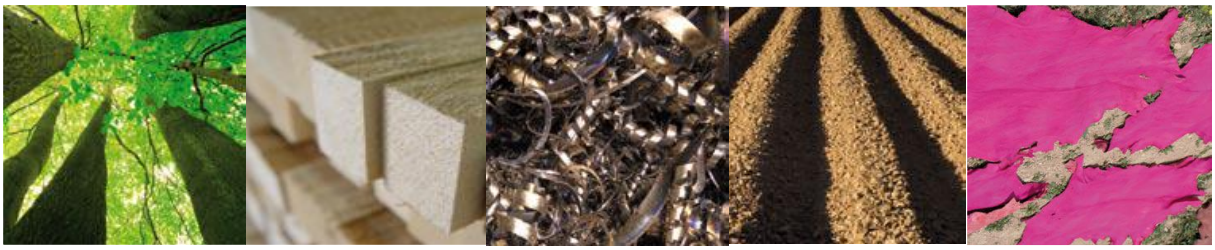

CIP Eco-innovation
Pilot and market replication projects
Call 2011

Call Identifier: CIP-EIP-Eco-Innovation-2011

Deliverable D4.9: Material design and production

WaPiCA

Contract ECO/11/304204

12/01/2014 (updated 25/08/2015)

Project coordinator: Per Arnold Dyrkoren

Project website: http://breivoll.no/about/research-and-development/

Co-funded by the Eco-innovation Initiative of the European Union

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SUMMARY:

Breivoll Inspection Technologies (BIT) are building two *PipeScanners* as part of the WaPiCA project. They will be used for the internal inspection of drinking water and district heating pipes. The project also includes the marketing and deployment of the *PipeScanners* in the UK and Central Europe. This deliverable concerns the design and production of marketing material. A number of brochures and flyers have been designed at different stages of the project. An example of a brochure is attached. It is based on the most pertinent information on the website.

A design template has been established for posters, presentations, brochures, flyers and the website in order to establish a recognisable brand for the company. This consists of colour schemes, associated images (*e.g.* The Northern Lights) and the new slogan "Sound advice in pipes".

BROCHURE (2015):

IN-LINE UTILITY PIPELINE INSPECTION
SOUND ADVICE IN PIPES
BREIVOLL
INSPECTION TECHNOLOGIES

Co-funded by the Eco-innovation Initiative of the European Union

WaPiCA

Contract ECO/11/304204

BREIVOLL
INSPECTION TECHNOLOGIES

ABOUT US

Breivoll Inspection Technologies AS (BIT) is a leading international supplier of pipeline inspection services, using cutting edge Acoustic Resonance Technology (ART) in order to perform in-line pipe inspections for water and district heating pipes.

Through this unique technology, the Company is able to provide constant and highly accurate measurements from inside the pipe of both internal AND external corrosion, pipeline thickness and leak detection, using an in-line pipescanner weighing only 30 kgs.

The company was formed in 1998 and in that time has gained significant experience, undertaking inspections in Norway, Denmark, Sweden, France, Holland, Russia and Finland.

As of August 2015, BIT has inspected more than 11,000 pipes amounting to over 70,000 metres in total.

The company today has branches in Moscow and London and representative offices in Singapore and Copenhagen.

Our clients:

- MOEK (Moscow District Heating Company)
- Oslo Water and Sewerage Works (VAV)
- Tromsø municipality (Norway)
- Groningen Waterworks (The Netherlands)

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WHY USE BIT?

If you are the owner of potable water distribution assets or district heating pipes

- own a large number of metallic pipes
- want to manage your assets effectively
- have limited resources for the replacement of pipes
- have large heat losses or a high percentage of leakage
- do not have sufficient knowledge of the condition of the network
- need complete and reliable information on the condition of the network in order to
- promptly reduce risk and increase sustainability

BIT – is your best solution!

- BIT provides for savings on rehabilitation costs of up to 65% from BIT inspections
- BIT delivers complete and reliable information on the condition of the network
- BIT prioritises pipes according to urgency and type of repair
- BIT provides recommendations on cost-effective and risk reducing actions

The Main Advantages of the Technology

01. Accurate data. BIT technology, with its 360 degree continuous inspection, supports information gathering on remaining thickness around the pipe wall.
02. Detection of internal and EXTERNAL corrosion.
03. High speed - 300 m/h.
04. Low cost of preparations – scanning capacity up to 1500 m from one entry point.
05. Scans pipelines with internal rust nodules without any prior cleaning.
06. There is no necessity for water to be purged from the pipe during or before an ordinary inspection.

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VISION & STRATEGY

Breivoll Inspection Technologies AS aims to be the leader in water pipe inspection technology as well as in district heating.

Our Vision

Our main values are:

- **Quality.** We deliver extremely high resolution data, which allows high quality diagnostics and cost-effective asset management.
- **Customers.** We work closely with our customers to understand their needs and demands and support them in cost-effective asset management.
- **R&D approach to pipeline inspections.** We work closely with leading universities and R&D Institutions worldwide and take part in international projects on the application of innovative technologies for effective, resource-efficient management of district heating and water supply networks.

Our Strategy

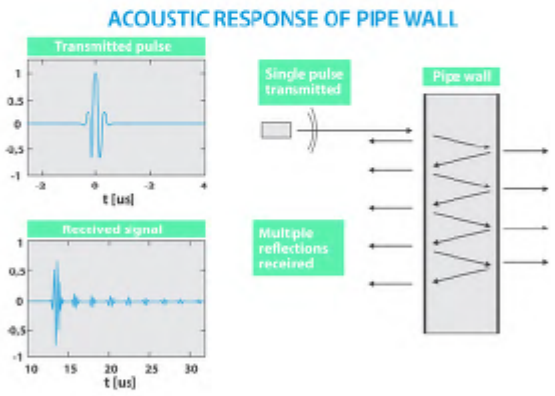
- Continuous technology development leading to new generations of inspection units.
- Continuous enhancement of data processing.
- Development of new technologies for inspections of all types of pipelines.
- Capacity expansion by manufacturing new inspection units.
- Rapid expansion of geographical and service market presence both within and beyond EU (Russia, South East Asia, North and South America).

BREIVOLL INSPECTION TECHNOLOGIES

DIAGNOSTICS

BIT has developed a method of inspection for water mains based on the advanced use of acoustic resonance technology . This method makes it possible to estimate the thickness and indicate the internal and external corrosion on water pipes. For our work in developing this inspection technique, we were awarded Engineering Achievement of the Year 2007 by Teknisk Ukeblad and TEKNA.

ACOUSTIC RESONANCE TECHNOLOGY



- Developed by Det Norske Veritas since ~1990.
- Patented and registered, licensed to BIT
- Wide bandwidth, low frequency ultrasonic pulse
- Half-wave resonance detects thickness
- Robust to corrosion and sediments
- Does not require direct contact
- Detects external and internal corrosion

Acoustic Resonance Technology is a low frequency, ultra-wideband inspection technology, which enables very accurate thickness measurements to be made. BIT has developed advanced algorithms to perform ART analysis on very large amounts of data.

A transducer transmits a broad-band acoustic signal towards the pipe surface. The signal propagates in the pipe wall, exciting half-wave resonances. The response of the structure transmits a characteristic signal which is detected by the receiving transducer. Analysis of the frequency content of this response signal yields the resonance peak frequencies, from which the base resonance frequency, and ultimately the structure's thickness, can be estimated.

During post-processing, multiple measurements can be combined to estimate the size and depth of flaws, such as corrosion (internal and external) on the pipe surface.

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The benefits to the customers in using Acoustic Resonance Technology:

- Highly accurate wall thickness measurements
- High repeatability/consistency
- External anomaly characterisation

Challenges for Owners of Water Pipes

- High reliability demands
- Asset life hard to predict
- Limited resources
- 30-50 % water loss common
- Little knowledge of state of the network
- Huge variety of pipe types and classes

GOAL: rehabilitate with the right method at the right time at the right place

PIPELINE INSPECTION

The BIT method is:

- Assess the condition of every single pipe, instead of limited number of samples
- Prioritise pipes and actions by risk and cost, instead of using weak indicators such as age
- Strategic planning for the future, instead of "Run to failure", then rebuild

We routinely scan between 200 and 750 meters (depending upon the pipe) in each direction from a single entry point and scan the full 360 degree circumference of the pipe. We scan pipes in the range 250mm to 600mm. The resolution generated by BIT's proprietary PipeScanner (PS) enables us to identify corrosion pits down to a resolution of 1 x 1.5cms (based on 300mm pipes), as well as small and large areas of corrosion, and to differentiate between internal and external corrosion.

A BIT Inspection Unit consists of a specially equipped inspection vehicle, a two-man operational team and a PipeScanner. The PS is lowered into the water-filled pipe and floated through the inspection length of the pipe. The PS is weight-neutral in water, minimizing contact and pressure on pipe walls. The actual scanning takes place as the PS is pulled back to the insertion point, while transferring data to computers in the inspection vehicle. Most scans take no longer than 2 hours.

Scan results are analysed by BIT's advanced computer analysis system (PARS) before our engineers produce a report for presentation to the client. With this data, we provide recommendations on the most suitable and cost-effective rehabilitation schemes. Clients receive a thorough and clear report that is easy to understand, with fact-based recommendations that enable a cost-saving and a sustainable infrastructure asset management strategy. Data from our inspections can also be integrated in geographical information systems (GIS) or other asset management systems. As a result, the life-cycle cost of water distribution networks is reduced, as is the risk involved in not knowing the actual condition of crucial water infrastructure.

Stage 1 **Planning & preparations**

- Verify suitability of site: visit site, study maps, ship BEP/hatch

Stage 2 **Site preparation**

- Excavate pipe, install BEP/Hatch
- Same day or day before

Stage 3 **Inspection**

Stage 4 **Post-inspection work**

- Repair pipe cut, close ditch.
- Same day or next

Stage 5 **Analysis**

- Starts next day (+1), 2-10 work days. Depending on complexity.

Stage 6 **Report delivery**

- Max 10 days after inspection

Operational Requirements

BIT services require:

- Entry through standard hatchbox (DN400) or custom entry element (DN250-300)
- Total service interruption typically 8-12 hours including pipe access
- Access to pipeline for 5-8 hours during inspection
- On-site staff to control water pressure and flow during inspection
- No more than 11 degree bends on DN300, or 22 degree bends on DN400
- No butterfly valves

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RESULTS

Existing tools to assess the actual status of extensive water distribution networks are limited. Too often, utilities are limited to using statistics, pipe sampling and modelling to predict breakages. Modelling often leads to premature replacement of water pipes that would otherwise provide a significant remaining service lifetime. Likewise, the heterogeneity of individual pipes makes pipe sampling highly inefficient, and frequently causes weak pipes to go undetected. This approach is costly, ineffective and unsustainable.

BIT provides:

Data on the condition of every single pipe

Measurements of remaining thickness

- Distinguishing production variance from corrosion

Quantifications of corroded pipe walls

- Distinguishing external from internal corrosion

Mapping of internal topography

- Presence of valves, branches, joints, repairs, etc.

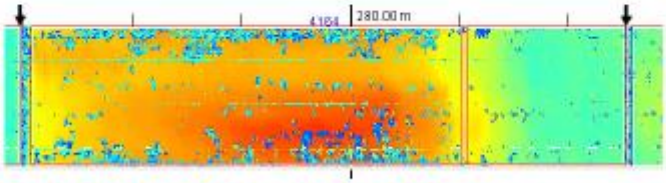
On-board leak detection

- Matches leak noises with pipe topography

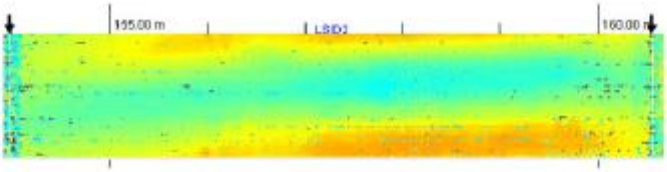
Recommendations for cost-effective and risk-reducing actions

Production Variance is very common, particularly in cast iron pipes. Many casting processes are not capable of producing pipes of uniform thickness. This can result in localised thin areas with thickness values below the design standard. These areas might be missed if only spot measurements are made. Additionally, the calculated loss of thickness might be erroneous if based on the assumed original standard value. Depending on the production process, pipes might exhibit production variance along the pipe and/or around the pipe.

Along the pipe



Around the pipe



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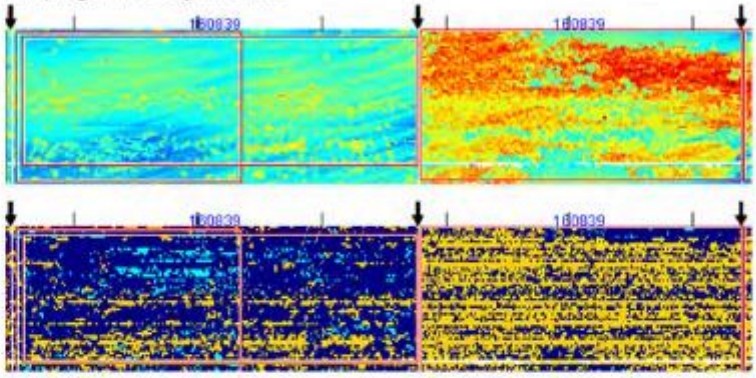
Heterogeneity

The condition of pipe segments can change considerably, from one to the next or even within the same segment. This can be related to the original state of the pipe (cf production variance) or localised phenomena such as external or internal corrosion. For this reason, spot sampling can be very unreliable.



The pipe segment on the left has heavier external corrosion on its left half. The adjacent pipe segment on the right has much heavier internal corrosion.

The report from the inspection includes:

Technical data on pipe and inspection

List of important findings

- Thickness
- Production variance for each pipe
- Internal/external corrosion
- Condition of lining

Analysis of the condition of each pipe

Summary and recommendations for actions

Flexible format – suitable for GIS import

The use of the BIT Report:

Prioritise pipes by urgency and action

- Which pipes are healthy?
- Which pipes can/should be lined?
- Which pipes should be replaced?
- Which pipes should be repaired?
- Cost/benefit/risk analysis
- Combine data with other sources/tools:
- Geographical Information Systems (GIS)
- Asset management tools

BIT AS is at present the only company in the world that deliver all these data without pre-cleaning the pipe and in a single scan operation.

in line utility pipelines inspection 11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NORWAY, OSLO
2009-2013
More than 24 kms of water pipes inspected by BIT in Oslo.
VOLVO
RUSSIA, MOSCOW
April-May, 2015
BIT's inspection on district heating in Russia for the world's largest district heating company MOEK.
FINLAND, HELSINKI
March, 2015
Our first pilot inspection on water pipes in Finland
NORWAY, ALESUND
2009-2015
More than 4 km of water pipes were inspected by BIT in Ålesund
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FRANCE, LA BARRE, GUINEHEUS, ST.MALO
October, 2013
Successful inspection in France for the world's biggest water company Veolia.
NETHERLANDS, GRONINGEN
2009-2010
More than 4,4 kms of water pipes were inspected by BIT for Groningen Waterworks, a large water supply company in the Netherlands.
SWEDEN, STOCKHOLM
December, 2008
Our first pilot inspection of water pipes in Sweden.
DENMARK, AARHUS
October, 2014
Our first pilot inspection of district pipes in Denmark.
in line utility pipelines inspection
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