

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

**CIP Eco-innovation
Pilot and market replication projects
Call 2011**

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

Deliverable D4.4: Layman's report

**WaPiCA
Contract ECO/11/304204**

**22/09/2015
(updated 23/08/2016)**

<http://breivoll.no/about/research-and-development/>



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

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of Breivoll Inspection Technologies AS and can in no way be taken to reflect the views of the European Union

The Problem

Pipes play a vital role in the distribution of our most important nutrition. A substantial amount of the pipes are very old and research studies show that renewal of water pipe infrastructure in Europe is too low to cope with the deterioration rate.

Consequences of pipe failures are water delivery failures, resulting in close down of water delivery and / or reduced pressure in larger part of the pipe infrastructure, risk of water pollution caused by induction of contaminated water, costly repairs and public disturbance due to closing of roads etc. The industry is reactive due to lack of knowledge about

the condition of the infrastructure and inability to foresee where the next incident will happen. More information on the condition will enable utilities to become proactive, plan and choose where to take action, how and when. Furthermore, coordinate activities with others like road, sewage, fibre, gas and electricity suppliers.

Water is the single most important economic input to the global economy and more specifically to individual enterprises and every human being. 75 % of all Europeans live in urban areas. This percentage is anticipated to increase to 83 % within 2030 according to UN forecasts. These people can only get their water through pipes. With no exceptions, all of these cities have challenges with their water infrastructure today.

The challenges are;

- 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

The need for maintenance of water pipes will grow as will the public demand for regular supply of enough water with good quality.

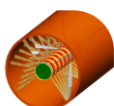
Asset manager's goal is to rehabilitate with the right method at the right time at the right place. This is not possible to reach without knowing the condition of the pipe. Knowledge makes sustainable asset management possible.

Project overview

After lengthy R&D activities in cooperation with world leading R&D Institutions and Norwegian Water Utilities, BIT has developed an Inspection Pilot for inline inspection of metallic water mains consisting of a *PipeScanner* (PS) with a specially built inspection vehicle.



"If we had known what we know now, after reading the pipe inspection report from Breivoll, we would have chosen a cheaper and more appropriate rehabilitation method" (Oslo City Water & Sewage Works)





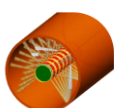
Based on a patented Acoustic Resonance Technology (ART) further developed by BIT, resonance signals sent by - and received to transducers, are transferred to the inspection car through the attached cable and then transferred to BIT headquarters for computer analysis.¹ After one to two weeks the Client receives a report describing a) remaining solid wall thickness, b) inside and outside corrosion and wall thickness reduction/variations, c) detected manholes, joints, bends, narrowing's, connections, valves and service pipes, d) displaced joints and repairs, and the actual hydraulic capacity of the pipe, e) leaks, f) risk evaluation, g) residual lifetime estimate.

The report classifies status of individual pipes and the whole inspected network. Weakened areas are identified and rehabilitation method is recommended.

- Remaining wall thickness enabling conclusion on;
 - Risk of leakages, ruptures and assesses remaining life span of the pipe
 - Weakened areas needing rehabilitation
- Inside topography enabling conclusion on;
 - Position of pipe, man holes, valves, flanges, connections, how and where the pipe is laid, facilitating measuring bends and angels
 - Valves, branching's, tapping's, etc., giving the physical layout of the pipe inspected
 - The inner condition of the water pipe
 - End control of new or rehabilitated networks
 - Curves and joints
 - Rehabilitation Method
- Inside& Outside condition enabling conclusion on;
 - To facilitate Client Choice of Rehabilitation method
- Leaks

Based on our reports, knowledge and experience we are able to classify individual pipes and whole network structures. The reports linked to GIS systems used, enable utility managers to plan and give priority to how and where to rehabilitate. Also important, the information at hand is value added to other activities like planning related road building, performing sewage maintenance, connecting power lines, and laying fibre cables. In this way cost can be cut and time and environment saved.

Report production is supported by BIT developed software, PARS (Pipe Analysis and Reporting System) that allows a semiautomatic report generation.



Specific Objectives

In the project we have, produced two IU's, established own departments in London (UK) and Toulouse (France), established commercial relations with several utilities in both markets, inspected in both France and Denmark and are piloting several places in the UK.

The two Inspection Units and our organisation will enable services also to other European countries.

Our most important delivery is the report from our inspections.

Business Plans for the respective markets are developed and information about our work and achievements has been disseminated in reports and brochures, seminars and conferences and via internet.

Major outputs and results

Eco – Innovative aspects

Seen from the BIT's customers the challenges associated with maintenance and rehabilitation of water distribution infrastructure may be summarised as follows:

- Old or aging distribution infrastructure
- Pipeline failures
 - Leakages: none-revenue water, contamination risk
 - Breaks: delivery security, costly damages
 - Expensive repairs
- Low rehabilitation rate
- Insufficient information on pipeline condition
 - Inefficient rehabilitation
 - No quantification of probability in risk analyses
- Shortage of human and financial resources
- Apart from *PipeScanning* no methods for assessment of a pipeline's real condition

Today, assessment of water pipes is a big need, but is hardly ever performed aside from listening for water leakages and assessing pipe remaining life span based on statistical models. There are few water pipe condition assessment tools in the market. None giving as detailed information as the BIT inspections give. Today's practise is;

- Very costly and ineffective (Introduces repeated unplanned digging with direct consequences for water supply, traffic, and other activities)
- Introduces pollution resulting from break-downs
- Leads to big loss of drinking water

In and as a result of the WaPiCA project we have;

- Developed and implemented leak detection capability.
- Developed and implement services for larger diameter pipes.
- Come further in solving the challenge of cement mortar-lined pipes.
- Participated in other research projects where already collected data has been utilized and resold and which have given us more knowledge on pipes and how they deteriorate.
- Increased our competence on drinking water infrastructure and shared this with other players in the industry.

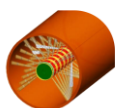


Table Performance indicators (eco-efficiency)

Alternative action after inspection	Assumed Distribution	Greenhouse Gas emissions	Waste Created	Water Saved	Energy Used
Do nothing (pipe in good condition)	24 %	0 %	0 %	None	0 %
Spot repair of poor segments	15 %	10 %	5 %	Yes by avoiding break	10 %
Relining of pipe	25 %	2 %	0 %	Yes by avoiding break	5%
No-Dig rehabilitation	36 %	60 %	50 %	Yes by avoiding break	50 %

Table Performance indicators (marketing objectives)

Performance Indicators	Month 0	Month 36 (updated figures)	Month 60 (updated figures)
Market Potential (applied countries)	1	13 (7)	13 (17)
Number of Customers	10	25 (23)	35 (33)
Payback time (years)	5	3 (5)	3 (3)
Km inspected pipes in total	0	140 (40)	280 (160)
Leakage Reduction (BIT inspected Pipes) Central Europe		11 %	9 %
Leakage Reduction (BIT inspected Pipes) UK		15 %	13 %

The market

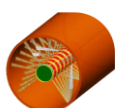
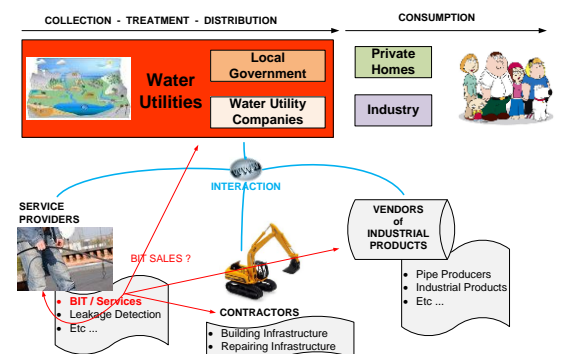
The usage of cast iron and steel for water mains in 12 European countries varies from 40% to 90%, with United Kingdom and Switzerland on top.ⁱⁱ Across Europe, the water infrastructure, especially in major cities, has been built during the last 150 years.

Target groups and key actors

Target groups of German and British operations will be

- Water Utilities (private & public companies)
- Contractors (private companies)
- Service Providers (private companies)

THE VALUE CHAIN OF DRINKING WATER - & BIT



Market Potential

In the western hemisphere the estimated total length of water pipes amounts to 3 300 000 km. The global water market is worth just over €500bn and is growing at a respectable 6% per annum with a strong growth trajectory for both developed and emerging markets. The economic fundamentals for investment in the water industry remain stronger than in almost any other sector of the global economy. In the European market the majority of operators are public, but there are also a substantial amount of private operators. E.g. in France (Suezⁱⁱⁱ, Veolia^{iv}, and Saur^v) and the UK (17 privately owned companies^{vi}).

An enormous investment lag in the water sector has been building up for years. Siemens AG and the Fraunhofer Institute have estimated the global need for maintenance and replacements to 5 600 Billion € for the next 20 years. European figures show water sector investment need reaching 1 400 Billion € (Siemens AG) while comparable USA numbers show investment need of approximately 670 Billion € (Green Chip Review). Comparing today's investments with what is needed over the next 20 years, today's investment level in the water industry will have to be multiplied 43 times, a number much higher than in comparable industry segments. This investment picture underscores the urgency of action and the business opportunities involved.^{vii}

Water utilities cannot meet challenges ahead using the same methods and technologies used until today. New technologies are the key to more efficient and sustainable asset management. The network operated today already exists and has an enormous replacement value. Getting an overview of its condition is the first step towards a sound asset management. It like at the dentist – they also get an overview before taking actions!

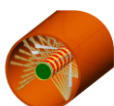
Identified market barriers to the proposed solution

Market barriers to the BIT solution have been discussed with

- Clients (Oslo City Water & Sewage Works, Groningen Water Betrief, Tromsø City Water & Sewage Works, Bergen City Water & Sewage Works),
- Market information players (Lux Research),
- Water technology evaluators (Isle Utilities / TAG), and
- Potential Investors (Seba GmbH (Germany), Emerald Holdings (Switzerland), Morissons (UK), Blue Orange (Suez)).
- There are no legislative activities or existing frameworks conflicting with BIT technology and services. On the contrary, the EU water framework directive^{viii} and related documents positively strengthen the need for improved water quality.
- This way of measuring is more robust to corrosion and sediments than any other technology and does not require direct contact to the pipe wall.

The environmental effects on market penetration of BIT technology and services are:

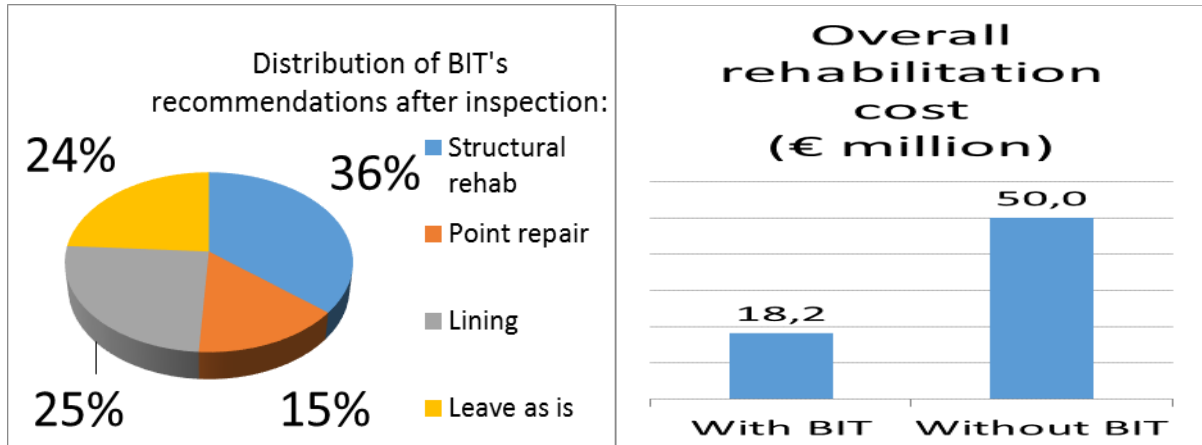
- Less digging onto pipes
- Reduced need for traffic redirecting, chaos handling, etc.
- More controlled digging: pro-active activities rather than re-active
- Reduced pollution of drinking water supply resulting from pro-active processes rather than waiting for break-downs
- Controlled replacement of drinking water mains. BIT technology and services to predict life expectancy of pipes (rather than replacing fully functioning pipes as is being done today) leading to reduced usage of metals
- Reduction of Water Loss



Sustainability

Collecting data about the condition of the pipes is clearly an activity enabling more sustainability - if the collected data is actually used for making the right Asset Management (AM) - decisions.

Economic sustainability (incl. cost-benefits)



Contact information

Breivoll Inspection Technologies AS, CEO Mark Bond

Telephone 0047 904 00115

Address: Fr. Nansens plass 6, 9008 Tromsø, Norway

www.breivoll.no

ⁱ Software PARS = *PipeScanner* Analysis and Reporting System built by BIT

ⁱⁱ UK:86%; Switzerland:90%; Sweden:65%; Luxemburg:82%; Germany:63%; Ireland:57%; Denmark:50%; Norway:48%; Belgium:55%; Austria:40%; Rajani, B & Kleiner, Y.; "Non-destructive inspection techniques to determine structural distress indicators in water mains", National Research Council Canada, NRCC Report 47068.

ⁱⁱⁱ In 2009 Suez had total sales of €12.3 billion: a total of 52% of these were earned in the water sector. The company has close to 66.000 employees in a number of countries. Suez has direct ownership to water companies in 8 European countries.

^{iv} In 2009 Veolia had total sales of \$34.9 billion, of which €12.6billion, about one-third, was in water. Veolia has subsidiaries in 10 European countries.

^v In 2009 Saur had sales of €1,517 million, of which €1,211 was in the water and water engineering sectors. Saur has subsidiaries in 3 European countries.

^{vi} Four of the 10 large water and sewerage companies – Anglian, Southern, Thames and Yorkshire - are owned by private equity or financial groups. Four large companies are still part of groups quoted on the London stock exchange – Northumbrian, Severn Trent, South West, and United Utilities. Of these, Northumbrian is 45% owned by three financial investors; and Pennon Group, owners of South-West Water, is 46% owned by 6 major financial shareholders. Only one of the 10 large water and sewerage companies is now owned by a multinational group - Wessex, owned by the Malaysian company YTL. The remaining one is owned by a not for profit private company (Glas Cymru).

^{vii} Johannes Schmidt, Siemens Financial Services GmbH, Frankfurt/M., Sept. 2007; Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.; The Green Chip Review, Thursday January 8th, 2009;

^{viii} See http://ec.europa.eu/environment/water/water-framework/index_en.html

