WATER SERVICES
ASSOCIATION OF AUSTRALIA

Classification of water pipe liners

Introduction

The following fact sheet gives information about the four classes of cured in place pipe (CIPP) and spray liners. The majority of the information was gathered from AWWA M28 (2014) and ISO 11295 (2017) and adapted for Australian lining projects. Recommended pipe liner class for different modes of failure is shown in Table 1.

Table 1. Recommended pipe liner classes for different modes of failure in host pipes (adapted from (AWWA M28 2014); Ellison et al. (2015); (ISO 11295 2017)).

Estimated future condition of pipe	Class I	Class II	Class III	Class IV
Minimal deterioration (no corrosion pits)	Yes			
Isolated corrosion pits (including through holes)		Yes		
Leaking joints		Yes	Yes	
Reduced ring stiffness (vacuum, external loads)			Yes	Yes
Burst failure, circumferential (broken back) failure, shear failure				Yes

Class I liner

Class I liners are non-structural. The main purpose of a Class I liner is to protect the inner host pipe from corrosion, which can improve the hydraulic capacity (reduces build-up of corrosion products and tubercles) of a structurally sound host pipe. The liner is typically sprayed, and generally no structural support is given or used in calculation from the liner. The liner has minimal ability to bridge joint gaps and corrosion holes. In addition, it is assumed that Class I liners do not contribute to leakage reduction. Class I liners including cement mortar liners have been present in Australia since the 1930s. The UK has used epoxy resin, polyurea, and polyurethane as Class I liners to improve water quality and flow, however these are less commonly used in Australia.

Class II liner

Class II liners are semi-structural used inside a host pipe for semi-structural support, improving water quality and improving hydraulic capacity (varies depending on previous condition and liner thickness). Class II liners require adhesion to the host pipe and should be able to extend the life of a partially deteriorated pipe by reducing leaks. All loads are transferred to the stiffer host pipe material (in the case of cast iron) and therefore only the liner sustains internal pressure loads at discontinuities in the host pipe (such as corrosion holes). Polyurethane or polyurea are Class II liners typically used at present.

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Class III liner

Class III liners are similar to Class II liners with the exception that Class III liners should be able to withstand inherent ring stiffness (not rely on adhesion to the host pipe). Class III liners are CIPP or fibre reinforced spray liners (new on the market and unconfirmed liner class).

Class IV liner

A Class IV liner is a fully structural liner and must be able to withstand all of the following: partially deteriorated host pipe, fully deteriorated host pipe, reduced ring stiffness, leaking in pipe or joints, circumferential failures and longitudinal splits. Class IV liners are suitable for pipes in a deteriorated state (through-holes, leaks and cracks may be present). Class IV liners should be tear-resistant and have the ability to hold water under the failure of the host pipe. Connections, joints and end seals must be adhered or sealed to the liner. The liner does not need to adhere to the pipe, however water tightness must be satisfied. Typically, Class IV liners are CIPP with glass or fibre reinforced layers.

References

AWWA M28 (2014). Manual M28 - Rehabilitation of water mains. AWWA (American Water Works Association), Denver, Colorado, USA.

Ellison, D., Ariaratnam, S., Allouche, E., and Romer, A. (2015). The assess-and-fix approach: Using non-destructive evaluations to help select pipe renewal methods, Water Research Foundation, U.S.A.

ISO 11295 (2017). Classification and information on design and applications of plastics piping systems used for renovation and replacement. International Standard Organization, Geneva, Switzerland, pp. 1–50.