Alternative approaches to assessing Asbestos cement pipe & Critical assets insitu

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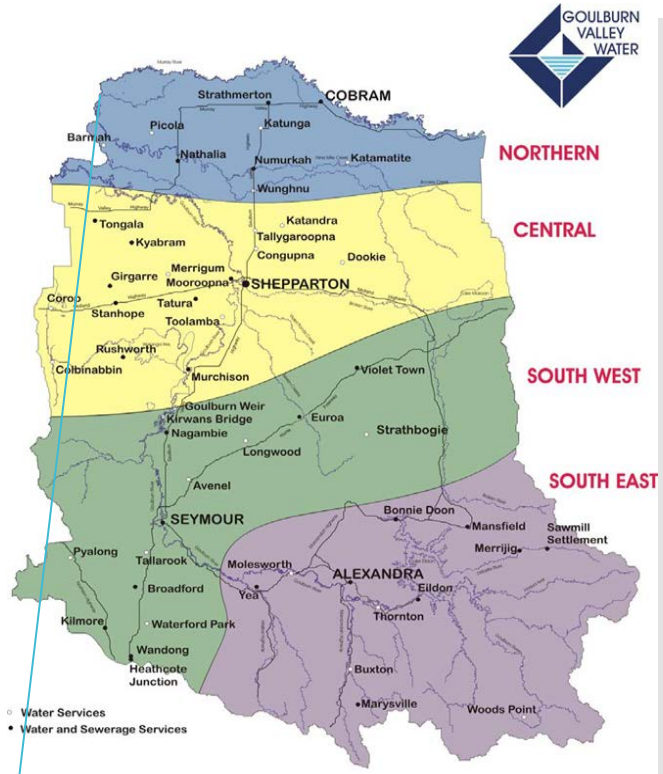
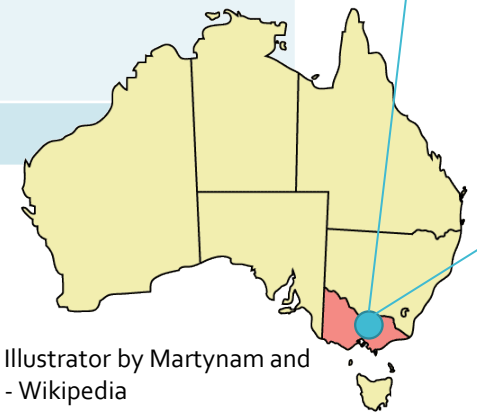
Goulburn Valley Water

SNAPSHOT	
Asset base	AUS$888 million
Number of employees	212 FTE
Estimated population serviced	134,677
Residential customers	50,682 connections
Non-residential customers	6,347 connections
Water consumption	26,256 ML
Recycled water reused	89%
Water Treatment Plants	37
Wastewater Management Facilities	26
Water mains	1,825 km
Pressure and gravity sewers	1,271 km
Pumping stations	332
Tanks and reservoirs	128



Locality Plan Of Towns within the Goulburn Valley Water District



Map of Australia highlighting Victoria made in Adobe Illustrator by Martynam and released under the GFDL Category: Maps of Australia - Wikipedia

Problem description

- How to assess the condition of pipes:
  - Pressured pipes made of different materials in a retic network; and
  - Critical assets insitu
- Main issues are:
  - Depth
  - Interruption to customers
  - Interruption of production/process
  - Loss of water when water main fails
  - Impact on environment when sewer mains fails

Key critical assets

- Water mains
- Pressure sewer
- Pumps
- Valves
- Fire hydrants
- Reservoirs

Current technologies assessing critical assets

Assessing Critical Assets

- Ultrasound, magnetic, acoustic(metallic)
- Dismantle and inspect / overhaul
- Vibration analysis
- Performance monitoring

Current technologies for assessing AC pipe

Assessing Asbestoses cement

- Sampling
- Impact Echo (acoustic)
- Phenolphthalein
- Computer tomography scanning (CT)
- Back scatter CT scanning

Sampling

- Determining tensile strength
- Predicting remaining asset live based on a statistical model

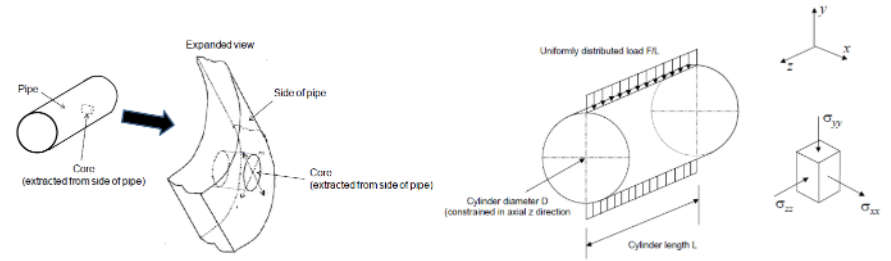
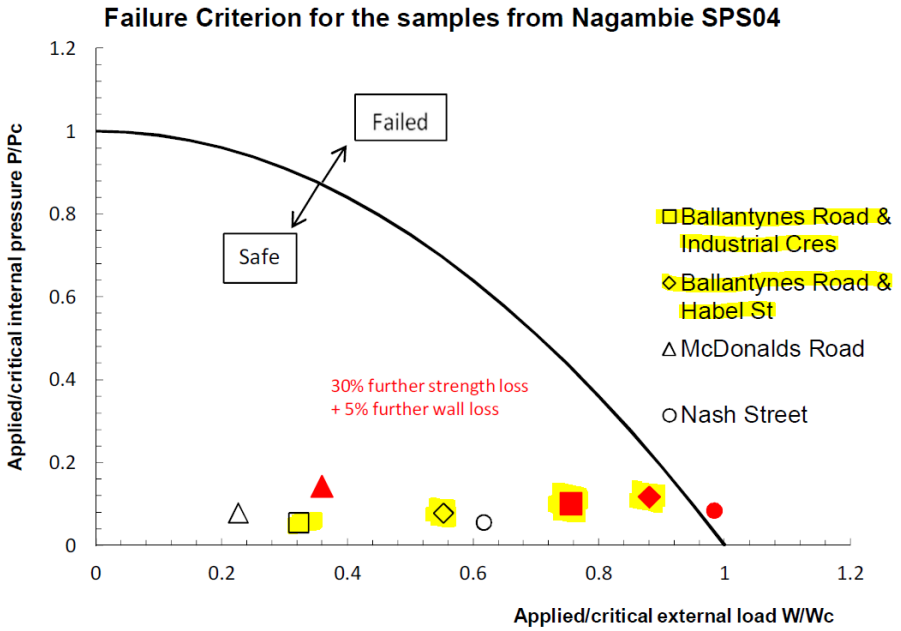


Figure 1. Schematic diagram – Core samples used for indirect tensile strength testing

$$\frac{pD}{2bs_f} \geq 1 - \left[\frac{wD}{1.048b^2 s_f}\right]$$

$$\left(\frac{pD}{2[b_0 - \delta t][s_0 - s_R t]}\right) + \left(\frac{wD}{1.048F_m[b_0 - \delta t]^2[s_0 - s_R t]}\right)^2 >$$



Impact Echo (acoustic)

- Sample to determine tensile strength and thickness
- Use impact echo to determine remaining thickness

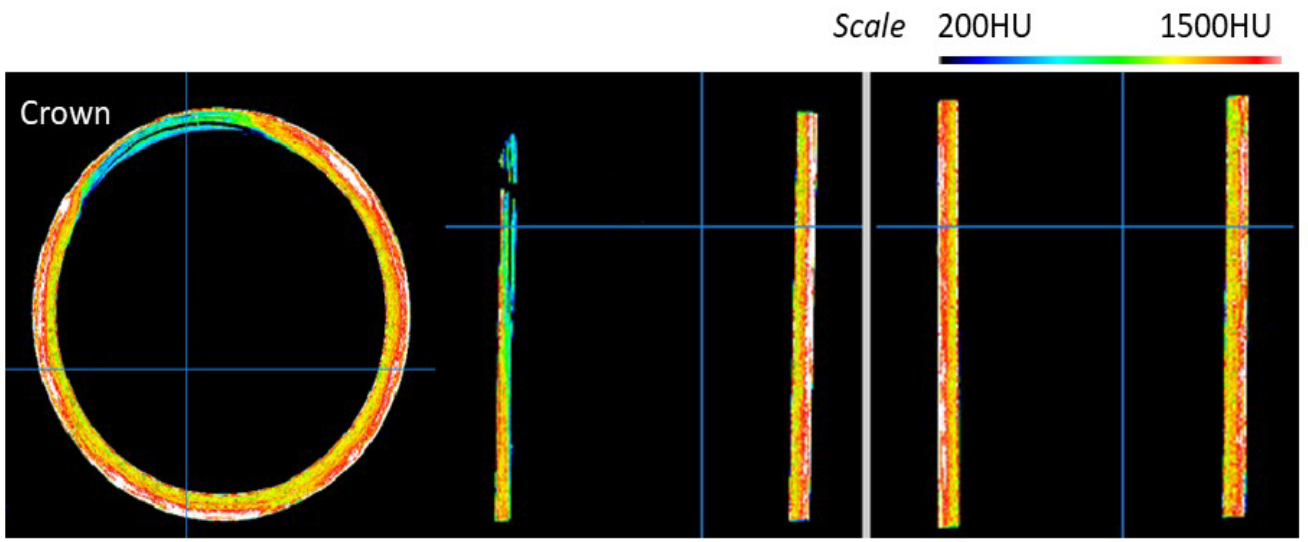
Phenolphthalein

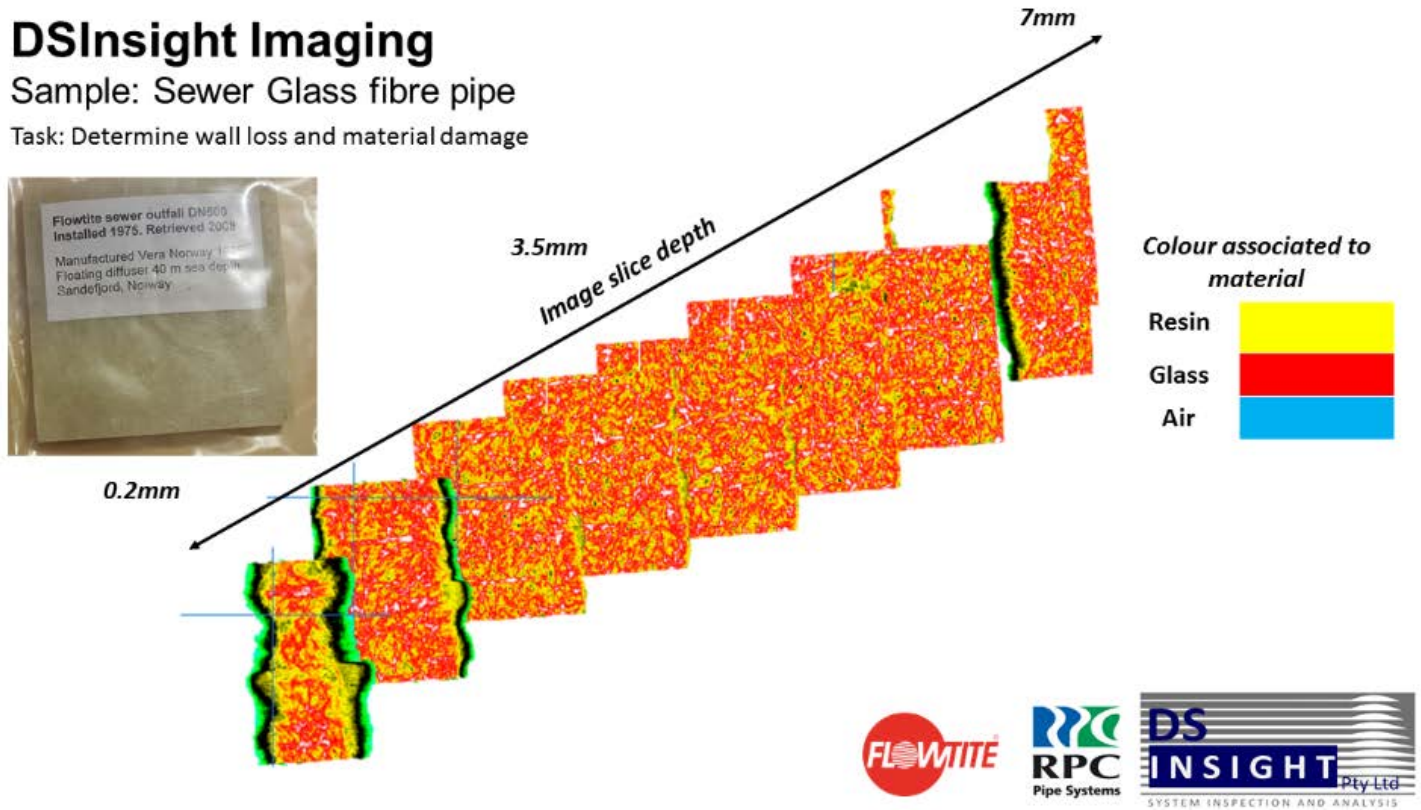
- Changes in pH will change the colour
- Loss of calcium can be associated with deterioration of asbestos cement pipe

Computer tomography

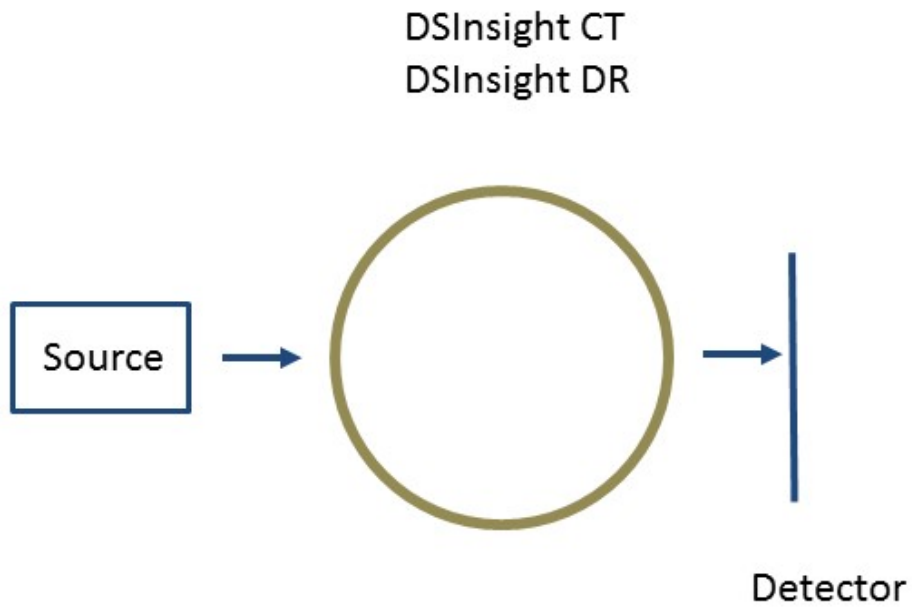
- Used to differentiate density changes
- Losses of calcium due to deterioration can be associated with density profiles
- Samples have to removed from the field and placed into the scanner
- Produces a 3D model of the pipeline which can be adjusted to remove deteriorated section

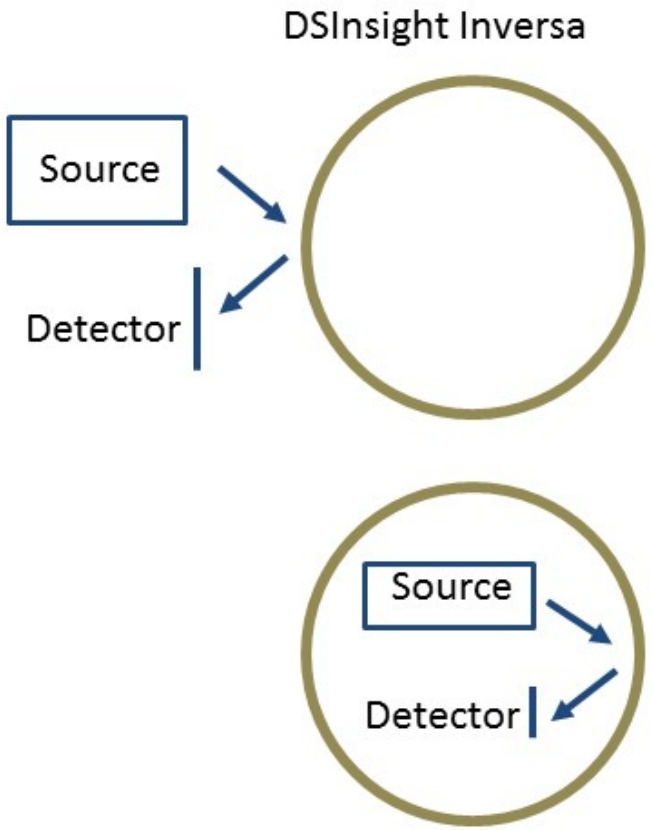
Example of CT scan data





Scanning positioning

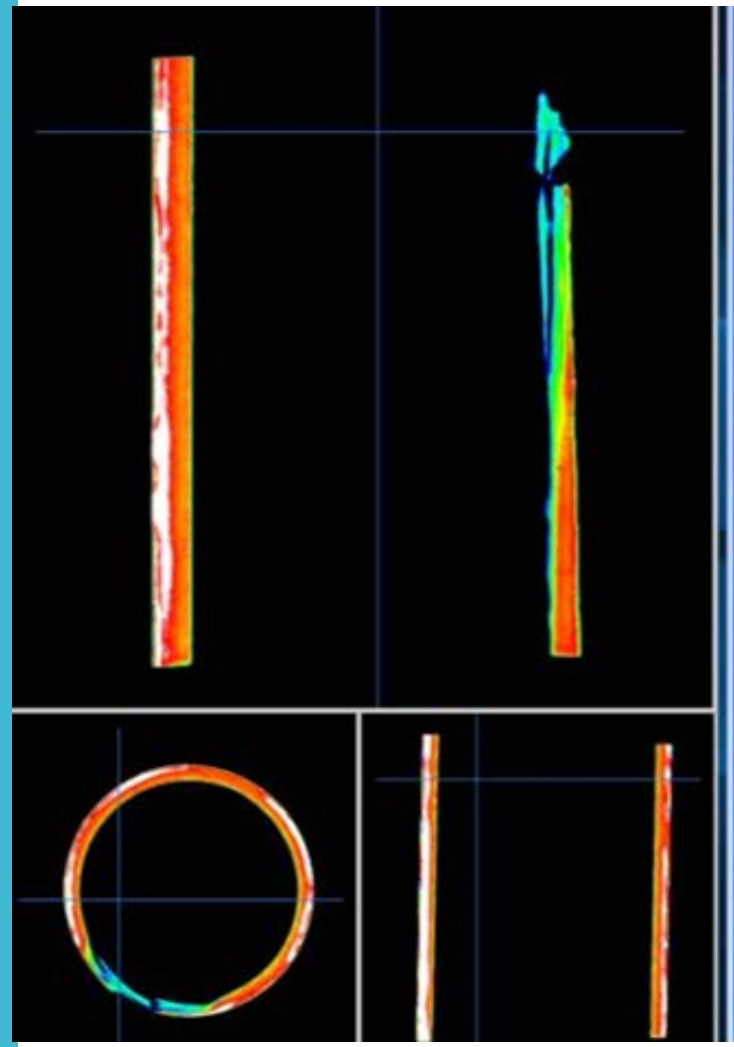


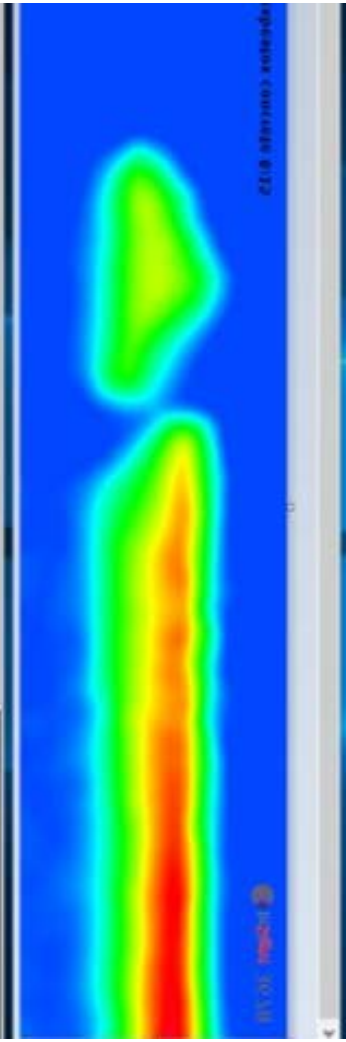


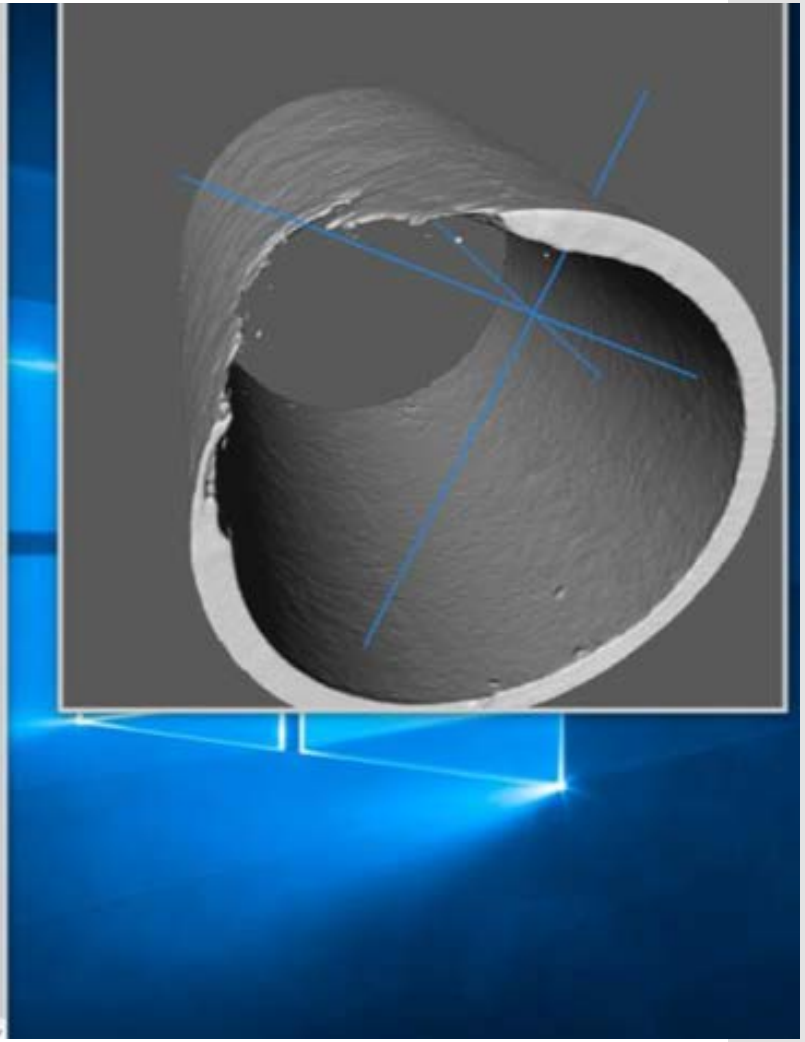
Back scatter CT scanning

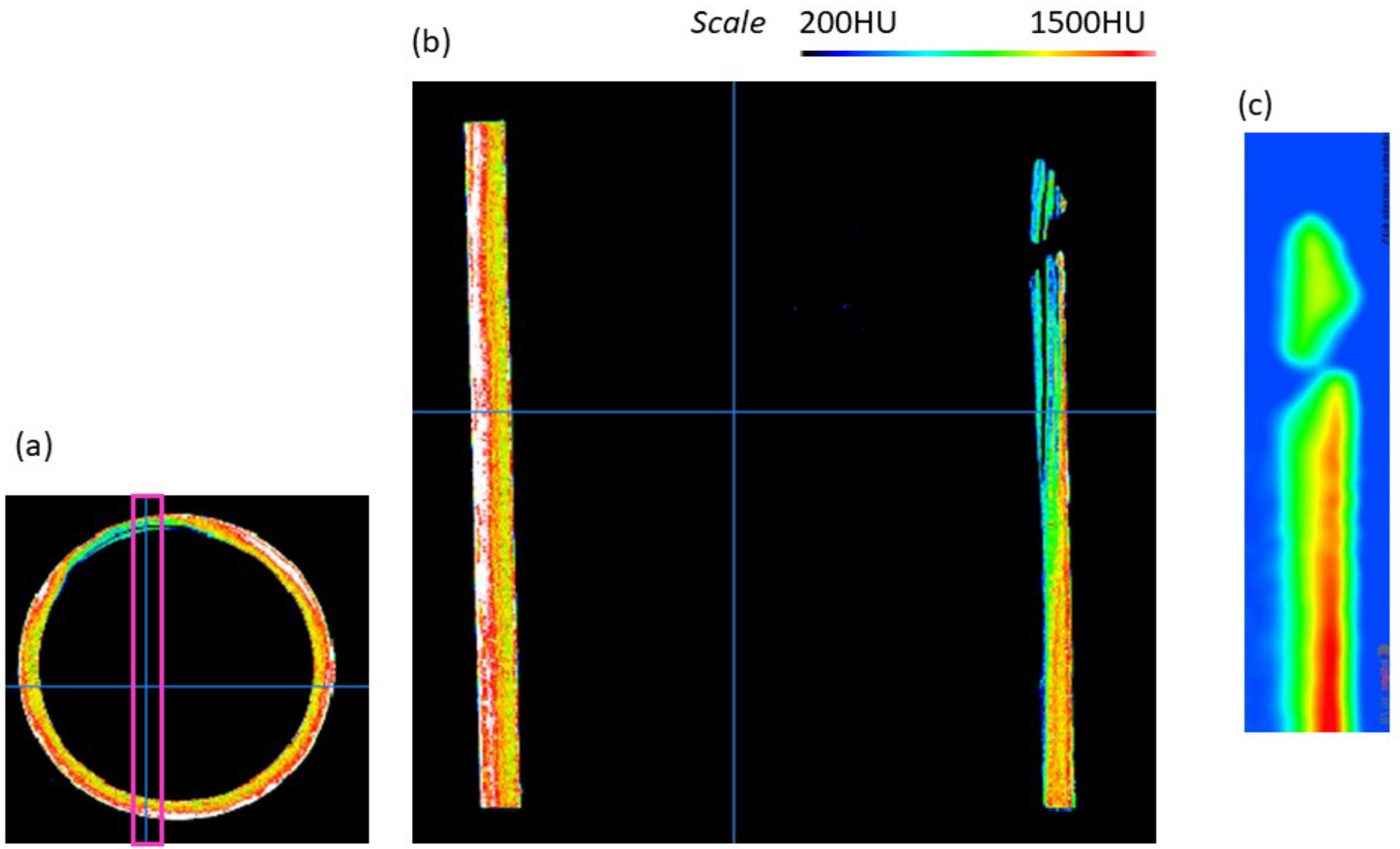
- A field CT scanner
- Can scan the wall thickness of any material
- A mobile unit that can be used within the field
- Obtain single slice data along a length of pipe

Examples of Backscatter CT scanning data








(a)
(b)
Scale 200HU 1500HU
(c)

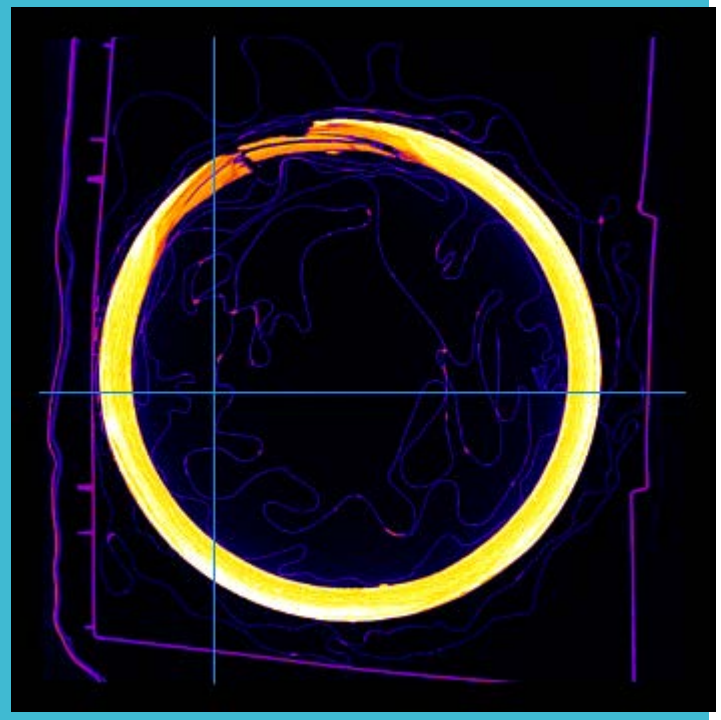
Digital radiography

- Can penetrate many different materials
- Data obtained instantly within the field
- Used for visual inspection and quantitative data can be collect from the images
- Can be used to identify internal issues

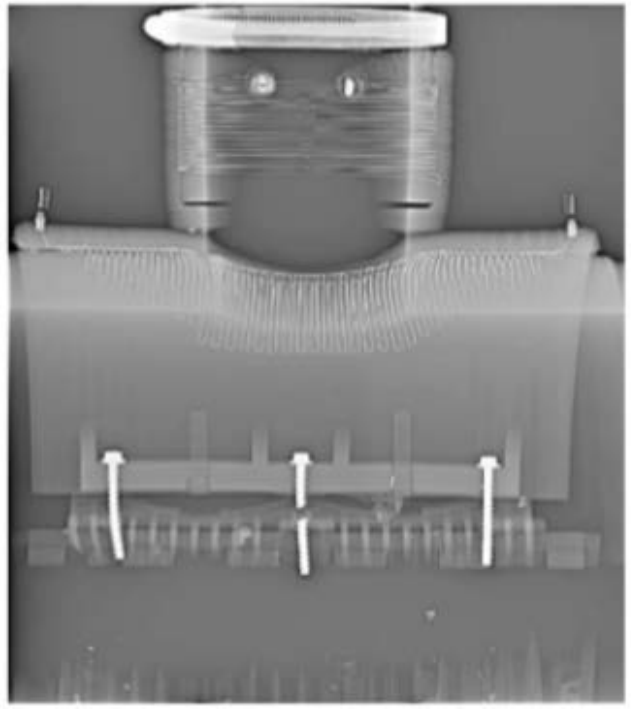
Digital radiography

Example setups

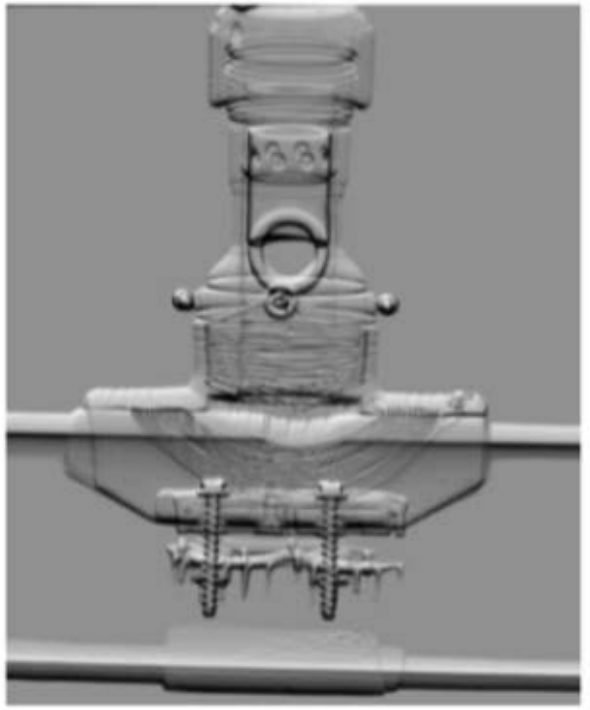
Technology	*Insitu / Exsitu*	*Accuarcy*	*Imagine zone*	*Application*	*Defect detection*
DSInsight CT	Exsitu	100microns	500OD, 1.8m long, excised from the ground	Cement material, plastics, and some metals	Wall thickness, material density changes, cracks, pitting
DSInsight DR	Insitu	100microns	Access to both side	All materials	Wall thickness, material density changes, cracks, pitting
Inversa	Insitu	100microns	Access to one side	All materials	Wall thickness, material density changes, cracks, voids

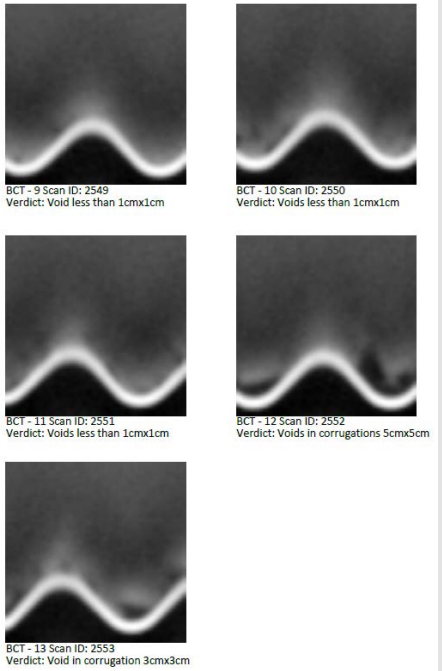


DSInsight CT



DSInsight DR





DSInsight Inversa

	Asbestos cement	Poly / PVC	Metallic
Magnetic flux	✗	✗	✓
BEM	✗	✗	✓
Ultrasonic	✓ Limited	✓ Limited	✓
DSInsight clear imaging	✓	✓	✓
Inversa Insight	✓	✓	✓

Summary

- New technologies are entering the market utilising new forms of assessing key assets
- Key ex-situ tools can now be used in-situ
- Instant results with digital radiography
- Can be used during the constructions of new pipelines to mitigate future issues
- Data can be made into 3D models and placed into simulation software to observe stressors