

Selecting mains for rehabilitation through the Cluster Analysis' predictive value

brabant Water

Client: Brabant Water (Brabant Water N.V.)
Country: The Netherlands
Period: 2020

Case

Brabant Water is a Dutch drinking water utility company providing drinking water to 2.5 million inhabitants and 50,000 companies. The company has more than 18,000 kilometer of mains in order to transport 180 million m³ of water per year. In order to meet performance requirements of the network, the company has the ambition to prevent a rise of the current number of failures in the aging network. Brabant Water has asked Spatial Insight to help identify water mains with the highest likelihood of failure based on asset and failure data.



Figure 1. Water main with historic failures

Approach and solution

In Spatial Insight's experience, mains with similar characteristics that were installed in a single project, will show comparable performance when aging. This knowledge is used to group mains and predict their chance of failure. The grouping of these main-sections is called clustering and is performed in a cluster analysis.

Spatial Insight previously developed the cluster analysis method and now, in close cooperation with Brabant water, further improved and refined it. Cluster analysis relates pipes in each other's immediate proximity and with comparable characteristics such as pipe material and installation year. These clusters allow analyzing historic failure behavior of larger sections and thus selecting water mains that have the highest chance of failure. The effect of leakages was not taken into consideration in this study. Although certainly possible, this was not requested.

The method comprises of three iterations:

- Targeted clustering: finding the optimum of capturing as many failures as possible with the lowest cumulative cluster length.
- Predictive value: a filter was developed in order to select the set of clusters with the highest cumulative number of predicted future failures per total cluster length.
- Cluster set generation: running all possible filter settings led to the selection of a set of clusters that are most effective with the least effort. By replacing approximately 250 km of mains (1,4% of the total length of Brabant Water's main network), 20% of the leakages of 2019 can be prevented (red circle in Figure 2). Two extra cluster sets with lower priority were generated (orange and yellow circles in Figure 2, colored lines in Figure 3).

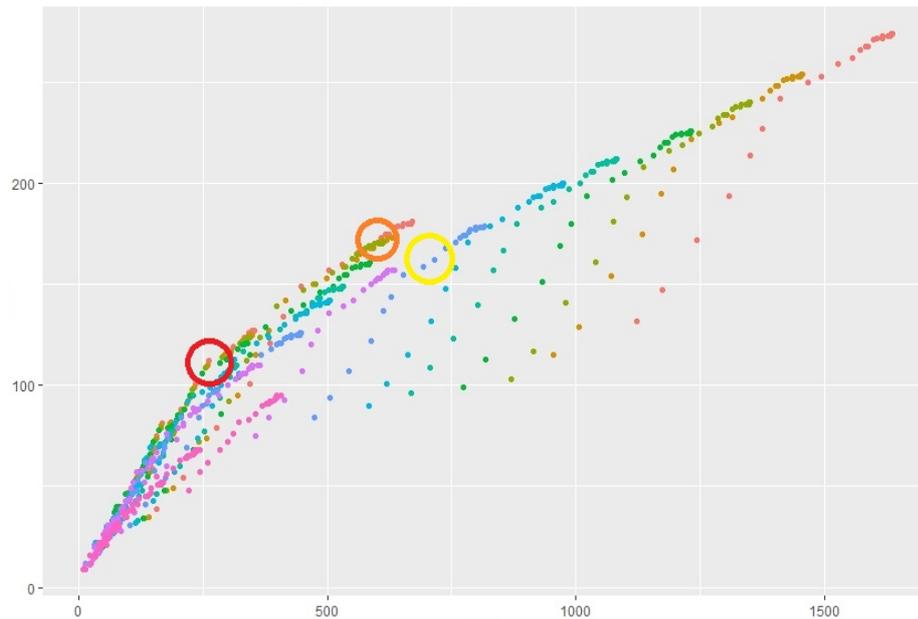


Figure 2. Selection of filter settings for selection of the right cluster set. The cumulative cluster length (x-axis) leads to a yearly amount of leakages (y-axis).

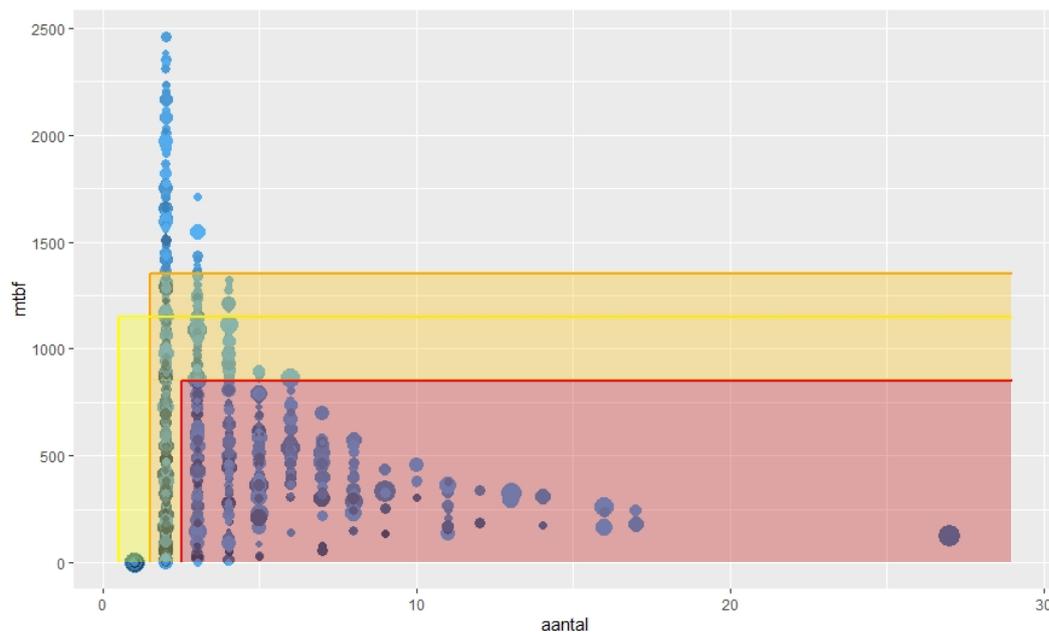


Figure 3. Individual clusters (blue dots) with the amount of failures (x-axis) and 'Mean Time Between Failure' (y-axis). The red, orange and yellow lines represent the filter settings by which clusters sets are selected.



Figure 4. A selected cluster that contributes significantly to the total number of leakages.

Contribution to the organisation's strategy

Brabant Water's top priority is to ensure that its customers can count on fresh and reliable drinking water every day. The network plays a vital role, it distributes water to the customer. This function is threatened by the aging of the network. Aging results in higher non-revenue-water, burst rates, customer-minutes-lost, and customer contacts. These threats can be mitigated by addressing them from an asset management point of view: replace the right mains at the right time, with maximum effect, against minimal costs.

Customer review

Roel Diemel, senior advisor assetmanagement at Brabant water: "The cluster analysis' predictive value of Spatial Insight, contributes to the selection method of Brabant Water for the annual renewal program of pipes".

More information

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