Concrete Pipe Association of Australasia

ASSESSING INTERNAL ENVIRONMENT FOR PRECAST MAINTENANCE CHAMBERS

Use of precast concrete access and maintenance chambers provide asset managers with the opportunity to adopt quality structures that are resilient to applied dead and live loads with the durability required for a 100 year in service life.

AS4198:2022 Precast concrete access and maintenance chambers for sewer applications is a performance-based standards that was developed to supersede AS4198:1994 Precast concrete access chambers for sewer applications.

A major change incorporated into the new standard is around product durability requirements. Concrete in sewer can be detrimentally affected by biogenic H2S corrosion, however research and practice has established that concrete material and performance specification, aggregate choice and cover to steel requirements combinations can be utilised to design product for a 100-year in-service life.

The content of the durability section was well considered with substantial review of reference material and consultation with industry experts in Australia and worldwide. As there is no universally accepted model for the evaluation of the levels of biogenic corrosion to which access/maintenance chambers are exposed. The USA EPA Process Design Manual for Sulphide Control in Sanitary Sewage Systems was used to define the additional durability requirement for the moderately (as compared with mildly) aggressive exposure classification, based on the EPA formulae for pipe corrosion.

The internal and external environments are considered separately, providing guidance and specification of appropriate durability measures applicable to a given set of circumstances. This approach was taken to ensure economical asset management and allowing sustainable practices to minimise climate impacts of unnecessary onerous specification. Use of more efficient constructions, maintenance and operations material and processes

Significantly, Appendix I, Guide to determining Exposure Classification provides a flowchart for Asset Managers to utilise to determine appropriate durability requirements to deliver a 100-year in-service life. Exposure classifications are defined as non-aggressive, mildly aggressive, moderately aggressive, or highly aggressive, based on the expected rate of biogenic H2S corrosion of the internal surface of the concrete component.

Following the flowchart based on system parameters and conditions, an appropriate exposure classification can be determined. Considerations in determining the flow chart are outlined below:

- Sewer pipe configuration and size hierarchy differ considerably across sewerage network utilities. Typically, reticulation sewers from DN150 to DN300 collect property sewer flows. Branch sewers, or in some instances, main sewers convey sewage from smaller reticulation sewers into larger trunk sewers that convey major flows to sewage treatment plants.
- Some sewer networks typically define sewer sizes from DN300 or DN375 to DN600 (and even up to DN975) as branch sewers while others define sewer sizes from DN375 to DN975 as principal reticulation or main sewers. Hence the sewer nomenclature and sizes shown in this flowchart are broadly indicative only and will vary from utility to utility.
- The areas and reach of gravity (non-pumped) urban catchment sizes are, typically, limited by urban land topography. Pumping station depth is typically constrained by constructability and economics. This inevitably requires a considerable number of pumping stations across reticulation and larger sewerage networks. Detention of sewage in pumping wells over lengthy periods, together with pumped flow and in-system turbulence, inevitably accelerates sewer gas release and, with it, increased environmental corrosivity potential and acidity in downstream catchments.
- Outflows from industrial/commercial developments into downstream sewerage systems frequently contain organic and acidic constituents that contribute to the depletion of oxygen and acceleration of corrosive gas releases and acidic corrosion environments in downstream concrete components.
- Sewage flow turbulence occurs in all parts of sewer networks at and downstream of property sewer discharges i.e. at significant points of sewer grade change, horizontal sewer direction change (i.e. hydraulic jumps) and downstream of drop sewer and pumped discharges

- The environmental conditions that are pre-requisite to a significant rate of internal concrete corrosion include exposure to aged sewage, high sulphide levels, low/reduced DO levels, H2S gas levels higher temperatures and humidity and low pH.
- The upstream movement of sewer gases from larger downstream non-reticulation sewers can often be prevented by the use of boundary traps, and other gaseous barrier mechanisms, where installed in legacy systems or incorporated into planned sewerage system specifications. Smaller upstream reticulation sewer systems that directly serve residential properties are commonly ventilated by means of upstream property ventilation pipes that have been installed in accordance with the appropriate property building regulations.
- The selection of access and maintenance chamber components that will deliver service longevity in local sewerage networks will typically need –
  a. assessment and/or measurement of local corrosion precursor data, typically sewerage age and levels of sulphide, DO. H2S, temperature, humidity, pH
  b. local modelling, recording and analysis of precursor corrodents and biogenic corrosion data and
  c. adoption of the level of (precast concrete access and maintenance chamber) internal environmental aggressivity that best matches local business corrosion risk parameters.
- It should be noted, that typically, established corrosion models do not include the use of antimicrobial additives, being proprietary formulations. Where these additives are considered for use, additive performance and additive effect on concrete design life should be determined and accepted by agreement between manufacturer and purchaser. All additive heavy metals and other potentially toxic chemical constituents should be declared so that the consequential environmental impacts are appropriately addressed.

FLOWCHART TO DETERMINE INTERNAL SURFACE EXPOSURE CLASSIFICATIONS