

**DSD R&D Report No. RD 1091**  
**Study for Causes of Deterioration to Sewers and Drains**

**Executive Summary**

**Background**

This R&D item no. RD1091 is to study major causes of deterioration to underground sewers and drains, propose measures to improve the durability of sewers and drains and recommend field tests for investigation of in-situ corrosion characteristics. It is covered under a Consultancy Agreement No. CE 56/2011 (DS) – Enhanced Management of Underground Sewer and Drain Networks by Black & Veatch Hong Kong Limited (B&V). The Assignment is to carry out a Feasibility Study (FS) on enhanced management of sewer and drain networks in Hong Kong.

**The R&D Study**

The Study comprise two stages. Stage 1 covers the following research and development studies on major causes of deterioration to sewers and drains:

**Part 1: Working Paper No. 2 – “Working Paper on Subsided Cases Analysis & Causes of Rapid Deterioration”**

The objective of this Working Paper is to investigate the causes of a number of failure cases that have occurred in recent years and to analyse the factors contributing to the rapid deterioration of sewers and drains.

Literature review of causes of rapid deterioration, investigation on DSD pipe incidents records and analysis of Grades 4 and 5 pipes/culverts have been done. Further, more than 30 DSD staff have been interviewed for the study of subsided cases and rapid deterioration. It is concluded that the major causes of failure include wear and tear, hydrogen sulphide attack, aggressive soil, chemical attack, mechanical damage and loss of ground support.

**Part 2: Working Paper No. 7 – “Working Paper on Study Causes of Deterioration to Sewers and Drains”**

The objective of this Working Paper is to investigate the major causes of deterioration to the sewers and drains of different materials with a view to improving their durability. The failure modes and mechanisms of different pipe materials have been identified and analyzed. Metallic pipe is generally

suffered from corrosion problems, while the main failure mechanism of PVC, VCP, GRP and PE pipes is structural cracking. Concrete pipes are deteriorated by both reasons.

Design and operation issues that would accelerate the deterioration of the pipes are also discussed. There are numerous existing pipes with gradient lower than 1:500 resulting in silting problem as self-cleansing velocity cannot be achieved. Besides, the extraction of grey water from the sewage could increase the concentration of black water resulting in the increase of the septicity of sewage and hence the generation of hydrogen sulphide. Other issues such as availability of air relief valves in rising mains and external disturbance are discussed.

Based on the above mentioned discussion, the paper provides recommendations on enhancing the durability of sewers and drains, including provision of polyethylene encasement and cathodic protection for metallic pipes, wider use of PE pipes, performing scrutiny of design and regular maintenance work, exploration of new pipe materials and products, proper record of failure incidents, etc.

Stage 2 comprises the field test and condition survey for 8 nos. of selected sewage rising mains for the investigation on the in-situ corrosion characteristics. Post field test and condition survey analysis reports are prepared by the specialist for the assessment of condition of sewage rising mains. Besides, condition assessment methods for sewage rising mains are discussed and recommended by B&V for future reference.