TECHNICAL NOTE

TECHNICAL INFORMATION FROM THE CONCRETE PIPE ASSOCIATION OF AUSTRALASIA

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ACCEPTANCE TESTING OF CONCRETE PIPE

AS/NZS 4058 – 2007 "Precast concrete pipe (pressure and non-pressure)" is a performance based Standard which requires the manufacturer to carry out a number of tests to demonstrate compliance with the Standard.

Performance specifications are used for products which can be tested for serviceability and allows the manufacturer to demonstrate a high level of consistency and repeatability through tight controls of materials, process and testing.

For steel reinforced concrete pipe there are a variety of type tests and routine tests in place that must be completed by manufacturers to ensure that concrete pipe is fit for purpose. However, the two main routine tests that prove that concrete pipe is accepted for use on any given project are the **proof load test** and the **water absorption test**.

1. Proof load test: This is the primary performance test to prove that the concrete pipe produced is **STRUCTURALLY** adequate and will perform under the designed loads. The supporting strength of a buried concrete pipeline is dependent on the structural strength of the pipe, the type of foundation, and the compaction of the fill material adjacent to the pipe.

Commonly conducted throughout the world, it can be performed using the three-edge or two-edge bearing test. In both cases a machine is used which is designed to apply a force in a true vertical plane, parallel to the vertical centreline, and extending the full length of the specimen. Using the three-edge bearing method the test specimen is supported on two parallel longitudinal strips and the load (force) applied through a top bearing beam. The two-edge bearing method uses the same methodology but the test specimen is supported on one longitudinal strip.

AS/NZS 4058 defines proof load as *"the specified load applied to and sustained by a pipe without the appearance of cracks greater than the appropriate test crack".* The load is applied at a steady rate along the pipe length until the proof load is reached. Whilst this proof load is being maintained the pipe is inspected internally and externally for cracks. The crack width (maximum of 0.15mm for 10mm cover) is measured using a special feeler gauge, and then the proof load is removed. After the load has been completely removed any crack remaining is measured again to ensure it is within the limits.

This is the most severe test that a concrete pipe will be subjected to as it has no lateral support (as found in buried conditions) and the applied forces in the test are virtually point loads.

Concrete pipe that passes this test means that the manufacturing process has passed and the product is fit for structural service.

The sampling, frequency and procedure for this test is outlined in AS/NZS 4058 and is controlled and audited by CPAA members through 3rd party certified ISO 9001 Quality Management Systems.

2. Water absorption test: This is the primary performance test to assess the quality and **DURABILITY** of concrete pipe. A low absorption value is an indication of low permeability. In general terms low permeability concrete will be more durable.

The test measures the increase in weight of an oven dried test specimen, which is caused by the absorption of water under controlled and specified conditions. It is expressed as a percentage of the initial oven dry weight of the specimen, and in accordance with AS/NZS4058, shall not exceed 6%. (NOTE – AS/NZS 4058 notes that for this water absorption rate to be achieved, the pipe must have a w/c ratio less than or equal to 0.4 and cement content equal to or greater than 330 kg/m^3)

The water absorption test is carried out on a concrete core sample taken from a pipe and therefore measures the property of the actual product. If the concrete is poorly compacted or cured during the pipe manufacturing process, the absorption test will reflect the inadequate treatment given. This is in contrast to compression strength test cylinders, where the test specimens are given special treatment.

Concrete pipe that passes the water absorption test demonstrates that the manufacturing process is effectively controlling and producing a consistent product that is inherently durable.

The sampling, frequency and procedure for this test is outlined in AS/NZS 4058 and is controlled and audited by CPAA members through 3rd party certified ISO 9001 Quality Management Systems.

Other routine checks required for concrete drainage pipe, as outlined in the Standard include:

- **Steel reinforcement cover** – Required to check the depth of cover to steel. Very important due to the precise placement of steel reinforcement needed in thin walled concrete pipe (-0 mm tolerance).
- **Workmanship and finish** – There is requirement to check each finished pipe to ensure that it has been finished appropriately and does not contain any defects that may affect the long term performance of the material. AS/NZS 4058 has a detailed defect classification chart that outlines what is acceptable and what is not.

Regular testing in accordance to the requirements of AS/NZS 4058 is vital to demonstrate that finished concrete pipes comply with the Standard. As concrete pipe is made to a performance based Standard, acceptance testing is a critical component of the whole manufacturing process as it ensures that the final product matches the requirements of the design. The purchaser then has the assurance that the product will perform as desired in practice.

NOTE: Did you know that traditional concrete tests such as slump tests and cylinder tests cannot be effectively applied to concrete mixes used in concrete pipe machines. Due to the very low water/cement ratio, the slump tests cannot be performed, and due to intense vibration of the moulds during concrete placement, the compaction achieved in the mould cannot be replicated in a cylinder.