



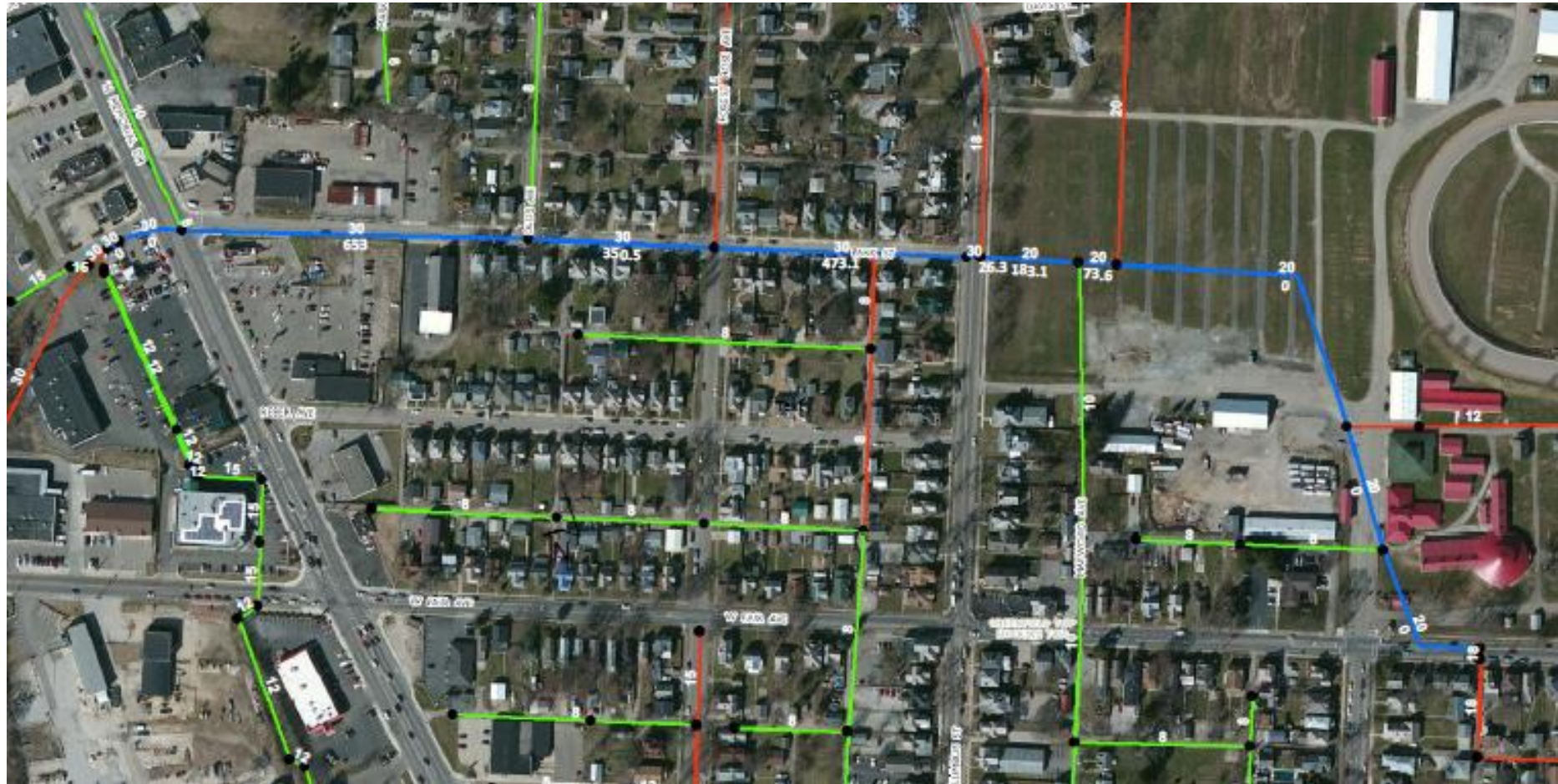
IF YOU LIKE IT, YOU SHOULD PUT A “LASER” RING ON

Condition Assessment and Rehabilitation – Lancaster, Ohio

Presentation Outline

- > 80 yr. old 20" and 30" RCP and VCP
- Limitations of CCTV
- Need for Laser
- Laser Data vs. LIDAR
- Ovality and design / construction considerations

>80 yr. old 20" and 30" RCP and VCP



CCTV Limitation

LC1: +0012.50 ft

07:35

07.03.17

MGP (General Photo)

Counter: 12.6

From: To:

Remarks:

LC1: +0023.30 ft

DSZ (Deposits Settled Other)

Counter: 29.3

From: 05 To: 07

Remarks: Debris

CCTV Limitation

LC1: +0282.10 ft
MGP (General Photo)
Counter: 282.1

From: To:

Remarks:

LC1: +0000.80 ft
05:19
07.03.17
DSZ (Deposits Settled Other)
Counter: 0.8

From: 04 To:08

Remarks: Debris.

Laser Ring Inspection

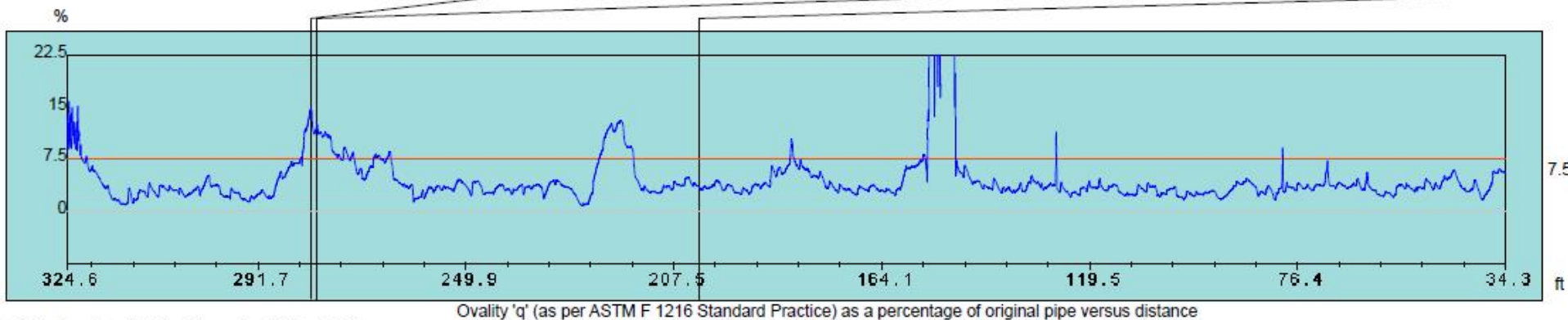
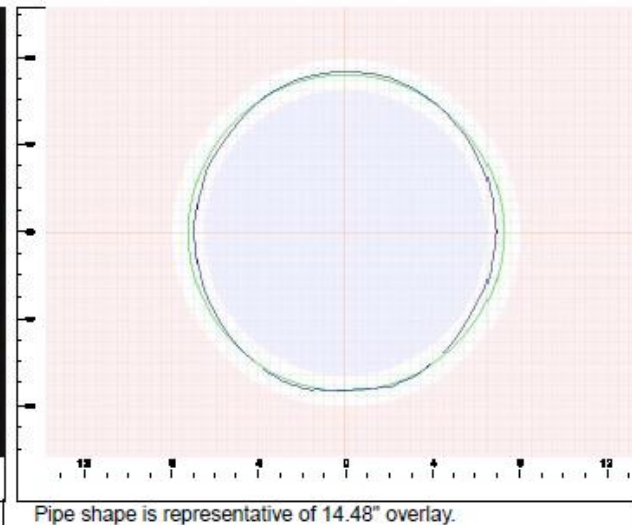
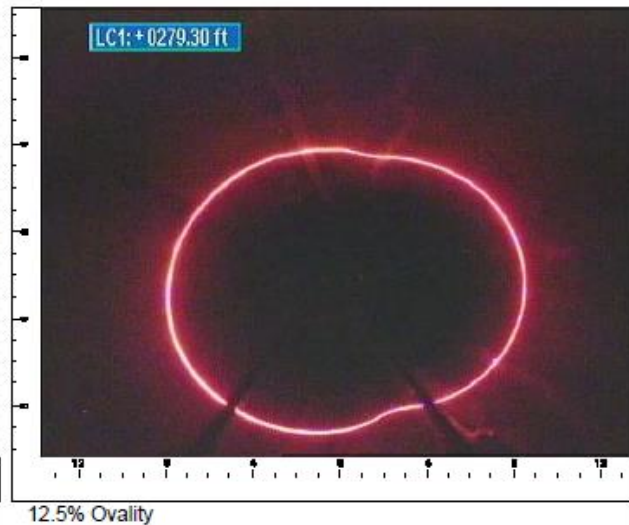
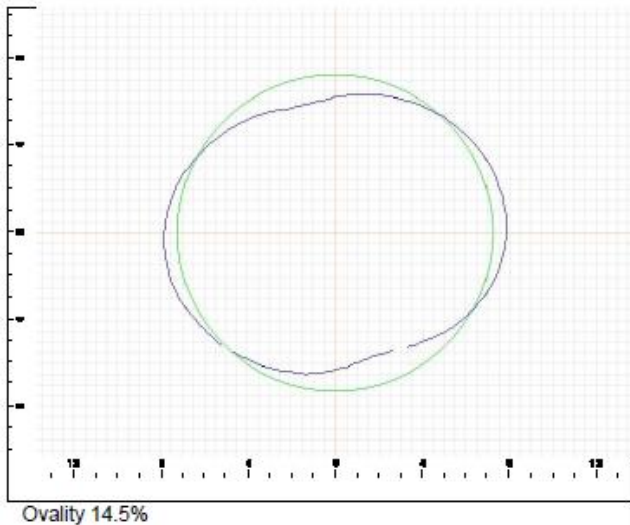
- Reached out to a few firms
 - Hydromax USA
 - Robinson Pipe Cleaning
 - R&R Visual
- Informal RFP and RFQ
 - Cleaning
 - CCTV / Laser
 - MH inspection

Laser Ring – Sample

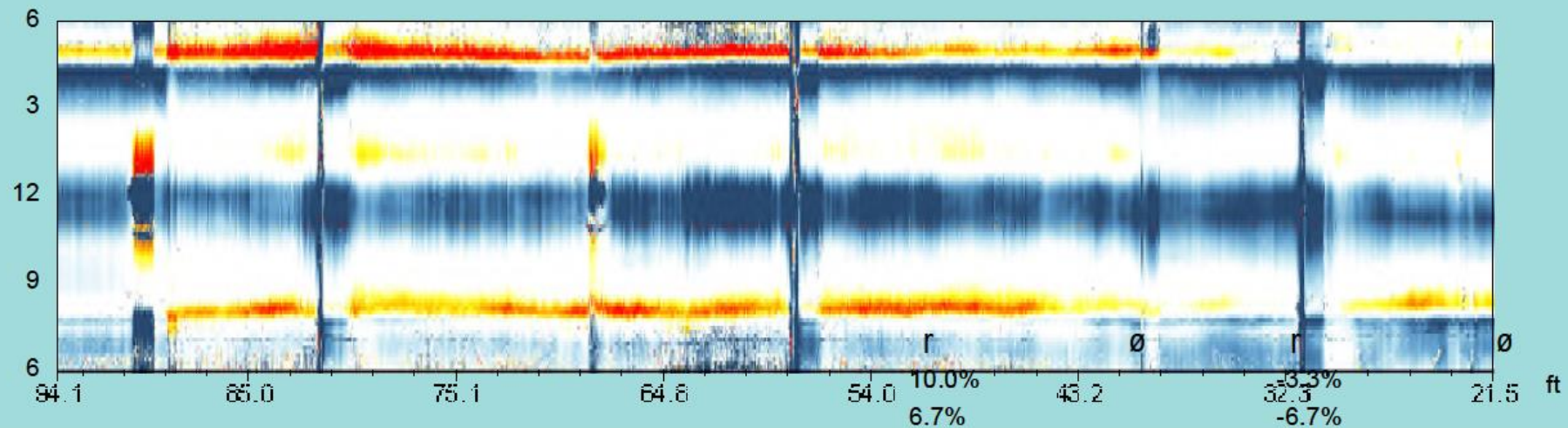
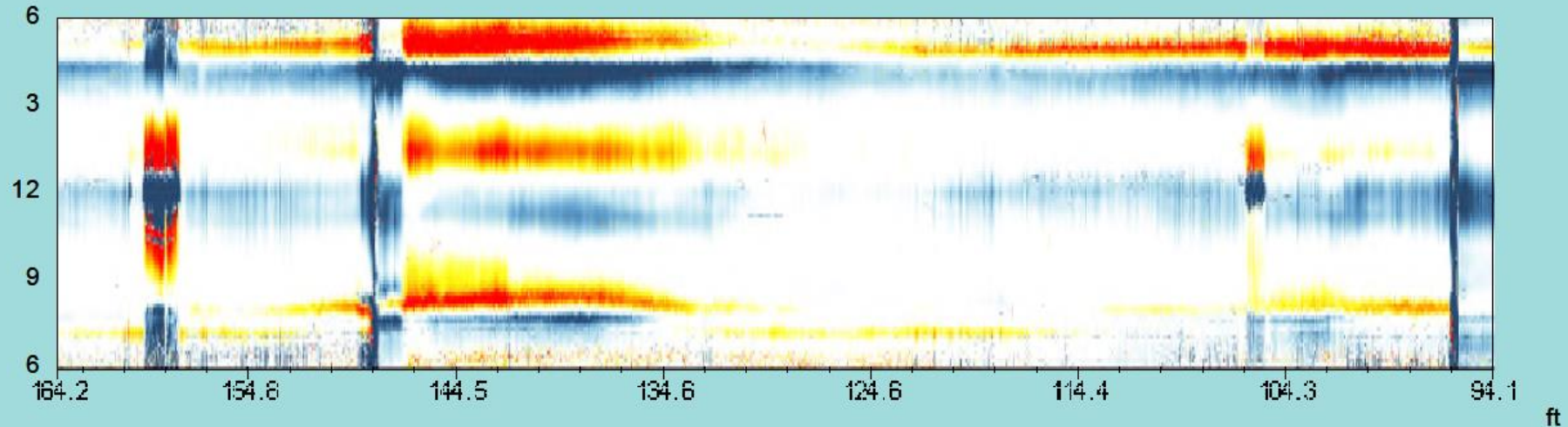
Site ID Mishaw
 City Indiana
 Start No SCMH-1596
 Location N. Indiana Ave.

Asset No. CIPP 2015
 Finish No SCMH-1589
 Location N. Indiana Ave

Date 11/3/2016
 Material FRP
 Pipeline Length 324.6 ft
 Internal Diameter 14.48 in



Laser Ring – Sample



Laser Ring – Sample

Suspect area with no masking.csv - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER ProjectWise Nuance PDF

Clipboard: Cut, Copy, Paste, Format Painter

Font: Calibri, 11, Bold, Italic, Underline, Color, Background Color

Alignment: Wrap Text, Merge & Center

Number: General, Currency, Percentage, Decimals

Conditional Formatting: Normal, Bad, Neutral, Calculation

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1				WaterLevel	0	0	0	0	0	0	0	0	0	0	0	0
2	Frame No	Distance	VideoTime		Point 1 (1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
3	1	297.6	57.78667	X-->	0.27	0.53	0.76	1.01	1.25	1.49	1.74	1.99	2.23	2.49	2.72	2.98
4				Y-->	-6.51	-6.49	-6.47	-6.46	-6.42	-6.43	-6.43	-6.4	-6.36	-6.33	-6.29	-6.21
5	2	297.6	57.82007	X-->	0.19	0.45	0.68	0.93	1.17	1.41	1.66	1.91	2.16	2.41	2.64	2.88
6				Y-->	-6.5	-6.48	-6.5	-6.45	-6.42	-6.42	-6.42	-6.41	-6.38	-6.35	-6.29	-6.22
7	3	297.6	57.85347	X-->	0.22	0.48	0.71	0.96	1.2	1.45	1.7	1.95	2.19	2.44	2.7	2.91
8				Y-->	-6.52	-6.49	-6.48	-6.46	-6.46	-6.43	-6.45	-6.42	-6.36	-6.34	-6.27	-6.17
9	4	297.58	57.88687	X-->	0.22	0.48	0.71	0.96	1.2	1.45	1.69	1.95	2.19	2.44	2.7	2.93
10				Y-->	-6.52	-6.49	-6.49	-6.42	-6.46	-6.43	-6.42	-6.4	-6.38	-6.35	-6.25	-6.17
11	5	297.56	57.92027	X-->	0.19	0.45	0.68	0.93	1.17	1.42	1.66	1.92	2.16	2.41	2.66	2.89
12				Y-->	-6.51	-6.51	-6.51	-6.45	-6.47	-6.43	-6.43	-6.42	-6.38	-6.34	-6.25	-6.2
13	6	297.53	57.95367	X-->	0.17	0.44	0.66	0.93	1.15	1.4	1.64	1.9	2.17	2.39	2.65	2.88
14				Y-->	-6.52	-6.49	-6.49	-6.48	-6.46	-6.45	-6.42	-6.45	-6.38	-6.35	-6.25	-6.17
15	7	297.51	57.98708	X-->	0.22	0.49	0.71	0.96	1.2	1.44	1.69	1.95	2.18	2.41	2.66	2.9
16				Y-->	-6.54	-6.51	-6.5	-6.48	-6.47	-6.45	-6.44	-6.43	-6.4	-6.33	-6.29	-6.22
17	8	297.49	58.02048	X-->	0.16	0.42	0.65	0.9	1.14	1.37	1.62	1.89	2.11	2.37	2.6	2.85
18				Y-->	-6.54	-6.5	-6.51	-6.47	-6.45	-6.48	-6.45	-6.45	-6.41	-6.33	-6.29	-6.22

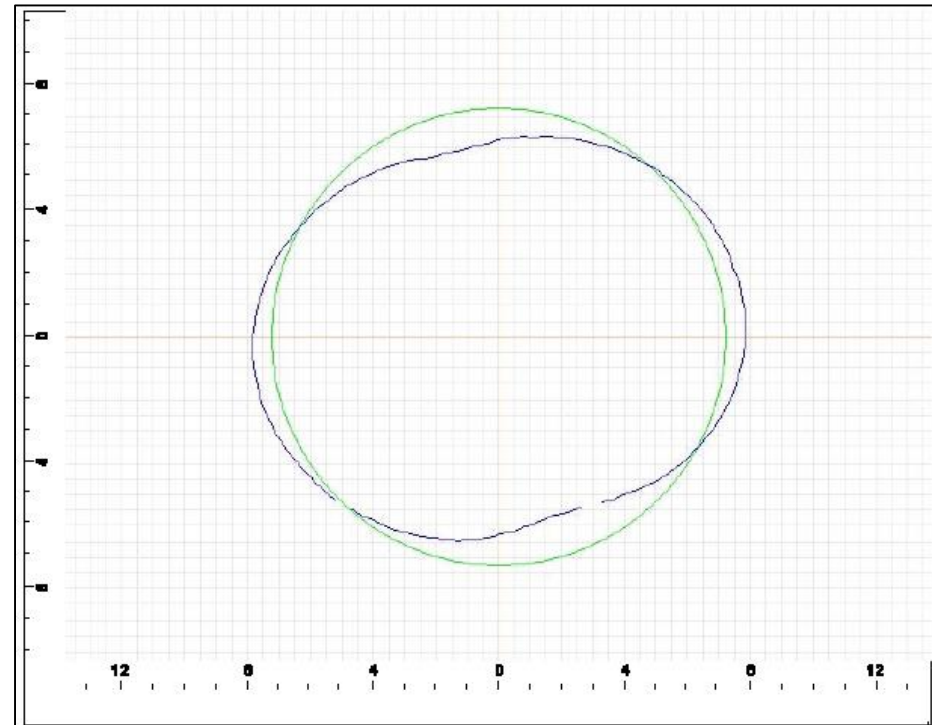
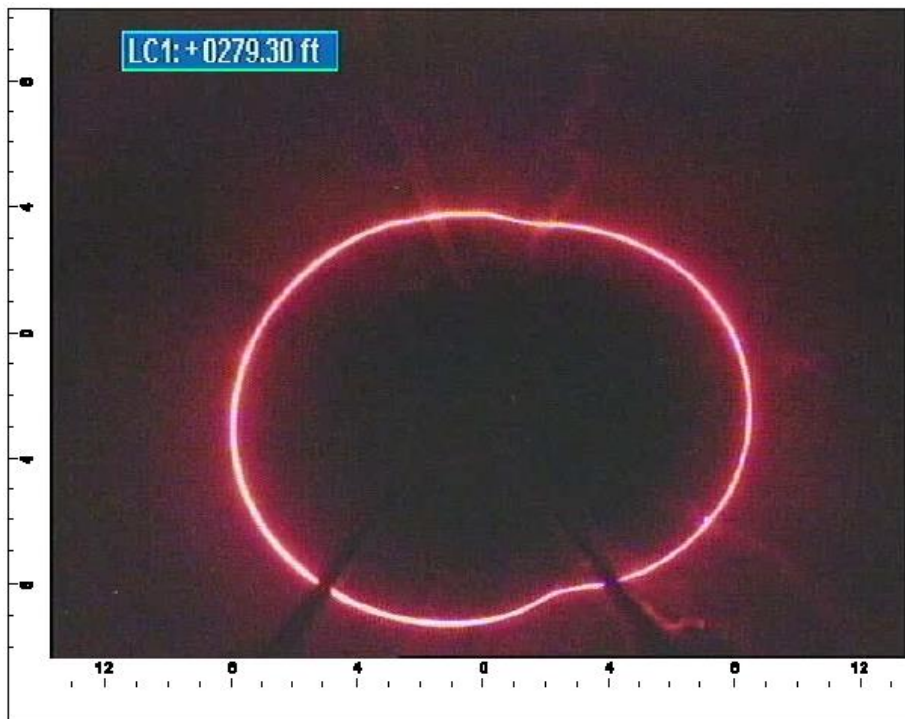
Laser Ring - Proposal

- Received 2 proposals
 - \$40k
 - \$27k
- Essentially due to availability



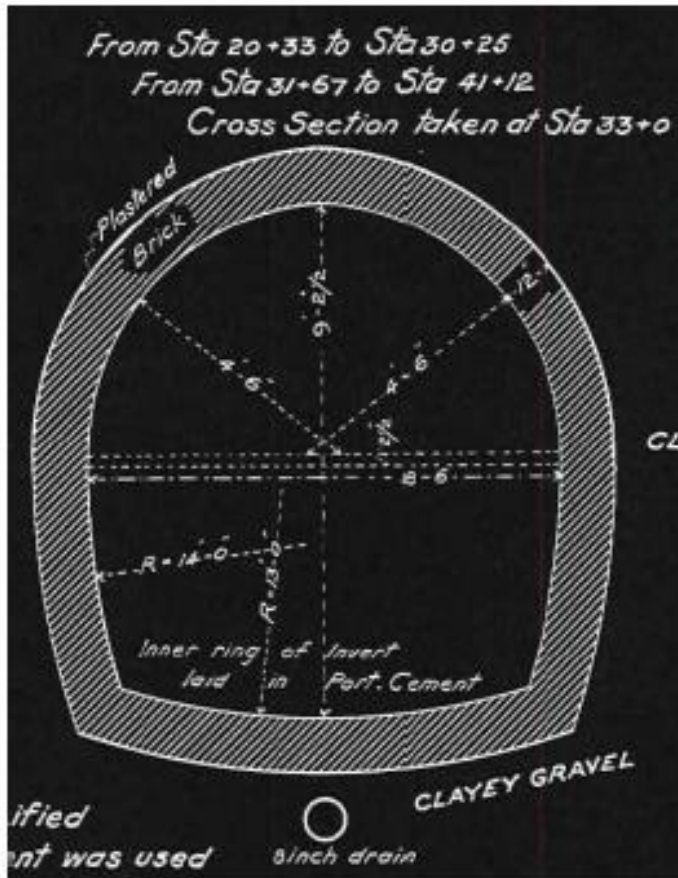
Laser Ring vs. LIDAR

- Laser does not measure
- Software measures images vs. know dimensions



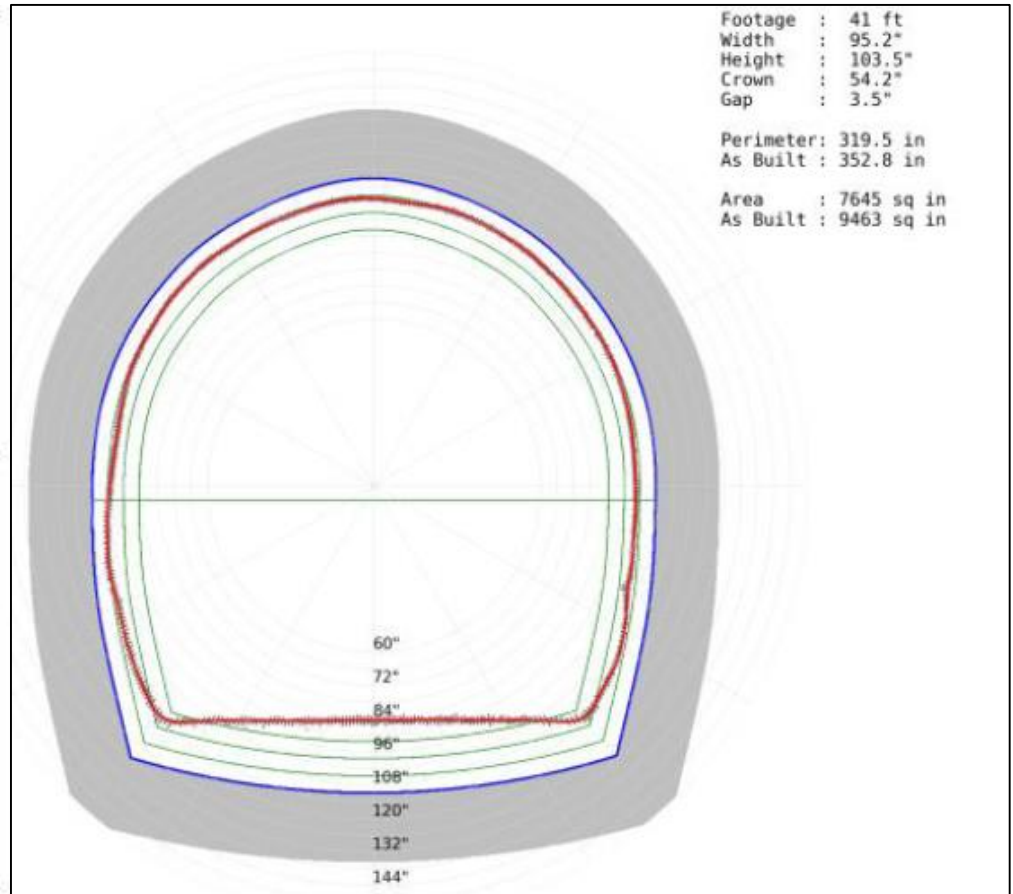
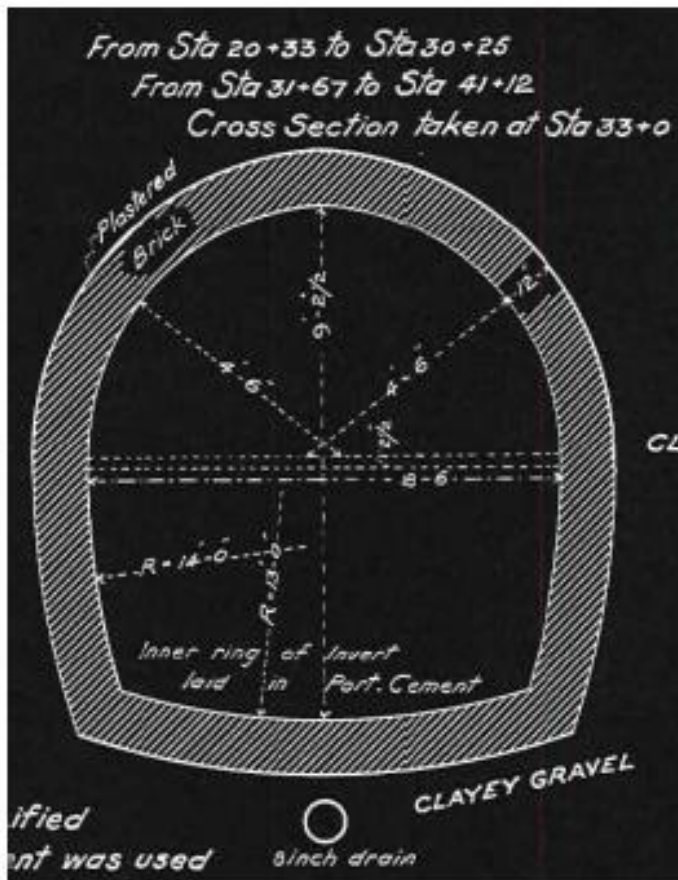
Laser Ring vs. LIDAR

LIDAR does measure



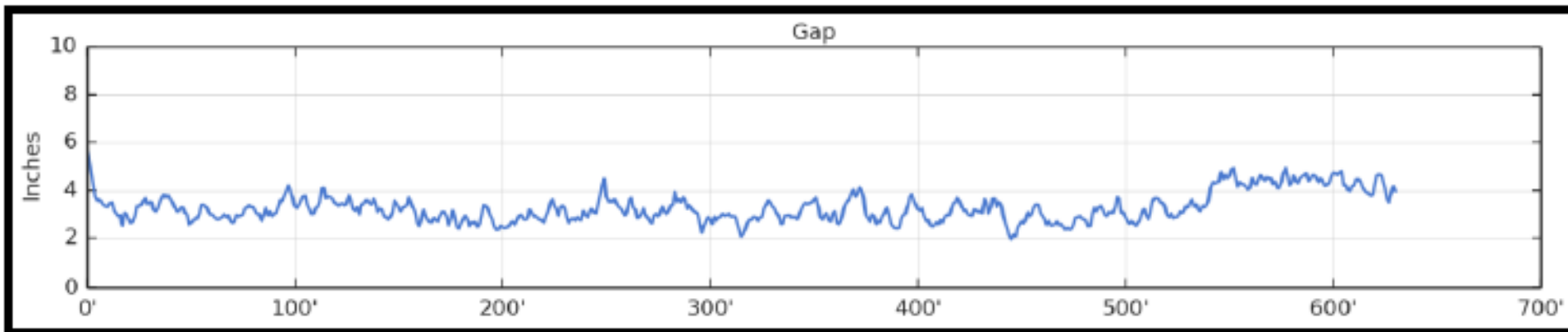
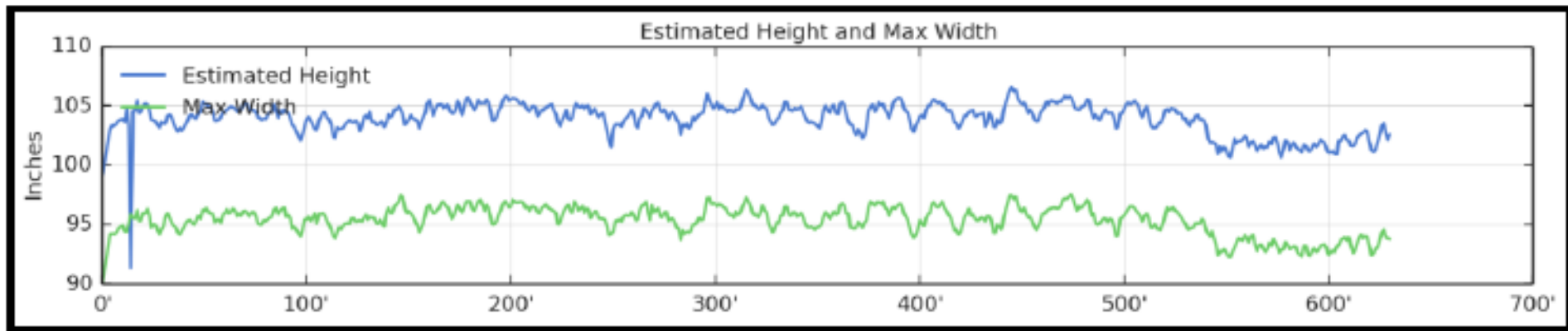
Laser Ring vs. LIDAR

LIDAR does measure



Laser Ring vs. LIDAR

LIDAR does measure



Laser Ring vs. LIDAR



Photo 2.13 – “Swamp Buggy” inside the pipe

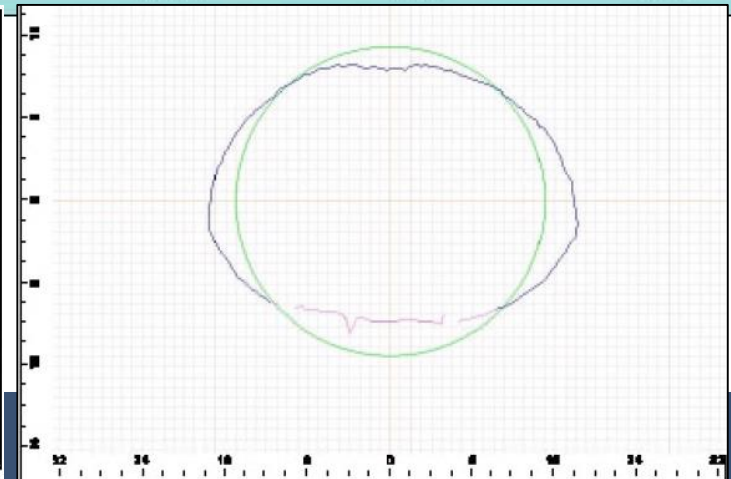
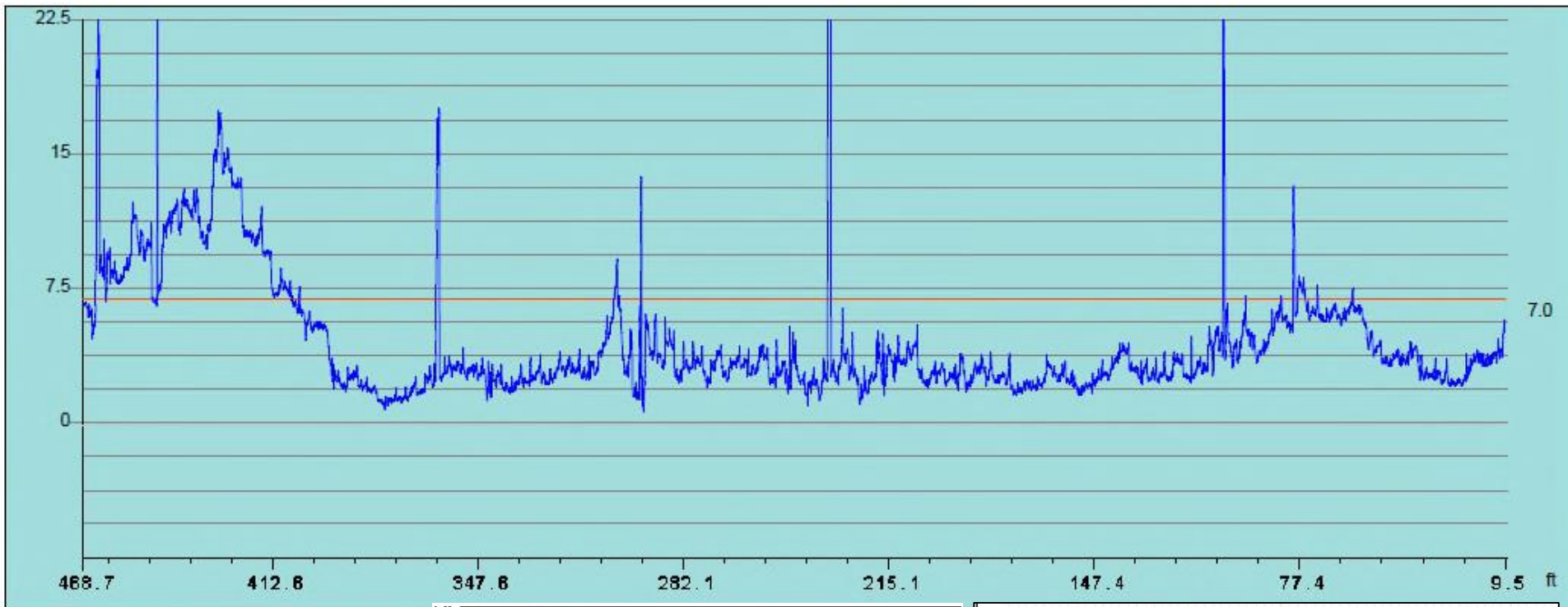


Photo 2.14 – LIDAR Sensor Head on “Swamp Buggy”

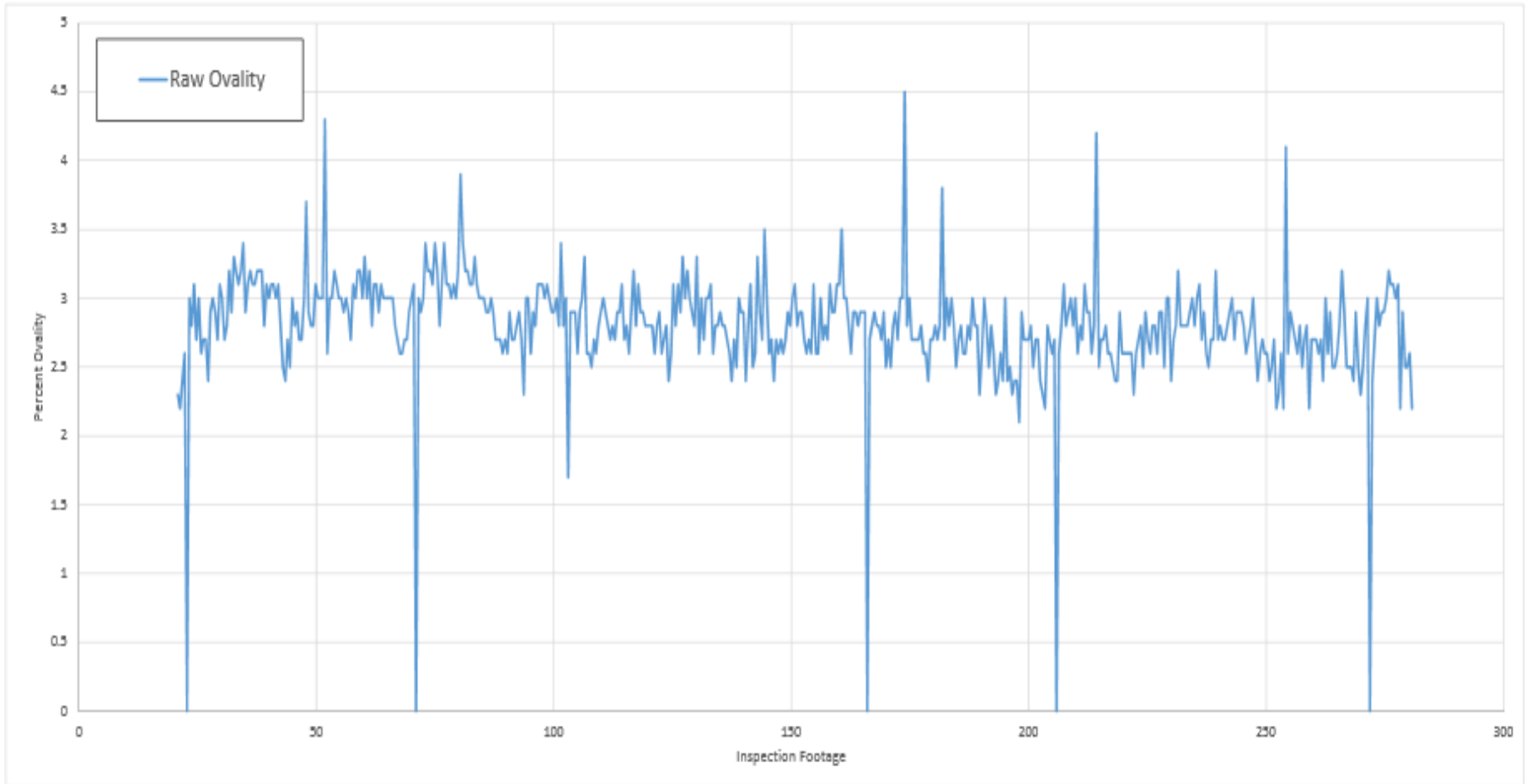
Laser Ring Profiling



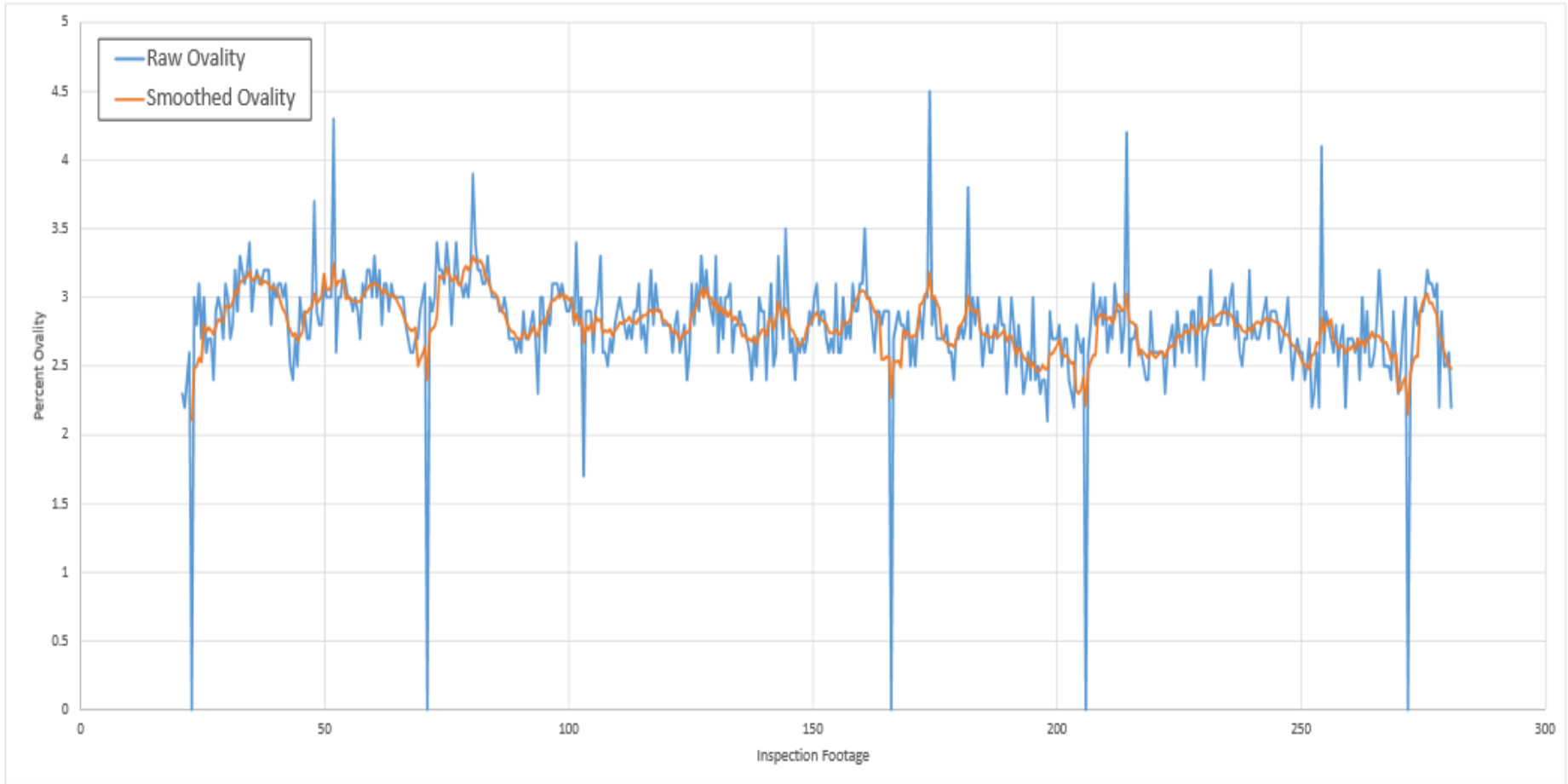
Laser Ring Profiling



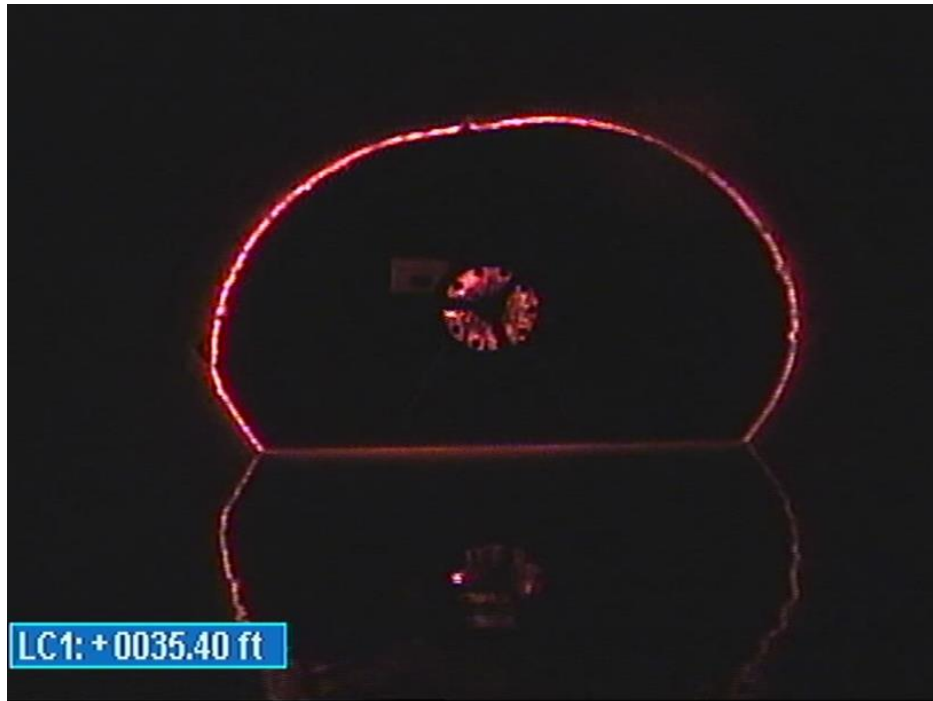
Laser Ring Profiling – Raw Data



Laser Ring Profiling – Raw Data



Laser Ring Profiling – Raw Data



- Ovality of 18% (shown left)
- Ovality of 16% (shown right)

Ovality Design

ASTM 1216

- Dead load
- Live Load
- Ovality

Hazen

Designer: O'Rourke

Date: 3/12/2018

Project:

Pipe Segment:

Client:

CIPP Wall Thickness Estimator

Design Criteria	Fully Deteriorated	
Flexural modulus or resin	400,000	psi
long-term reduction	50%	
D_o , Nominal pipe diameter	30	in
Soil cover above top of pipe	12	ft.
Groundwater height above top of pipe	12	ft.
E'_s , Soil modulus	1,000	psi
Soil density	120	pcf
HS-20 Loading	Yes	
Live load	0.0	psi
% of ovality	2%	
C , Ovality reduction factor	0.8	
N , Factor of safety	2.00	
Vacuum pressure	0.0	psi
P_w , Hydrostatic pressure	5.2	psi
R_w , Water buoyancy factor	0.7	
Soil load	6.7	psi
P_t , total load	11.9	psi
B' , coefficient of elastic support	0.353	
E_L , long term corrected CIPP modulus	200,000	psi
t , Thickness	0.56	in
t , Thickness	14.2	mm

Ovality Design

ASTM 1216

- Dead load
- Live Load
- Ovality

Hazen

Designer: O'Rourke

Date: 3/12/2018

Project:

Pipe Segment:

Client:

CIPP Wall Thickness Estimator

Design Criteria	Fully Deteriorated	
Flexural modulus or resin	400,000	psi
long-term reduction	50%	
D_o , Nominal pipe diameter	30	in
Soil cover above top of pipe	12	ft.
Groundwater height above top of pipe	12	ft.
E'_s , Soil modulus	1,000	psi
Soil density	120	pcf
HS-20 Loading	Yes	
Live load	0.0	psi
% of ovality	10%	
C , Ovality reduction factor	0.4	
N , Factor of safety	2.00	
Vacuum pressure	0.0	psi
P_w , Hydrostatic pressure	5.2	psi
R_w , Water buoyancy factor	0.7	
Soil load	6.7	psi
P_t , total load	11.9	psi
B' , coefficient of elastic support	0.353	
E_L , long term corrected CIPP modulus	200,000	psi
t, Thickness	0.90	in
t, Thickness	22.7	mm

Laser Ring Profiling – Raw Data

D/S MH	U/S MH	Material	Size (in)	Length (ft.)	Max Ovality	Recommendations
26A005	26A006	RCP	30	19	2%	CIPP
26A006	26A007	RCP	30	130	≤ 6%	CIPP + potential MH addition (at bend ~75' from U/S MH)
26A007	26A008	RCP	30	646	10%	CIPP + MH addition (~340' from U/S MH)
26A008	26A009	RCP	30	343	16%	CIPP
26A009	26A010	RCP	30	469	18%	CIPP
26A010	26A011	RCP	30	23	8%	CIPP
26A011	26A012	RCP/VCP	20/30	180	≤ 6%	CIPP + Note calling out size change in pipe
26A012	26A013	RCP	20	67	≤ 6%	CIPP
26A013	26A014	RCP	20	231	≤ 6%	CIPP + MH addition (at bend ~395' from U/S MH)
26A013	26A014	VCP	20	395	N/A	Re-CCTV in 5 years
26A014	26A015	VCP	20	239	N/A	Re-CCTV in 5 years
26A015	26A016	VCP	20	297	N/A	Re-CCTV in 5 years

Manhole Inspection

- 360° image
- measurability



Manhole Inspection

MACP Survey Report 26A008

Report Date 2017/03/15

Sheet No 6 **Surveyor's name** Evan **Certificate Number** U-913-18727 **Date** 2017/03/08
System Owner City of Lancaster **Survey Customer** City of Lancaster **Time** 14:07
Drainage Area **Locality/City Name** Lancaster Ohio
P.O. No **Location (No. & Name)** Park
Further Location Details **Inspection Level** Level 1
Outgoing Rim to Invert **Outgoing Grade to Invert** **Rim to Grade**
Use of Sewer Combined **Year Laid** **Year Rehabilitated** **Tape/Media Number**
Purpose Maintenance related **Sewer Category**
Pre-Cleaning Jetting **Date Cleaned** 2017/03/07 **Weather** Dry
Location Code Parking Lot **Potential for Runoff** Sheeting **Evidence of Surcharge** No
Access Point Type Manhole **Coordinate System**
Northing **Easting** **Elevation** **Accuracy of GPS**
Inspection Status Remote Inspection
Additional Information

Manhole Surface Types

Concrete Pavement
 Concrete Collar
 Asphalt
 Grass/Dirt
 Gravel
 Other

Cover

Cover Shape Circular **# of Vent Holes** 0
Cover Size 23.5 **Vent Hole Diameter**
Cover Size Width **Cover Bearing Surface Diameter Width**
Cover Material Cast Iron **Cover Bearing Surface Diameter**
Cover Frame Fit Good

Cover Type

- Solid Bolted
- Vented/Slots Locking
- Gasketed Lamphole
- Hatch Single Inner Cover
- Hatch Double

Cover Condition

- Sound Missing
- Cracked Corroded/Pitted
- Broken Bolts Missing
- Restraint Missing
- Restraint Defective

Cover Insert

Cover Insert Type None

Cover Insert Condition

- Sound Leaking
- Poorly Fitting Corroded
- Cracked/Torn/Holes Insert Fell

MACP Survey Report 26A008

Report Date 2017/03/15

Sheet No 6 **Surveyor's name** Evan **Certificate Number** U-913-18727 **Date** 2017/03/08
System Owner City of Lancaster **Survey Customer** City of Lancaster **Time** 14:07
Drainage Area **Location (No. & Name)** Park
Further Location Details **Inspection Level** Level 1
Outgoing Rim to Invert **Outgoing Grade to Invert** **Rim to Grade**
Use of Sewer Combined **Year Laid** **Year Rehabilitated** **Tape/Media Number**
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Access Point Type Manhole **Coordinate System**
Northing **Easting** **Elevation** **Accuracy of GPS**
Inspection Status Remote Inspection
Additional Information

Manhole Surface Types

Concrete Pavement
 Concrete Collar
 Asphalt
 Grass/Dirt
 Gravel
 Other

Cover

File Name MH48.jpg



Frame

File Name MH53.jpg



Bottom

File Name MH49.jpg



Wall

File Name MH50.jpg



Design Considerations

- Ovality per segment
- No MH rehab
- Robotic cutter for protruding taps (not chain)
- Physical CIPP sample testing at testing lab





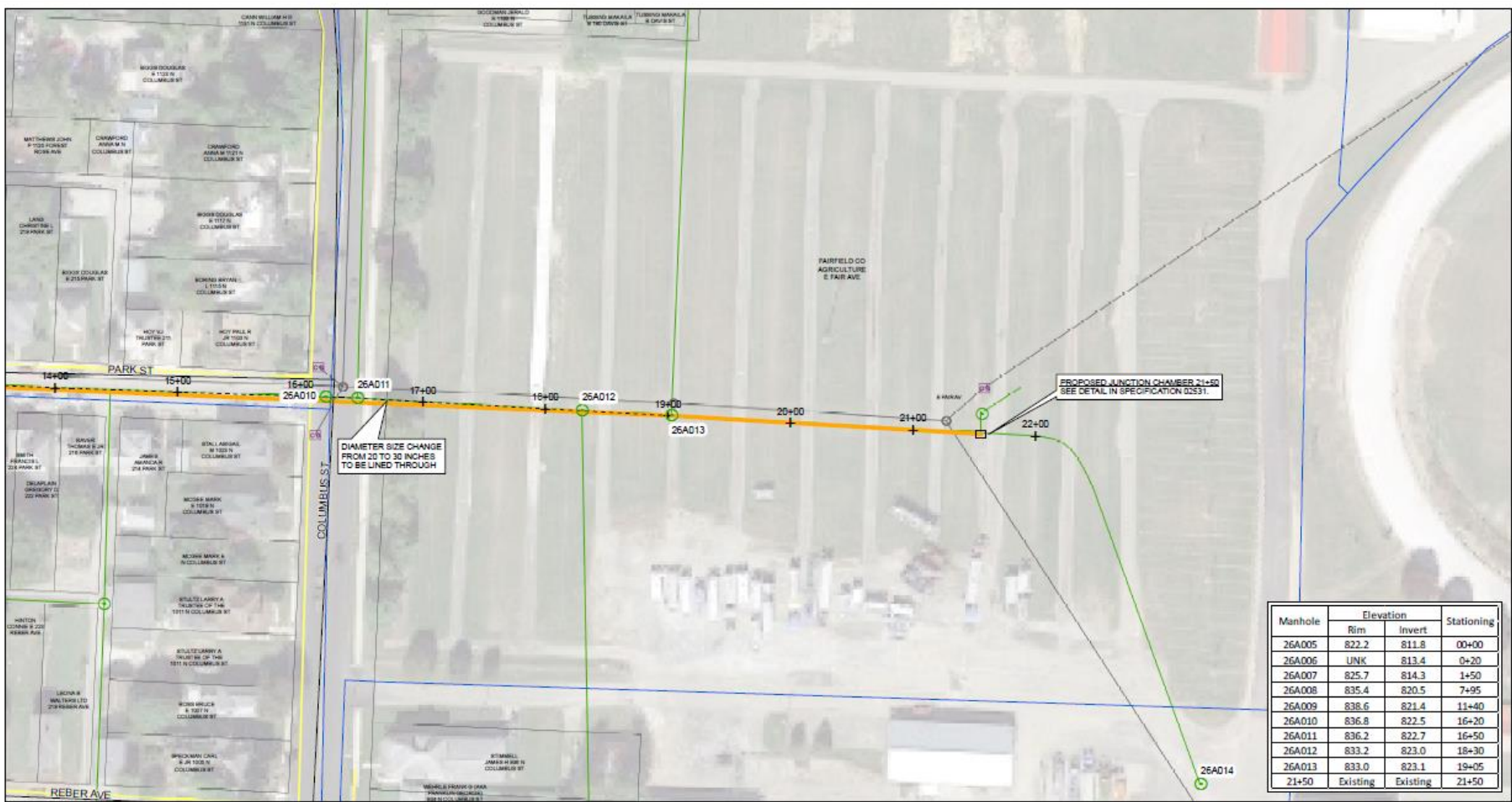
DRAWN
JWA
CHECKED
SOK

BID SET

STA. 14+00 TO ST. 22+00
PARK STREET

CITY OF LANCASTER, OHIO
DIVISION OF ENGINEERING & CONSTRUCTION
2018 PARK STREET & LOCUST DRIVING STREET
SEWER REHABILITATION

4 of 6



Manhole	Elevation		Stationing
	Rim	Invert	
26A005	822.2	811.8	00+00
26A006	UNK	813.4	0+20
26A007	825.7	814.3	1+50
26A008	835.4	820.5	7+95
26A009	838.6	821.4	11+40
26A010	836.8	822.5	16+20
26A011	836.2	822.7	16+50
26A012	833.2	823.0	18+30
26A013	833.0	823.1	19+25
21+50	Existing	Existing	21+50

D/S	U/S	Size	Length (ft.)
26A005	26A006	30	20
26A006	26A007	30	130
26A007	26A008	30	645
26A008	26A009	30	345
26A009	26A010	30	480
26A010	26A011	30	30
26A011	26A012	20/30	180
26A012	26A013	20	75
26A013	21+50	20	245

- NOTES:
- Existing Utilities are based on the best available information including the City's GIS mapping program. Contractor shall field verify and have marked by OUPs prior to any excavation.
 - Length and sizes of sewers to be lined are approximate. Contractor shall use the provided CCTV, Laser inspection, and manhole inspection data for exact dimensions.
 - Aerial image is based on Google Map data, 2017.
 - If Manhole casting and chimney is to be removed to insert the CIPP liner, contractor shall replace existing pavement and manhole chimney in accordance with the details in Specification 02531. Contractor shall remove and replace with care the existing casting. The chimney and pavement shall be replaced in accordance with the provided City's standard manhole and roadway details.
 - If Manhole is to be constructed between 4+00 and 6+00, the water line shall be rerouted in accordance with Section 02531 and the City's standard water line and roadway details.
 - CSO to be plugged and monitored during the release of cure water to ensure no overflows occur.

Legend

- Sanitary Manhole
- Water Main
- Proposed CIPP
- Storm Inlet
- Storm Manhole
- Parcels
- Gas Main
- Sanitary Sewer
- Storm Sewer



Key Takeaways

- Concrete corrosion can't always be seen
- Laser profiling - niche
- Laser doesn't measure – LIDAR does
- Data requires some analysis
- CIPP design requires ovality

Audience Questions

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Sean O'Rourke, P.E.
Hazen and Sawyer
(513) 469-5104
sorourke@hazenandsawyer.com

