IMQS: PIPE REPLACEMENT PRIORITISATION MODULE

Pipe Replacement Prioritisasion Planning and Operations Management Tool

PIPE REPLACEMENT MODULE

In the context of pipe replacement, it is important to know which pipes in a system have the highest risk of failure.

To better prioritise pipe replacement, accurate information on the current condition of the asset needs to be combined with risk factors, such as the likelihood, frequency and consequence of asset failure. The replacement of high-risk pipes needs to be prioritised based on these risk factors to better allocate limited funds to the most critical pipes that need replacement.

The IMQS Pipe Replacement Prioritisation (PRP) module is a web-based application that offers concise reporting on the results of risk analyses done on each pipe in a network. A geographically linked pipe-replacement prioritisation list can easily be generated and made available to relevant stakeholders on a user-friendly, geographically linked and cloud-based interface. The list, which includes replacement cost totals, enables users to make informed decisions regarding the allocation of funds and resources for water and sewer pipe replacement.

TECHNOLOGY

IMQS is a web-based enterprise application software that enables effective infrastructure lifecycle asset management. The software consists of a collection of web-services and components that are supported by specialised tools and frameworks. The core platform provides an extensive set of generic functionalities, that together make the implementation of infrastructure projects possible. Due to its high level of configurability and ability to combine componentised sets of functionality, IMQS offers a highly flexible framework able to produce tailored-made solutions. Users primarily interact with the IMQS service through a browser-based front-end, which is additionally supported by tablet-based apps.

WHO WE ARE

IMQS builds specialised, GIS-centric software for the Infrastructure Asset Management market. This means that we are committed to conceptualising and constructing solutions for real-world problems that impact the lives of people, at all levels and from all communities, on a daily basis. It is our business to think of innovative ways to enhance the value of your organisation's physical assets, while you focus on the work that matters – delivering key services to your valued customers. IMQS's software is currently enabling effective decision-making, service delivery and customer satisfaction in over 100 government and private organisations in South Africa and internationally.

PIPE REPLACEMENT MODULE

- George Local Municipality
- Rustenburg Local Municipality
- Stellenbosch Local Municipality
- City Of Tshwane
- City of Cape Town
- City of Ekurhuleni
- Buffalo City Metropolitan Municipality
- Johannesburg Water

TECH BENEFITS

- Cloud-based
- Seamless deployment
- Fast and Secure
- Customizable
- User-friendly
- Mobile

IMQS IN NUMBERS

- **143 534 km** combined length of water pipes
- **3 892 086** lines of code used to program our software and counting

Interfaces for the enterprise software follow REST principles, both internally and externally. All constituent services have a published API as their primary interface. These interfaces are the foundation on which the browser-based front-end is built. Standard protocols, like HTTP with JSON payloads, however, make it effortless for third parties to consume them for integration purposes. Authentication and authorization services enable security on the interface level.

IMQS's web-based stack runs on enterprise operating systems, including Linux (with Docker containerisation) and Microsoft Windows Server. Database technologies include Microsoft SQL Server and PostgreSQL, which are both tried and tested in high-demand environments.

A dedicated DevOps team manages on-site deployments from a central point. IMQS DevOps makes use of in-house developed, fit-for-purpose tools to manage client-specific data and configuration. The IMQS operations team attends to monitoring server health and service performance by using state-of-the-art monitoring software. This enables fast detection and pro-active response to potential issues in the production environment.

KEY FEATURES

GEOGRAPHIC INFORMATION SYSTEMS

The GIS functionality implemented in the IMQS Pipe Replacement Module shows the water and sewer network infrastructure overlaid on a spatial map in order to visualize the complete reticulation network of an area defined by municipal boundaries. The pipe infrastructure is made up of various layers, which includes pipes, water sources, valves, etc. Each layer is broken down into more detail and categorized according to a legend. The pipe network could be categorized according to pipe diameter where each range of diameters is colour coded on the map to be easily identified.

OPERATING SCENARIOS

In the context of pipe replacement prioritisation, Operating Scenarios represent a specific spatial view of data. For the PRP Module, scenarios are configurable according to client specifications. Four configurations within the model allow a user to spatially view pipe replace-ment priorities according to: 1) geographic area; 2) pipe types (rollups); 3) year and 4) data-set scenario.

THEMES

In IMQS, themes provide a user with the ability to easily interpret the data by spatially display-ing map objects in the form of shapes, symbols and colours. A theme comprises multiple layers, where each layer contains data of the same type like water pipes, valves or water sources. Each layer in turn uses one field within the dataset. This means that values contained in the field are grouped into ranges and each range is then reflected as a specific colour on the GIS Map. The data is then displayed as a point, line or polygon on a map, where the colour and symbol is defined by the theme.

BESPOKE REPORTING

The reporting system is based on standard engineering reports that can be viewed on the IMQS built-in reporting platform. The reporting platform includes standard reporting tools such as filtering on a report or global level, but also more advanced capabilities that produce more complex reports, which in include graphs.

COMPREHENSIVE DATA GRIDS

Comprehensive Data Grids display data on a GIS Map in a list format. Users are able to find a range of features, like water pipes, based on simple or more complex joint-filtering criteria. Other features such as sort, filter, export and conditional statements selection are also included.

TELEMETRY

The Telemetry system implemented in IMQS provides its user with a spatial view of the operational status of their water network. Data is gathered from sensors across the water network and converted into information that can be displayed spatially on a GIS Map. Each cluster of sensors is represented by a symbol on the map and can provide its user intelligence to inform monitoring and decision-making.

RISK ANALYSIS

In the IMQS PRP Module, users are able to determine pipe-replacement priority against four Risk Factors: 1) Likelihood of Failure (LF); 2) Consequence of Failure (CF), 3) Frequency of Failure (FF); and 4) Assessed Condition (AF). The PRP value is determined by multiplying each factor (LF x CF x FF x AF = PRP Value). Consequently, the pipe with the highest PRP value has the highest replacement priority.

SUB-FACTORS

Each of the above Risk Factors consists of several sub-factors that make up the Risk Factor value. The sub-factor value is determined by multiplying a score and weight percentage. The score is a value of out 5, where 1 is the lowest contributing factor. The weight percentage is acquired from various sources such as SPIM.
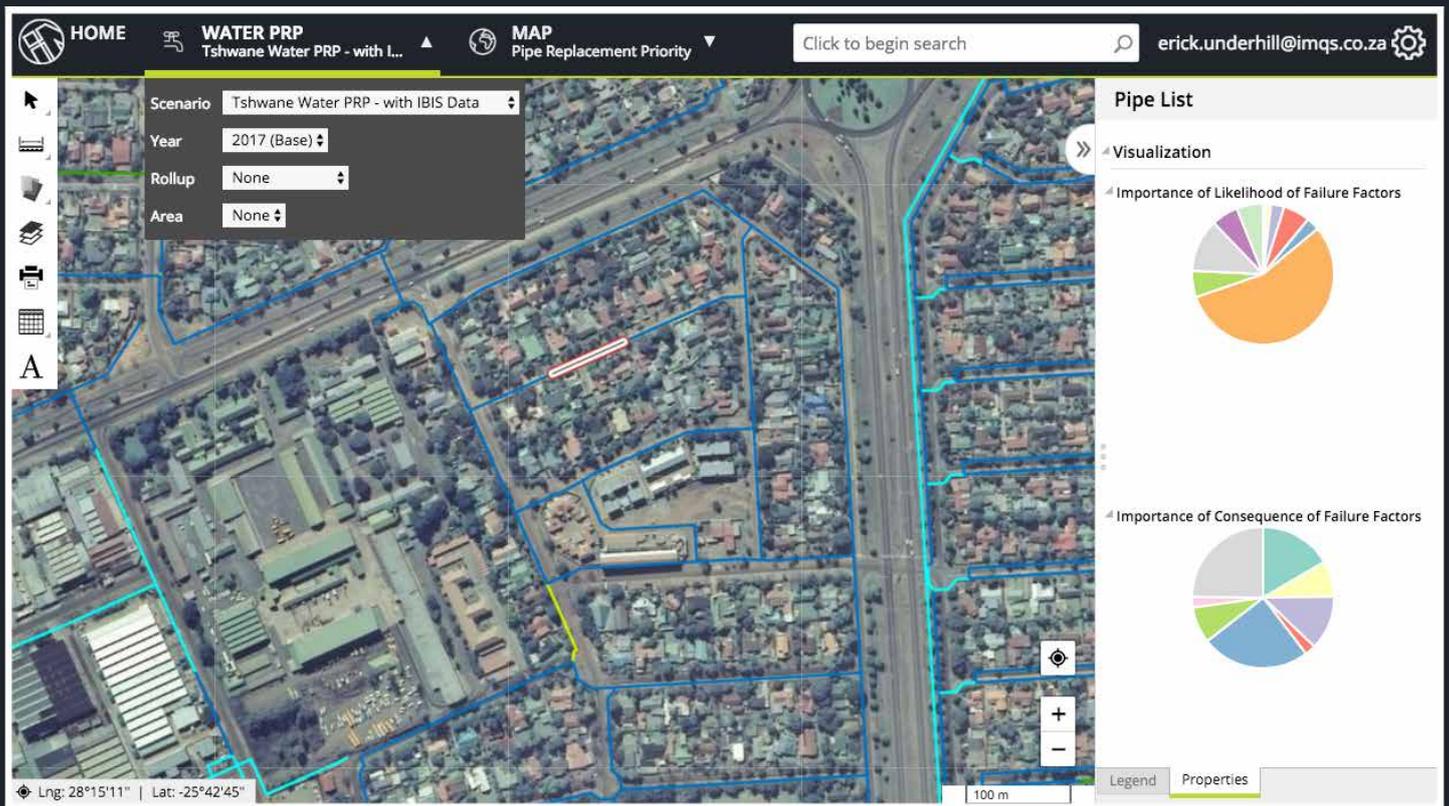

Image 1: Data Visualisation

KEY FEATURES (continued)

FAILURE POINTS LAYER

The failure point layer provides the user with a geographic view of the year(s) within which a pipe failed. This view allows a user to gain a historical perspective of pipe failure, enabling informed decision-making to better allocate funds.
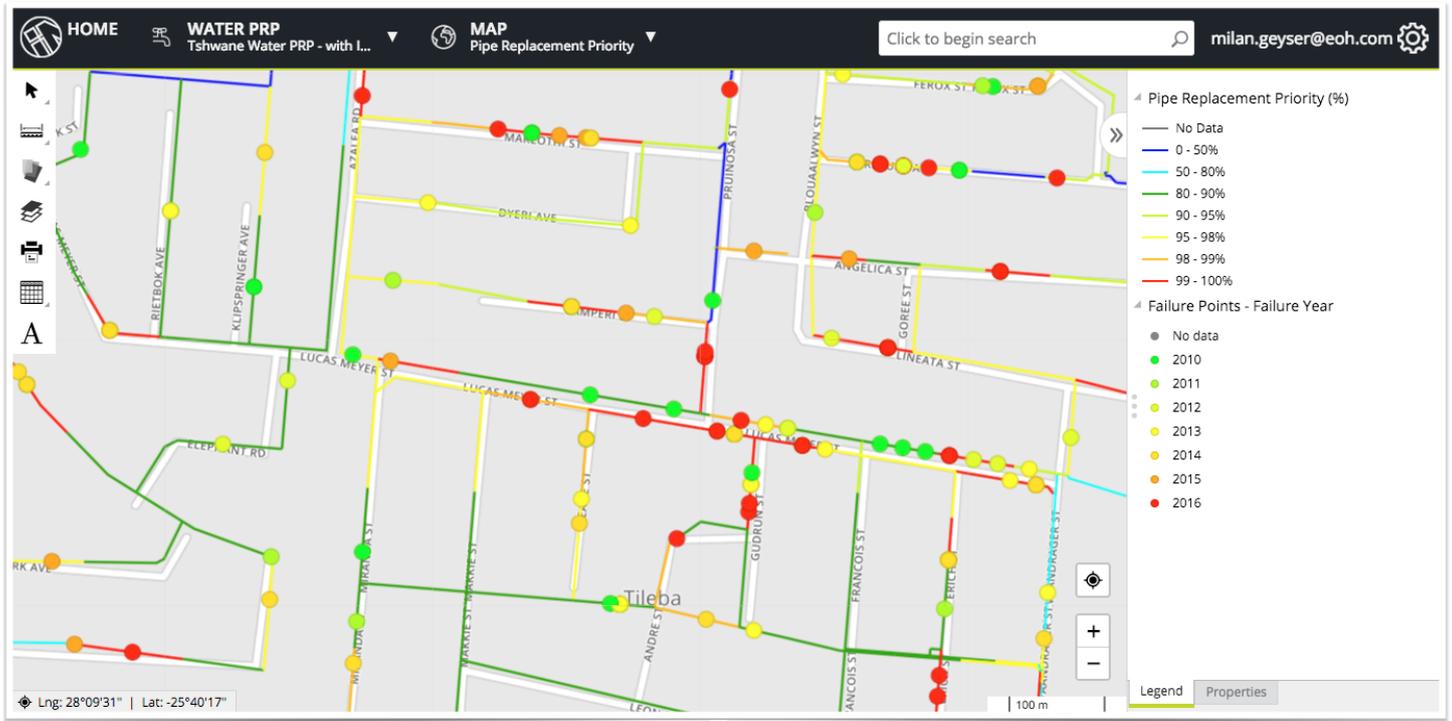

Image 1: Failure Point Layer

CONCLUSION

The IMQS PRP Module empowers municipal agents to make better decisions surrounding water and sewer pipe replacement. The module enables a proactive approach to pipe replacement, which saves valuable money and thwarts the risks associated with asset failure. In so doing, this software package helps municipalities to achieve greater customer satisfaction by ensuring unbroken service and the better use of public funds. The geographic visualisation of information makes IMQS a key node in the pipe replacement decision-making process. While IMQS maintains its own powerful GIS system, the module integrates effortlessly with other GIS ERP systems, such as ESRI. This offers users the freedom to work on their preferred GIS platform without having to waste time by switching between systems.

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