WaPUG Autumn Meeting 2006

UKWIR Deterioration Rates of Sewers Project

Richard Long – Ewan Group plc

Introduction

During 2005 and the early part of 2006, Ewan Group plc and Exeter University undertook the 'Deterioration Rates of Sewers' project for UK Water Industry Research Ltd. This paper briefly describes the objectives of the project, the conclusions drawn and the recommendations made.

Objectives

Current rates of investment in sewer replacement, renovation and maintenance represent only a small fraction of the value of the asset base. Concerns have been raised over the sustainability of such low levels of investment and the continuing ability of the sewer stock to deliver long-term stable serviceability to customers and the environment. The key objectives of this project were to assess current deterioration rates of sewers, to produce a sewer deterioration model for use in the next business planning cycle, to identify data gaps and to recommend how CCTV and other data can be better used.

Conclusions

This work has developed a process and methodology to robustly model the deterioration of sewer performance. This can be used both in the business planning process to determine appropriate future investment strategies, and as part of 'business as usual' sewer operational management. Much time was spent in the project considering the benefits of defining sewer deterioration at the pipe level or at a small-area level. A survey of the data that water companies hold on sewer attributes, performance failures and interventions showed that for most companies at the present time a pipe-level approach to sewer performance modelling could not be used. This project has successfully developed an area-based approach in which the sewer assets in areas of similar age are characterised by indicators that do not require such detailed information. For those companies with more comprehensive data sets the methodology can be applied at a pipe level with equal effectiveness.

Using innovative Evolutionary Polynomial Regression analysis software and applying the techniques to the two pilot catchments of Derby and Brighton & Hove it has been shown that performance failures (blockages and collapses) can be predicted with confidence of up to 90%. The method produces a range of explicit models relating system attributes to performance. These models can then be used to test the effect of different interventions over a period of time according to the level of asset detail available. This provides the basis for a whole-life costing approach to capital maintenance planning of sewer networks.

The models that can be developed from this approach are equally applicable to predicting performance and can be used to define probability of asset failure. The approach will therefore be invaluable to companies when applying the UKWIR Common Framework for Capital Maintenance Planning as part of a risk based approach. A key benefit is that the models developed here negate the need for weighting and scoring using risk trees and hence significantly reduce reliance on expert judgement.

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At present there are no nationally applied standards for gathering, storing and processing sewer data. Each company is using different standards and methods. There is, for example, no consistently applied definition of what should be recorded as a collapse, which means that comparisons between companies are difficult to make and standard models and methods cannot easily be applied.

Historically, the availability of sewer condition data has been heavily skewed towards critical sewers. Future survey programmes should be better balanced to include more of the non-critical sewers. To improve the usability of the output and to make a larger programme of survey more affordable, new survey technology that automates the analysis and reporting of the survey results while at the same time dramatically reducing costs is required.

Recommendations

At the present time each sewerage company should develop its own sewer deterioration models. Whether these should be at the level of individual assets or for groups of assets depends on the data that each possesses. Using the methodology outlined in this report, companies can identify the critical data to collect. Companies should harmonise their data polices so that consistent definitions of condition, performance and service issues are developed. The industry could do this by co-operating to establish a National Sewer Failure database.

To provide better data on the condition of the nation's sewers, a strong recommendation of this report is that a programme of repeat sewer surveys should be established. By collaborating in a national initiative with each company contributing, a meaningful proportion of the network could be surveyed. By repeating the surveys at intervals over an extended period of time a true picture of the state of the nations sewers could be obtained, together with the essential data that will in time lead to a better understanding of the processes of deterioration. Given the cost of CCTV and its limitations in monitoring deterioration, the industry must do more to promote innovation in sewer inspection techniques.

Benefits

The benefits of having a better understanding of how such a vital part of the nation's infrastructure as the sewerage system is deteriorating can hardly be overstated. The cost of reconstructing the system would be enormous, but no less significant would be the impacts of deterioration in terms of health, flooding, pollution and the disturbance to normal life that extensive remedial work would cause.

The development of robust predictive models for sewer condition, performance and service will allow whole-life cost approaches to capital maintenance of sewer networks to be established. The industry will be able to prepare compelling business plans to ensure that sewer networks provide service to the community in the long term. Companies will be able to use the same methods as part of their ongoing management process too, allowing the regulatory cycle to be integrated with 'business as usual'.

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Harmonising the standards companies use for recording, storing and processing data will allow more accurate comparisons of performance to be made and give a clearer picture of deterioration as it occurs. It will also help to spread best practice throughout the industry.

Extending sewer condition surveys to a more representative sample of sewers and improving understanding of the state of the nation's assets through a programme of repeat surveys will show how the condition of the sewer system is changing over time and will provide the essential data on which future improvements in asset management techniques will be based.

Further Information

The project report 06/RG/05/15 is available from UKWIR, 1 Queen Anne's Gate, London, SW1H 9BT.

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(1) Ewan Group plc

(2) Exeter University Centre for Water Systems