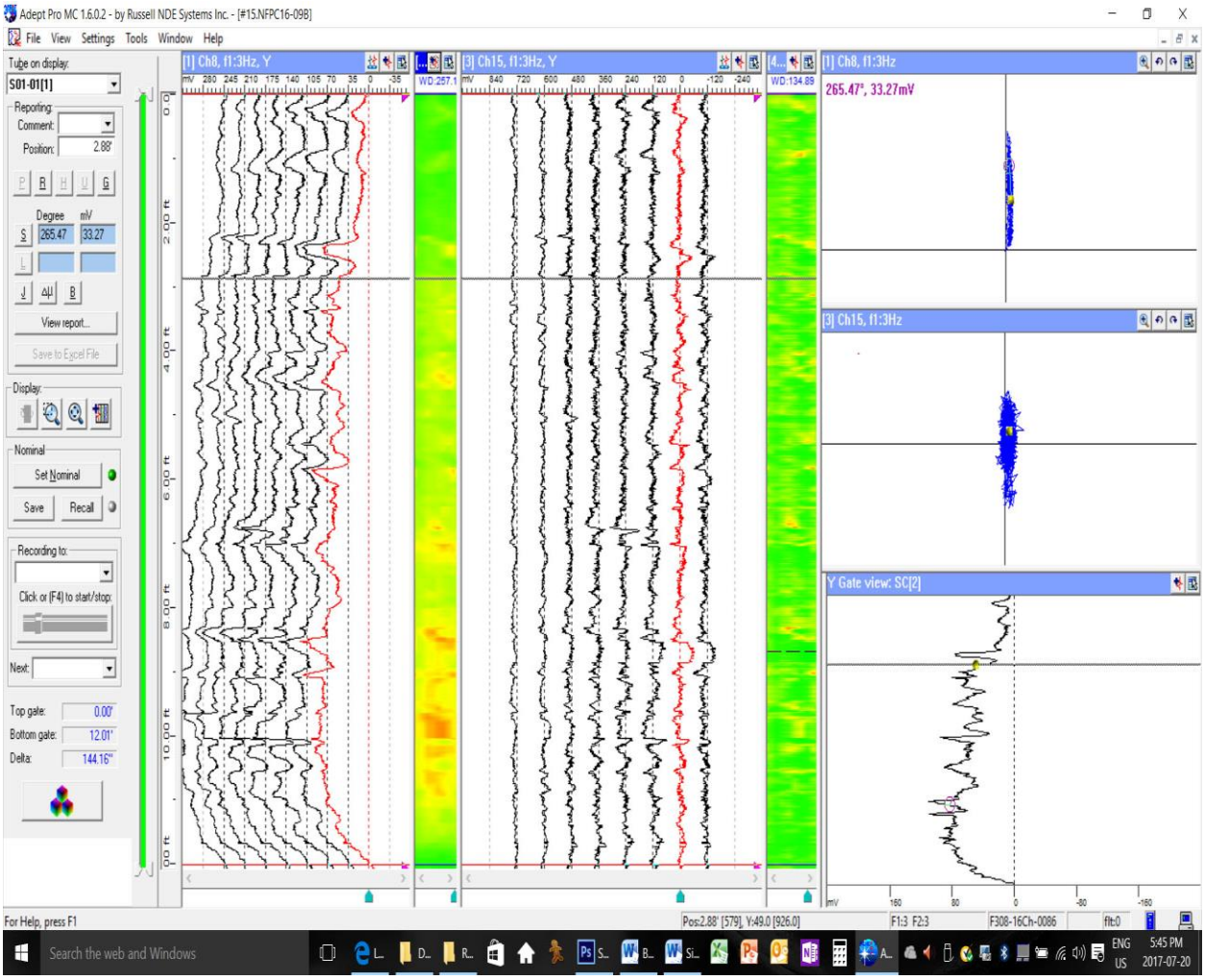

Figure 3 (Scan S01-02) BP data for a scan covering 0” to +9” circumference (+9 position), (0” =12 o’clock)
Heavy pitting throughout and wall variations away from nominal.

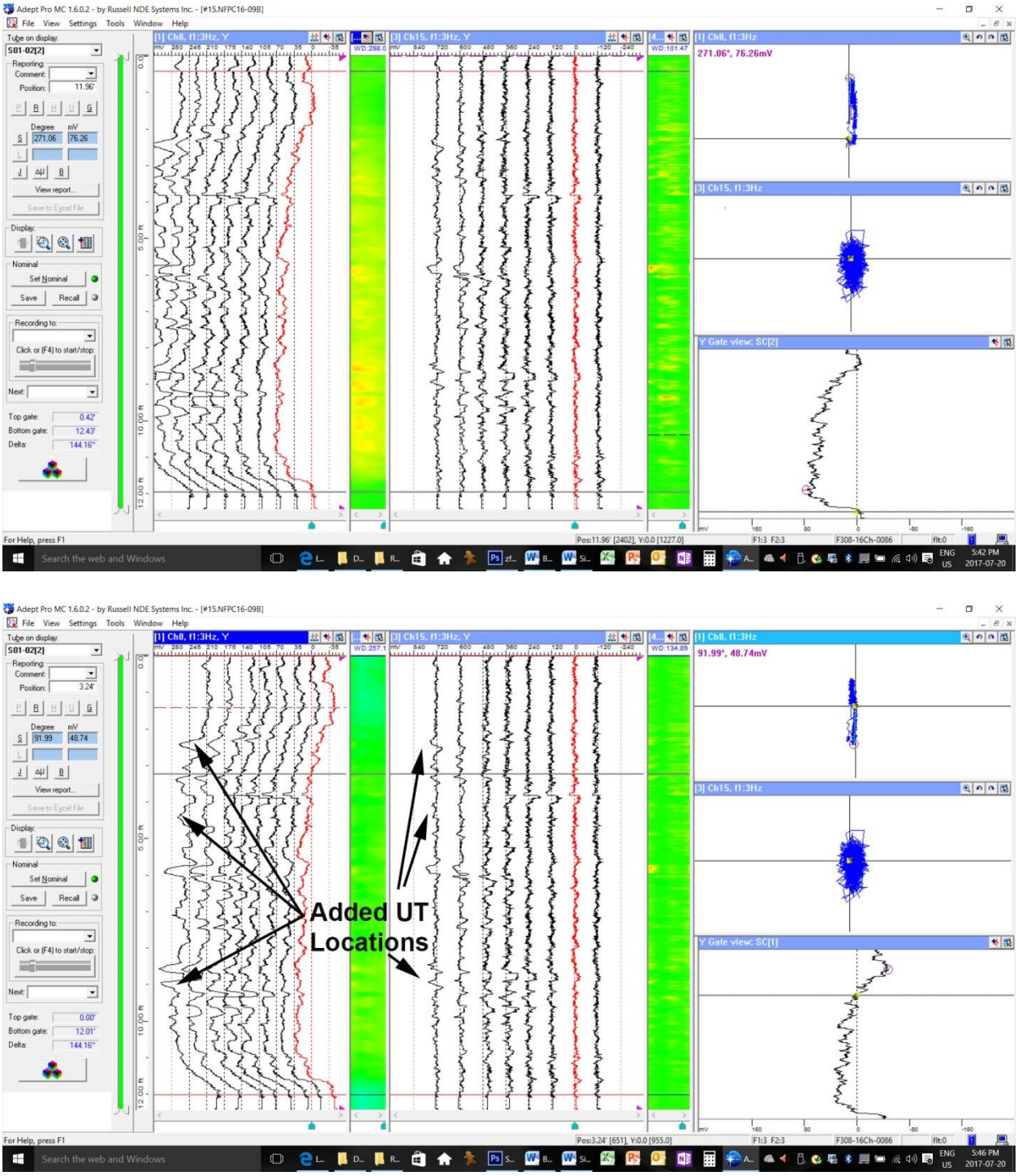

Figure 4 a+b. Note: The bottom screen cap data (4b) had to be nominalized on thinner pipe in order to see the left hand traces (‘0’ position or 12 o’clock). The extra pitting locations chosen for follow-up UT are shown.

Appendix 1: Technology background

The Bracelet™ and Blanket™ probe system is Russell NDE Systems' latest external pipe inspection tool. The probes are flexible and one Probe can fit on pipe sizes 6" and larger.

The Bracelet™ probe works on the principle of through-transmission (TT) Electromagnetics. Typical magnetic field pattern generated by the Bracelet™ is shown in Figure A1-1. The probe can detect internal and external wall loss in bare or coated ferromagnetic pipes (i.e., steel, cast and ductile-iron pipes). The threshold of detection (TOD) for local and general internal defects is respective 15-20% and 10-15% wall loss depending on corrosion morphology.

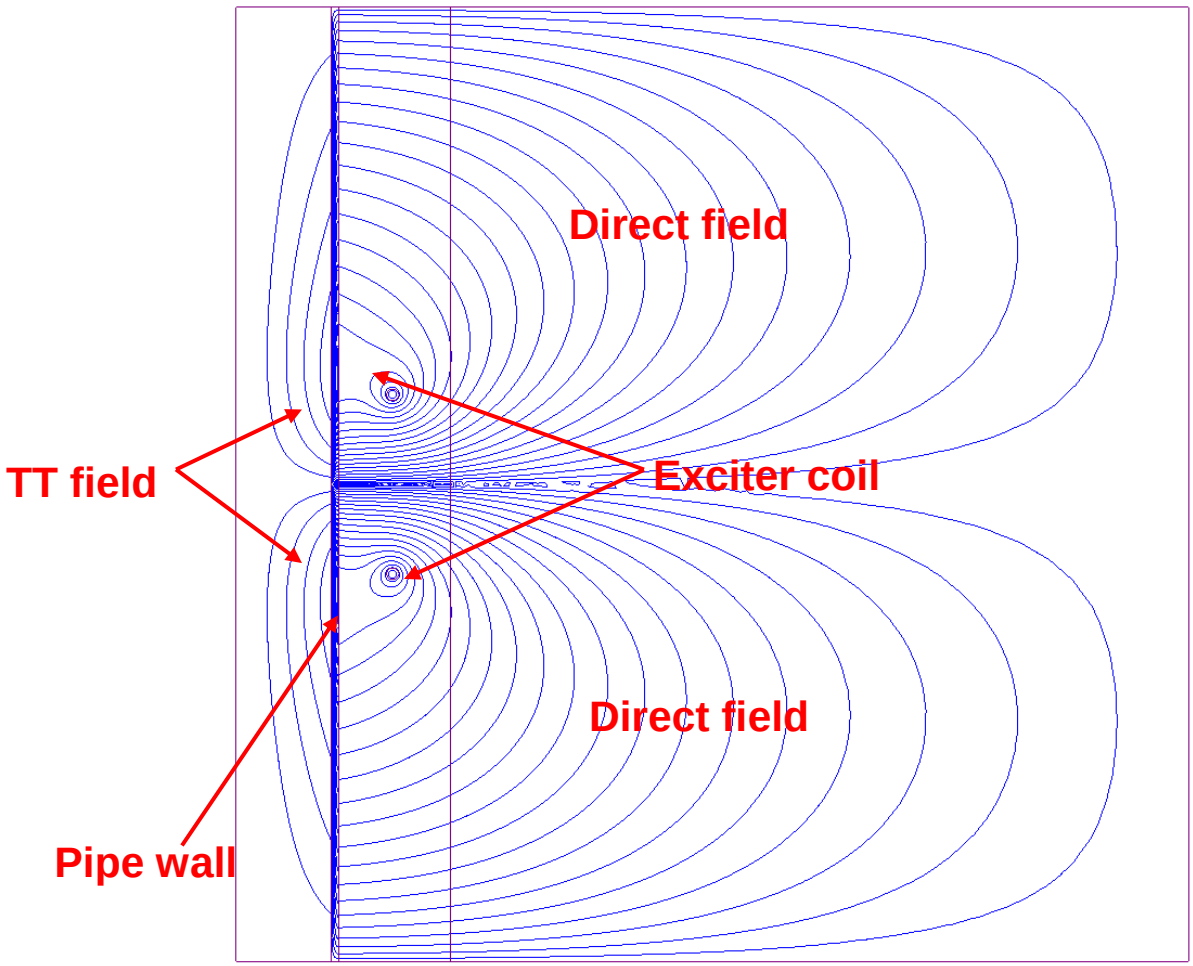

Figure A1. Typical magnetic field pattern of a Bracelet™ Probe.

The Bracelet Probe Technique: Typical Setup

Scan numbering and clock position

Clock position was defined by looking in product flow direction, as shown in Figure 1. The pipe crown area along the pipe length was examined. A total of 2 to 3 scans centered at 12 o'clock were performed to cover the crown area. Circumferential distance was measured clockwise (CW) as a positive number or counter-clockwise (CCW) as a negative number from the 12 o'clock position.

Coverage

The Bracelet Probe (BP) typically covers a 9" axial swath for each scan on a pipe; therefore several scans are required for full 360 degree inspection coverage.

Measurements

A "Zero Foot Reference" (ZFR, or datum line) was marked on each pipe and indicates the start of each BP scan. The scanning direction is from upstream (US) to downstream (DS), as shown in Figure 1. Axial distance increases downstream (DS) from the ZFR.

Scanning Speed

The probe was scanned at a speed of 1-2 feet per minute on the pipe, as shown in a photo in Figure A4. The BP data and distance information were gathered and stored in the laptop computer while the data was displayed real-time on the computer screen. The data was analyzed on site and any defects were noted and marked on the pipe with UT (Ultrasonic Testing) performed if needed for confirmation of BP results. Typical setup for Ferroscope and laptop computer is shown in Figure A5. The laptop was connected to the Ferroscope for data gathering and real-time data display.

Mill tolerance

For general wall variation that is less than 20%, we report it as mill tolerance variations. Unless there are clear pit indications, we do not differentiate between mill variations and internal wall loss due to pitting.

It is common to have mill variations of up to +/-20% in brand new DI pipe, due to the spin-cast technique. Wall loss due to pitting becomes easier to call if there are definite pitting signals and wall variation exceeding 20%. Pitting shows in our third strip chart from the left and general wall variation shows in the first strip chart from the left.

Bracelet Probe Calibration

Probe calibration was performed using the defects found in the pipe. The two detector arrays in the BP detect general wall variations (GWV) and local wall loss (LWL), which can be calibrated by using the GWV and LWL defects detected in the pipes at excavation sites. The wall thickness in the GWV and LWL areas was measured by the UT instrument and was used to calibrate the BP.

Ultrasonic System Calibration

The UT system was calibrated against a set of machined step wedges made of ductile iron. The step thicknesses are 0.100", 0.200", 0.300", 0.400" and 0.500"

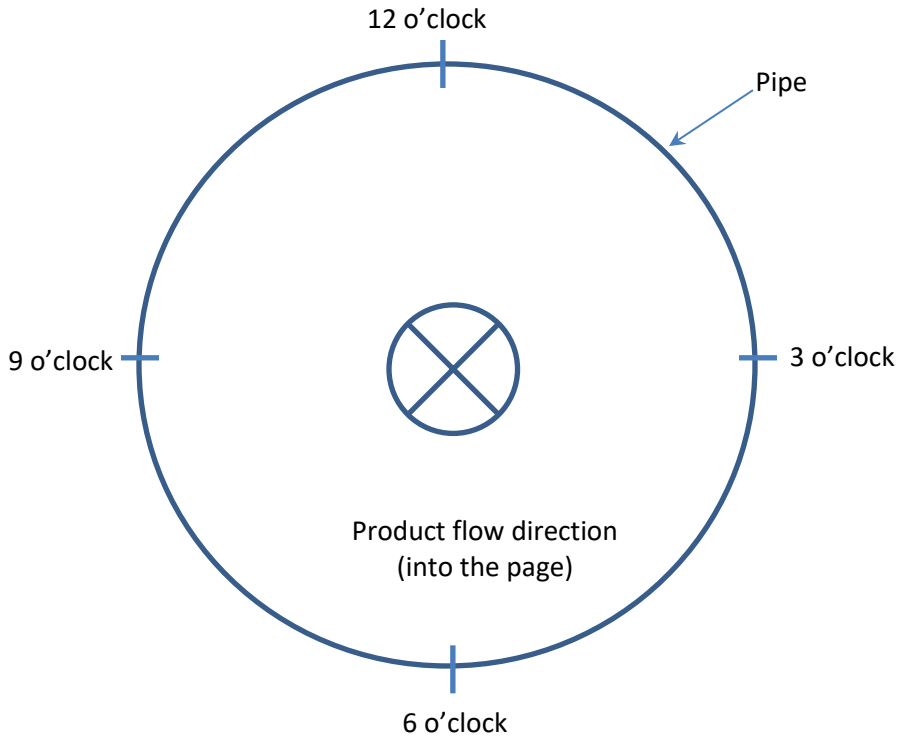

Figure A2. Pipe Cross Section Clock Definition vs. Product Flow Direction.

Zero Foot Refrence (ZFR) ‘0’ Location

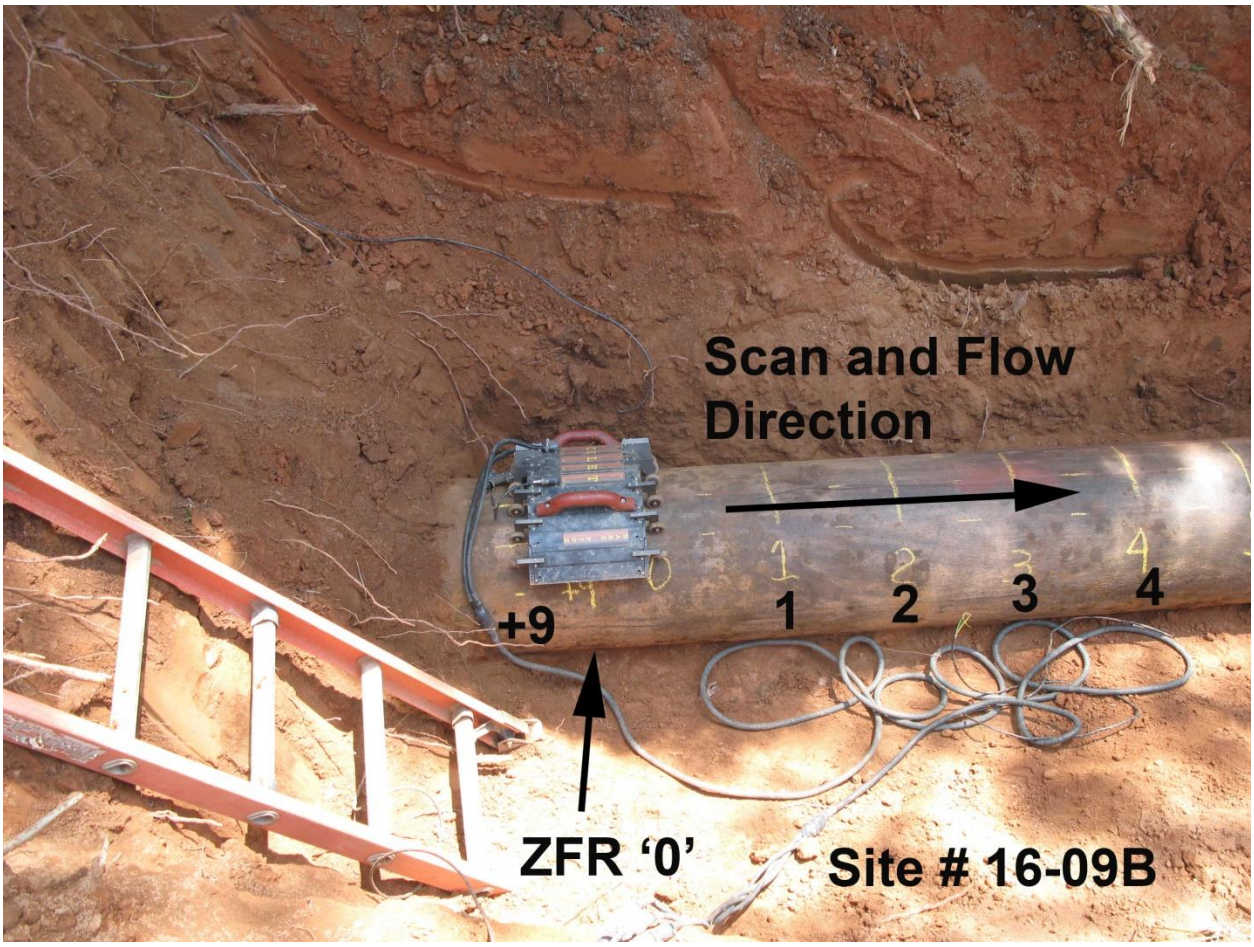

Figure A3: Bracelet™ Probe placed at the start location.

Figure A4 Typical BP scanning technique.

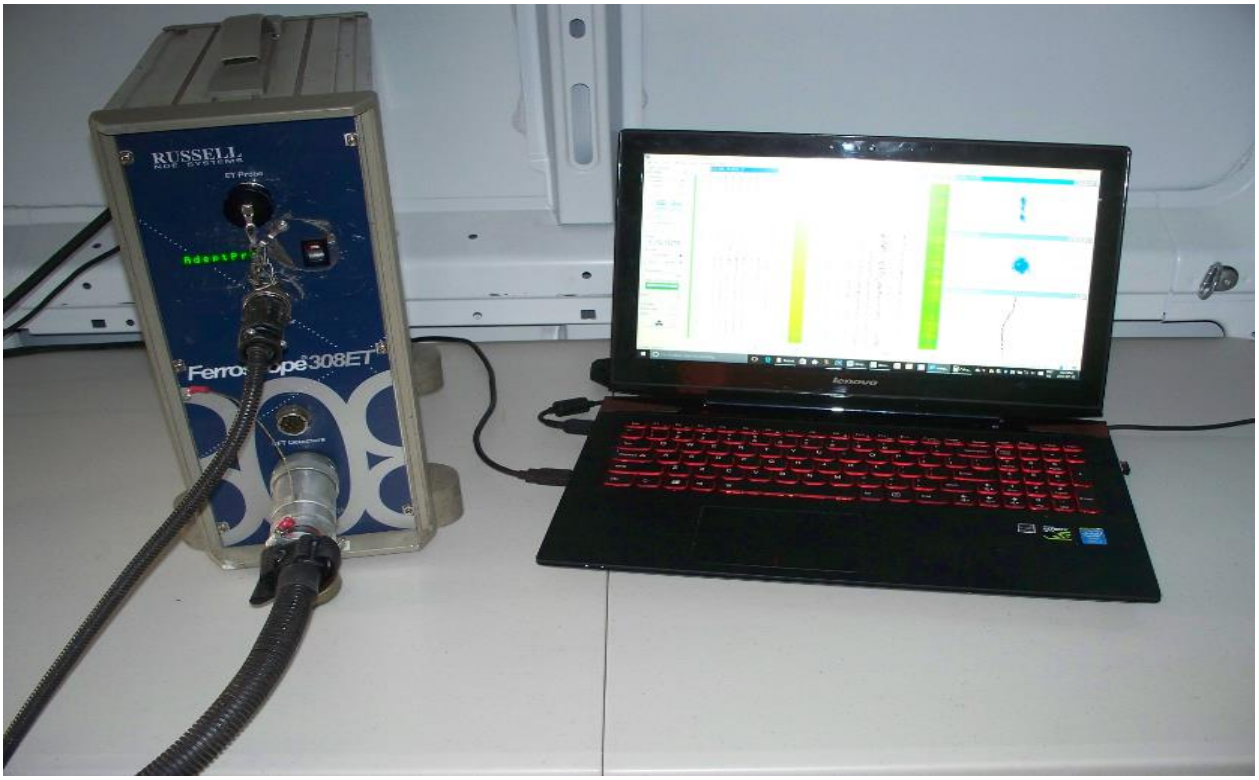

Figure A5 Typical setup for Ferroscope and laptop computer at job site.