BTO Executive Summary

Comsima can, with good quality input data, effectively predict the failure behaviour of asbestos cement mains

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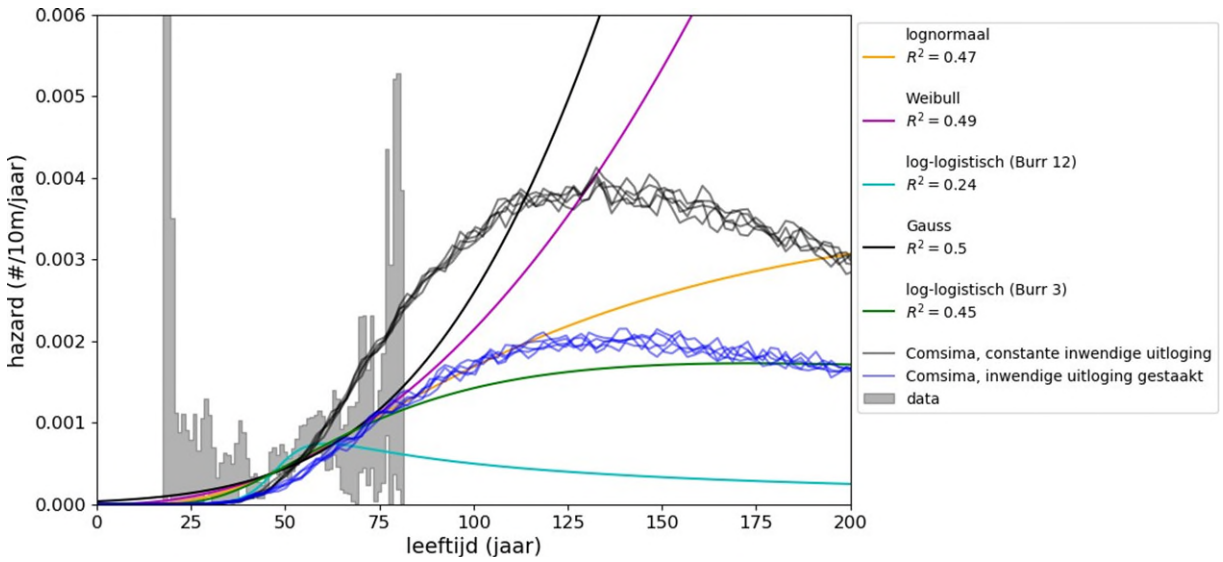
For their tactical and strategic decisions concerning the renewal of drinking water distribution networks, drinking water utilities can use pipe condition predictions based on historical failure data, by choosing a suitable model for the description and possible extrapolation of the historical data. The choice of this model is supported with the pipe-condition model Comsima, and is therefore based on knowledge about the physical processes behind pipe degradation. This is a promising approach, but it makes great demands on the drinking water utilities with regard to the collection of operational data.



Five probability distributions that are frequently used to describe and extrapolate failure behaviour, fitted to the failure data from Brabant Water. Also shown, for comparison, are two predictions of the failure behaviour with the Comsima physical model. In this manner, a choice for a particular distribution can be supported by the physical knowledge behind Comsima.

Interest: informed failure predictions for tactical and strategic decisions

For short-term tactical decisions – for example, about pipe replacement prioritisation – drinking water utilities can be guided by predictions based on historical failure data. But this requires that a suitable model be chosen to access the historical data.

Moreover, long-term predictions are also needed to support more strategic decisions. This calls for an informed method with which to project the historical data into the future, for which no data are yet available. The use of Comsima to translate pipe information into failure behaviour is one means of choosing a curve and supporting its extrapolation.

Approach: understanding long-term failure behaviour through knowledge of underlying processes

The condition (calculation) model Comsima was used to support the choice of a suitable model with knowledge of the physical processes underlying pipe degradation. The Comsima calculation model determines whether the condition of a pipe segment is satisfactory, based on an inputted description of its stress and position. Comsima's aging module shows how these, and thus the pipe condition, change over time. By feeding the model with the spread in the situations of a group of mains – asbestos cement pipes in Brabant Water's drinking water distribution network – the group's failure behaviour could be modelled. In order to determine whether the model sufficiently corresponds with the reality, the modelled failure data were compared with the measured failure data taken from the USTORE failure data base, thus enabling confident predictions about future failure behaviour.

Results: Comsima predictions agree with the historical data, but are sensitive to input parameters

The sensitivity analysis showed that the Comsima model corresponds better with the historical data when it is fed with good operational data. The quality of these operational data is improved by:

- taking into account pipe quality differences that originate in the pipe manufacture, rather than assuming the catalogue values;
- not drawing only on measurements on pipes that have been removed because they were defective;
- taking account as much as possible of values that change over time, such as the drinking water composition.

The model predictions of Comsima, in terms of order of magnitude and form, agree sufficiently with the historical data to support a choice for extrapolation. Nevertheless, the extrapolation of failure data is based on considerable simplification, an inevitable result of the current data availability.

Implementation: condition prediction is promising, effort is necessary for the collection of operational data

The use of a condition model to predict future failure frequencies is promising. It is clear however that such an approach will demand a great deal from drinking water utilities with regard to the collection of operational data.

Report

This research is described in the report *Toepassing methodiek voorspellen toekomstige storingsfrequenties: resultaten van een pilot met AC* (BTO 2019.050).

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