Spatial Insight
Data driven asset management

SI-Regression

The increasing average age of drinking water pipes

In 1854 John Snow suggested the relation of cholera and polluted water wells in London. This science-based knowledge accelerated not only the design and building of centralised drinking water treatment but also its distribution system. In Amsterdam in 1853 the first drinking water transportation pipeline was built, delivering fresh clean dune water to the citizens of the city. Since then, the immense underground infrastructure was created to supply safe drinking water at home, a network that we still use today. For most water utilities, the average age of their pipe network is increasing, while the technical lifetime of pipe materials stays constant, or is even decreasing. The short-term impact may be ignored, but the long-term impact will be significant and will require substantial and increasing investments. Would decentralised drinking water treatment be the logical alternative? Not yet, it will involve a higher cost and is likely to be less reliable than the water supply we know today. So, let us optimize the replacement of our underground network.

Spatial Insight

Dutch data science consultancy Spatial Insight is a data science consultancy agency which focuses on the management of underground assets. We combine geo-information and spatial (GIS) expertise, with data science and asset management. The 10 staff team represents a century of experience in the Dutch water sector and holds a strong passion to solve the needs of utilities with data driven solutions. Spatial Insight is a leading consultancy organisation on the Dutch market.

SI-Regression, knowing the basic dynamics of pipe failure

Our extensive pattern analyses in the field of asset management have shown that pipes that have leaked in the past, will have a higher probability to leak again in the future. The goal of every reliability engineer and asset manager is to move from reactive (scheduled, break-fix) and preventive (condition-based) maintenance, towards predictive maintenance. We have seen that maintenance carried out beforehand, will practically eliminate the probability of breakdown because of similar earlier failures.

Crucial knowledge for predictive maintenance is the historic relation between the age and failure behavior of different pipe types. For each selected pipe material or diameter, SI-regression derives these relations from asset and historic failure data. Figure 1 shows an example of the 4 possible fits of the relation between failure and age for a specific PVC pipe type.

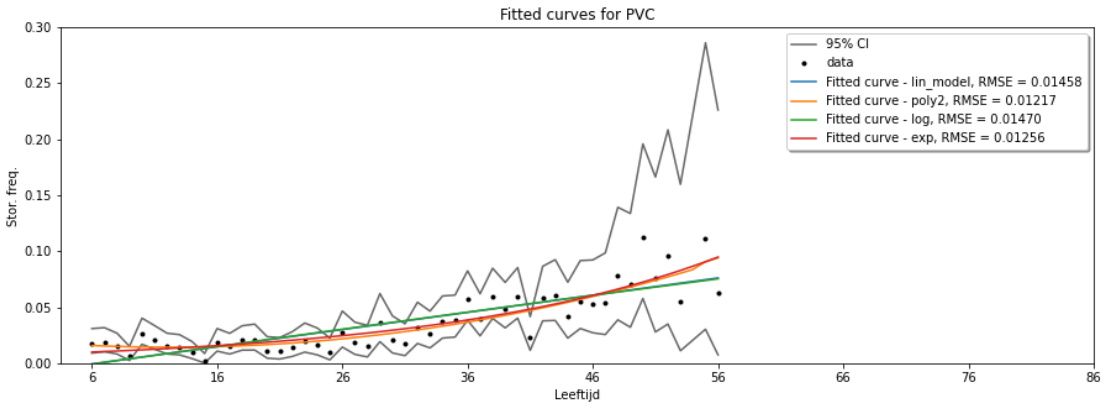

Figure 1. Output of SI-Regression for a PVC pipe: failures rate ('Stor. freq.') for different ages ('Leeftijd')

Spatial Insight BV
Nieuwe Gracht 45
2011 ND Haarlem
The Netherlands
spatial-insight.com
KvK 64763382

SI-regression in practice

Risk-based Asset Management System approaches typically comprise of four phases that are crucial to the success of this strategy. (PDCA) is the iterative approach of plan, do, check and act. Dutch water utilities have incorporated SI-Regression in their risk management (ISO 31000) approach to generate the probability of failure used in the plan, check and act phases. Such a data-driven approach has also been incorporated in the risk matrix assessments of many of our collaborators, which allows policies around replacement to be derived in a direct and actionable manner.

Figure 2 shows the impact of SI-Regression. After two years or replacing the 'worst' pipes as identified with SI-Regression (blue line in Figure 2), the number of failures has dropped between 25% up to 75% (red line in Figure 2). Updating SI-Regression after a period of specific pipe replacements, allows to 'check' the effect of investments objectively.

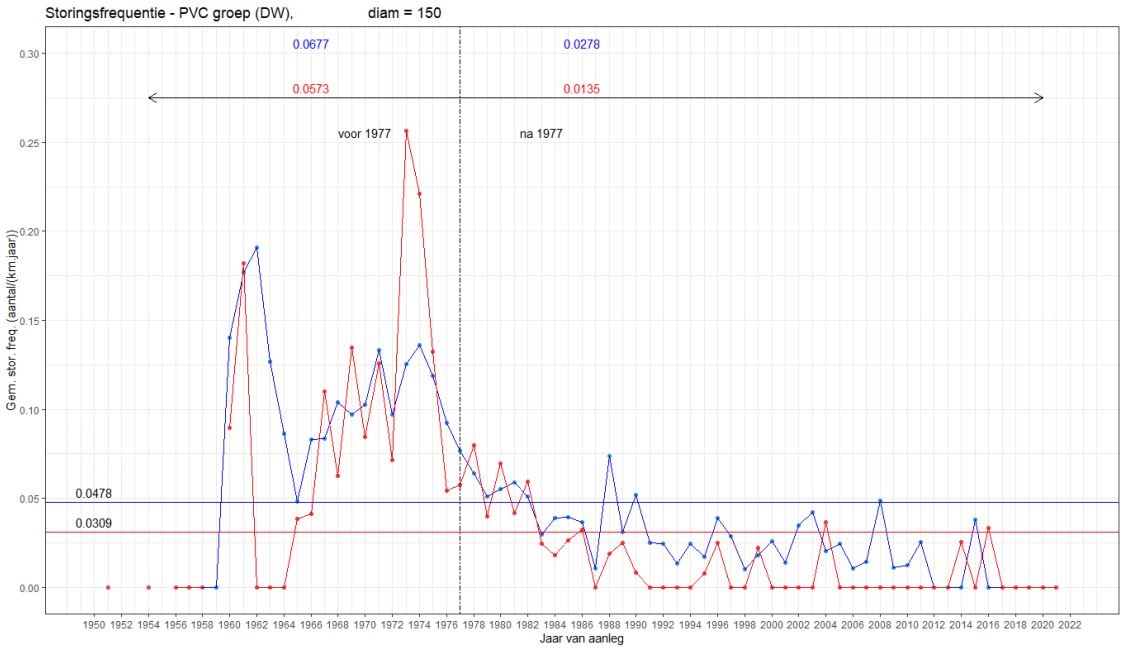

Figure 2. Impact of SI-Regression, reduction of failure rates (red line compared with blue line) after two years of replacing selected pipes.

Requirements

SI-Regression requires asset and failure data structured and stored according to Spatial Insight's standard data model.

Limitation of carbon footprint

Spatial Insight intends to limit the carbon footprint of its operations, and therefore we want to limit our travel movements. We prefer to work with trusted local suppliers or consultants. We propose only to fly in to build trust.

Next step

We hope and trust that SI-Regression will contribute to the needs for optimal and accountable risk management of your piping infrastructure. We are looking forward to exploring how we can integrate SI-Regression in your asset management approach.

Spatial Insight BV
Nieuwe Gracht 45
2011 ND Haarlem
The Netherlands

spatial-insight.com

KvK 64763382