British Precast Drainage Association

Publications from the British Precast Drainage Association (BPDA):

BPDA was formed in 2017 from the integration of the Concrete Pipeline Systems Association (CPSA) and the Box Culvert Association (BCA).

Information published by both CPSA and BCA will be rebranded and replaced as BPDA in due course. New material will be branded BPDA.

All CPSA and BCA web traffic will be redirected to the new BPDA web site at www.precastdrainage.co.uk

Managing the long term serviceability of sewers

This paper explores the gap between the actual service life requirement for gravity sewer pipelines and the design life of a sewer pipe / system. It also demonstrates how concrete pipes can help asset managers minimise the costs associated with maintaining the long term serviceability of our sewer network.

Introduction

With a long history dating back to the mid 19th Century, and well over 368,000 km of sewers (EUREAU, 2009), the UK has one of the largest and oldest sewerage networks in Europe. In 2002 OFWAT noted that the cost of replacing the UKôs ageing sewer network (estimated to be around 309,000 km at the time) could cost over £200 billion. With the transfer of ownership of an estimated 220,000km of private sewers and lateral drains to water & wastewater companies in October 2011 and that these sewers are thought to be in a worse condition than existing public sewers, the burden of renovating and replacing our ageing sewerage infrastructure has almost doubled. The state and long term serviceability of the sewer network and has been identified as an investment priority in the governmentôs White Paper ñWater for Lifeò published in December 2011.

Understanding design life and service life

Service Life Planning and Management literature make a clear distinction between the design life of a specific product and the number of years it can serve fulfilling a specific function considered safe and satisfactory for the end-user. CPSA has consulted with wastewater industry practitioners and developed the following definitions for Design Life and Service Life with sewer systems specifically in mind.

Design Life[1] may be defined as ñthe projected life in years of a new structure or structural component under predicted loading and environmental conditions before the anticipated performance falls below the original minimum design requirements. It is normally the period over which the asset's depreciation is charged and should include normal and routine maintenance.ò
Service Life[2] can be defined as ñThe period for which an asset is predicted to be usable without major repairs or replacement where some loss of performance and integrity may be toleratedò

It is common for a sewer to be fulfilling its function despite passing its design life. This will depend on a number of factors associated with its structural condition and the nature of service it needs to offer (for example, it may only be required to drain storm water or sewage occasionally).

Hau et al (2003) noted that the majority of the sewer network around that time was over 80 years old. This indicates that a sizeable proportion of the UKôs current network consists of assets at or approaching the end of their design life. This raises questions about the true impact of the widely ranging design lives for gravity sewers defined by Water Companies (50-125 years), the length of time beyond the design life that the pipeline can remain in service and the cost of maintaining the pipeline throughout its design and service life.

Calculating the service life requirements of sewer pipelines in the UK

CPSA calculated the service life requirement for wastewater sewerage networks by examining the annual renovation and renewal rate statistics submitted to OFWAT by the 10 UK Water and Wastewater companies between 2006 and 2010. Figure 1 shows the average service life requirement for the total wastewater network and for critical sewers over this five year period.

[1, 2] These definitions are generally consistent with the generic definitions found in existing ISO/BS Standards.

The average length of time required to renovate or replace the entire UK network ranges between 576 years for critical sewers and 879 years for all sewers. The minimum replacement/renovation time recorded was 127 years for Wessex Water (for critical sewers in 2008) and the maximum was 16,536 years for Yorkshire Water (for critical sewers in 2010). This worrying gap between the design life of sewers and the actual service life requirement is highlighted in the governmentôs White Paper ñWater for Lifeò, published in December 2011. It notes that only 1% of public sewers in England and Wales were replaced or rehabilitated between 2000 and 2008 and warns that if we continue to invest at that rate it will be about 800 years before the existing system is covered.

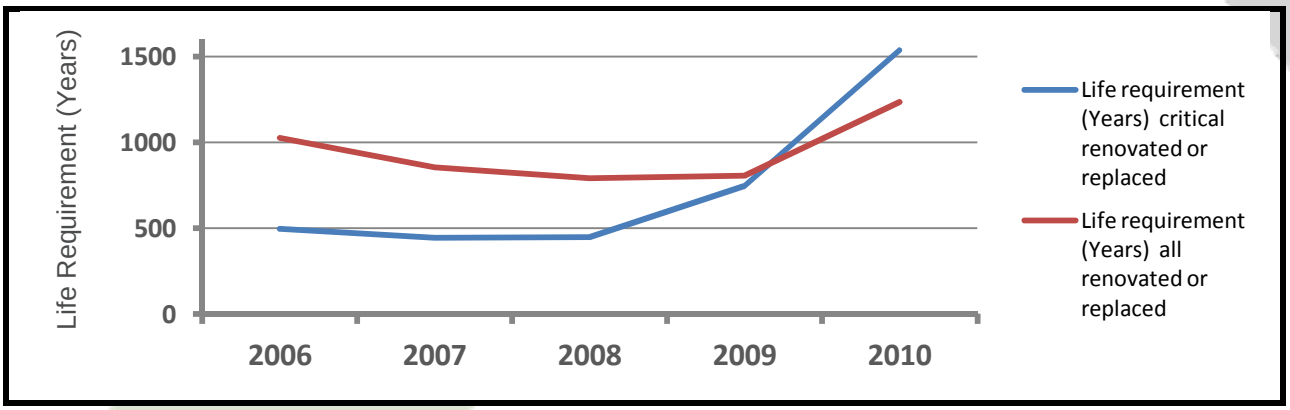

Figure 1. Average number of years required to renovate or replace the public sewer network (2006 to 2010).

There is no doubt that more investment is needed on renovation and replacement of the UKôs sewerage infrastructure. By only looking for a 50 to 125 years design life and without considering what might happen when that period ends, designers risk creating a considerable long-term burden on future generations as the problem with the UKôs ageing sewerage infrastructure intensifies. For new construction and replacement of existing pipeline assets, the appropriate design and selection of materials can help mitigate some of these effects. Concrete pipes have a proven, long service life which frequently exceeds a 100 year design life: for example, in the United States, sections of a 6 inch concrete sewerage pipe first installed in 1840-1842 were exhumed, tested in 1982 and were found to be in a good condition (American Concrete Pipe Association, 2011). Parts of that pipeline in Mohawke, NY are still in operation to date.

References

- EUREAU (2009) EUREAU Statistics Overview on Water and Wastewater in Europe -2008. Brussels, 2009.
- DEFRA (2011) Water For Life. A Consultation White Paper. London, December 2011.
- Hau, Y; Clarke, B; Howes, C; Cunningham, R.; Mathews, M (2005) Defects in sewer pipe joints and water tests. *Proceedings of the Institute of Civil Engineers, Water Management* 158. Issue WM 3, Paper 14044, Pages 119- 125. September 2005.
- **American Concrete Pipe Association** (2011) Concrete Pipe News Spring 2011 Volume 63 No. 2.

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