Accredited for compliance with ISO/IEC 17020

NATA
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Report on

TESTING OF A WATER TANK

CONSTRUCTED USING DINCEL WALL

FOR COMPLIANCE WITH THE

LIQUID TIGHTNESS REQUIREMENTS OF

AUSTRALIAN STANDARD 3735

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REPORT NUMBER REP03/20180

Report on
Testing Of A Water Tank Constructed Using Dincel Wall For Compliance With The Liquid Tightness Requirements Of Australian Standard 3735

Prepared For – Dincel Structural Walling

Abstract:

A tank, constructed using Dincel Wall, was tested against the liquid tightness provisions in Clause 7.3 of AS3735:2001.

The testing covered by this report showed that the tank met the requirements of the standard for liquid tightness for a water level up to 1.75 metres.

Written by - David Mahaffey	***Date of Issue -*** 6 March 2022
Checked by - Dr Benjamin Sabaa	***Issued as -***
Authorised for Release by - David Mahaffey	***Job Number -*** 20180
Released to - Mr Berkay Dincel, Dincel Structural Walling	***No. of Pages in Document-*** 29

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1. BRIEF

To view the testing of a water tank constructed from Dincel Wall and assess the performance of the tank against Clause 7.3 of AS3735:2001, "Concrete Structures for Retaining Liquids".

2. OVERVIEW

Dincel Structural Walling constructed a tank, square in plan, from 200mm thick Dincel panels. Reinforcement was placed into the walls of the tank and the Dincel panels filled with concrete.

The details of the tank are shown in the drawings in Appendix A (the drawings).

The tank was constructed on a slab with a rebate for the panels to sit in. This slab is also shown in the drawing in Appendix A.

Waterproofing work was subsequently undertaken at the base of the walls inside the tank. Some time later, the tank was filled with water and left for the required stabilization period of 7 days.

On completion of the stabilization period specified in Clause 7.3 of AS3735:2001, a roof was fitted to the tank to prevent evaporation and the water level in the tank measured.

After the 7 day test period specified in Clause 7.3 of AS3735:2001, the water level was checked again and the drop in water was determined.

The inspections necessary to complete this report were undertaken by David Mahaffey (CV attached in Appendix B) and the report was prepared under the Mahaffey Associates NATA accreditation for AS/NZS ISO/IEC 17020:2013.

3. INSPECTIONS

The tank was constructed at 919-929 Mamre Road, Kemps Creek.

Inspections were carried out at various points during the process. The dates of the inspections and the observations and measurements are reported below.

3.1 4 August 2021

The floor of the tank had been poured at the time of the inspection, but the walls had not been erected. This allowed the details of the wall recess and the reinforcement to be confirmed.

The base slab, showing the vertical embedded reinforcing bars, the panel recess and the vertical flashing at the edge of the recess, is shown in Photograph 1.

Photograph 1

It was confirmed that there were 5 vertical bars coming up out of the slab and these were at the spacings nominated on the drawings.

The width and depth of the recess were also measured and these complied with the drawings.

3.2 5 August 2021

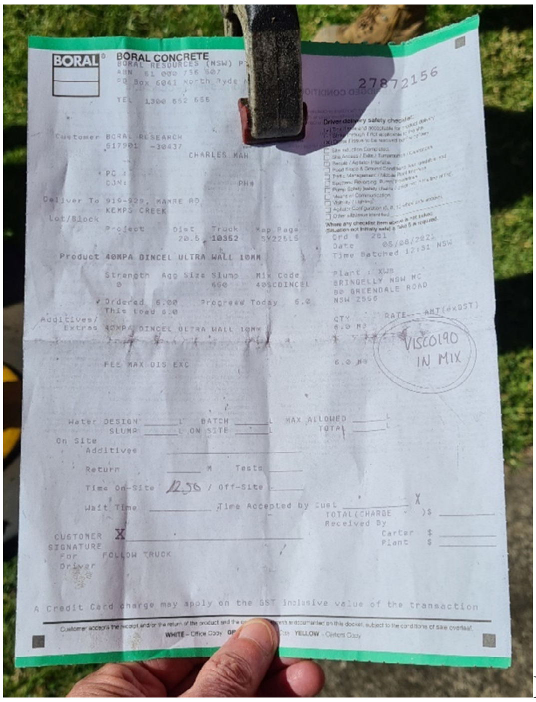
Reinforcement was placed into the Dincel panels. I confirmed that the reinforcement was placed in accordance with the drawings.

A membrane is shown on the inside face of the tank (W-S Wall Splice Details). This membrane was observed prior to placing of the concrete. The cover plate was also observed on the external face of the wall. This detail was provided on two opposite faces of the tank (locations noted as P-WS on drawing 1).

Once the reinforcement was placed and the corner sections were fixed in place, the walls were filled with concrete.

The concrete used in the work was specified on drawing 1 as Boral SCC227669, 10mm agg, 40MPa. The delivery docket for the concrete placed into the walls is shown in Photograph 2 and the mix details are as follows.

- 40MPa Dincel Ultra Wall 10mm
- Mix Code 40SC Dincel
- Slump 650



Photograph 2

The code on the drawing does not appear on the delivery docket, however, the key requirements for the concrete can be seen on the delivery docket. In particular, the 10mm aggregate, strength of 40MPa and the SCC notation, indicating self compacting concrete.

The spread of 650mm (shown as slump on the docket) is consistent with self compacting concrete.

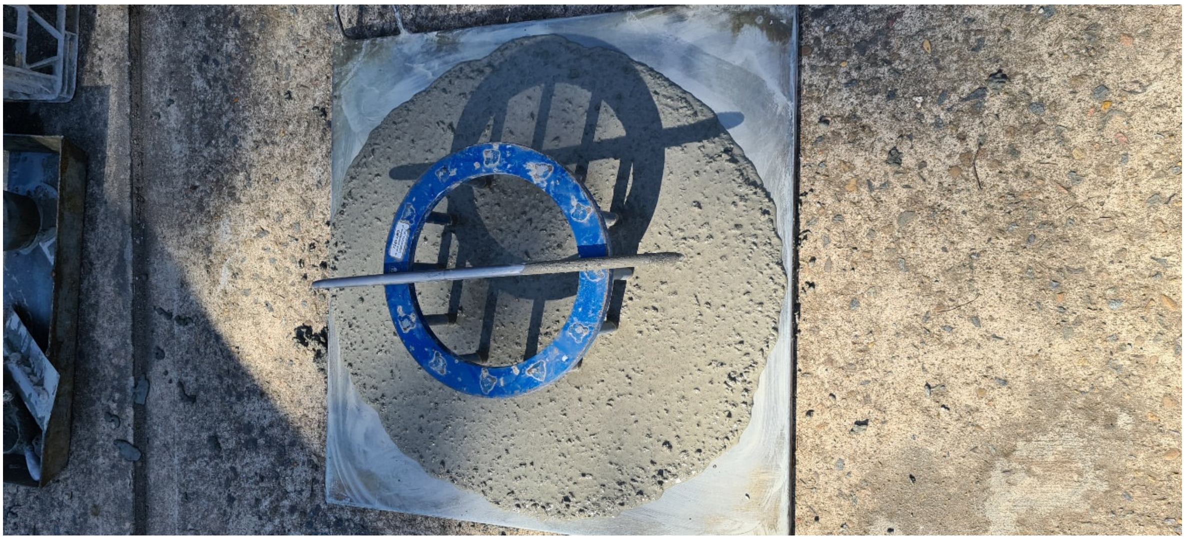
On this basis, the concrete ordered was consistent with the mix on the drawing.

Prior to placing, the concrete was tested for slump/flow, and the spread of the concrete was 670mm (see Photograph 3). 670mm complies with a nominated spread of 650mm, within the tolerance of ±50mm nominated in ASTM C1611.

J-Ring testing was also undertaken and there was no difference in height within and just outside the J-Ring (see Photograph 4).

There was no evidence of segregation during the slump flow test.

Photograph 3



Photograph 4

On completion of the testing, the concrete was pumped into place (see Photograph 5).

Photograph 5

3.3 1 December 2021

A waterproof bandage was applied between the floor and the walls of the tank, as follows.

- The floor surface was initially cleaned and then Ardex K900 was used to fill any gaps between the walls and the flashing.

- Enviro Joint Band by Enviro Systems was then embedded into a layer of Hydrostatic 1 cementitious membrane by Enviro Systems. The Joint Band was placed so that half its width was bonded to the floor concrete and half its width was bonded to the face of the Dincel wall panels.

The application of the Hydrostatic 1 is shown in Photograph 6 and the application of the Joint Band is shown in Photographs 7 and 8.

Photograph 6

Photograph 7

Photograph 8

3.4 27 January 2022

I am advised that the tank had been filled with water for 7 days at the time of the inspection on 27 January 2022.

On this day, I checked the following:

- The water level in the tank. As shown in Drawings 1 and 2, a viewing pipe was installed in the tank to allow the water level to be viewed from the outside. I checked the level of the water in the tank by measuring down from the top of the tank to the upper surface of the water in the tank. I then checked that the water level in the viewing pipe was the same as the water level inside the tank. I again did this by measuring down from the top surface of the tank to the top surface of the water in the viewing pipe. I placed a spirit level on top of the wall to ensure that the measurements down from the surface of the tank on both sides were taken from the same level (see Photograph 9).

Photograph 9

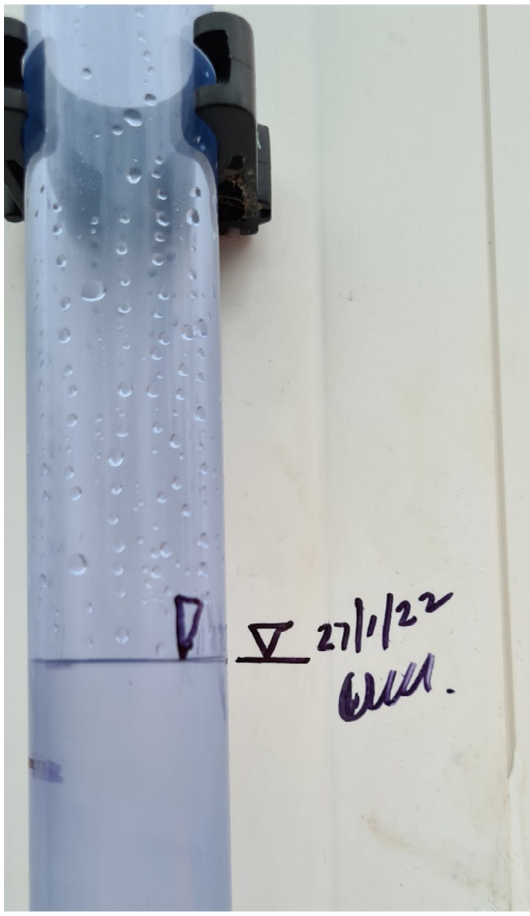
- Based on these measurements, I can confirm that the water level in the tank and the water level in the viewing pipe were the same.

- To ensure that there was a direct connection between the water in the tank and the water in the viewing pipe, I asked that some additional water be added to the tank. I then checked that the water level in the viewing pipe rose by the same amount as the water level in the tank.

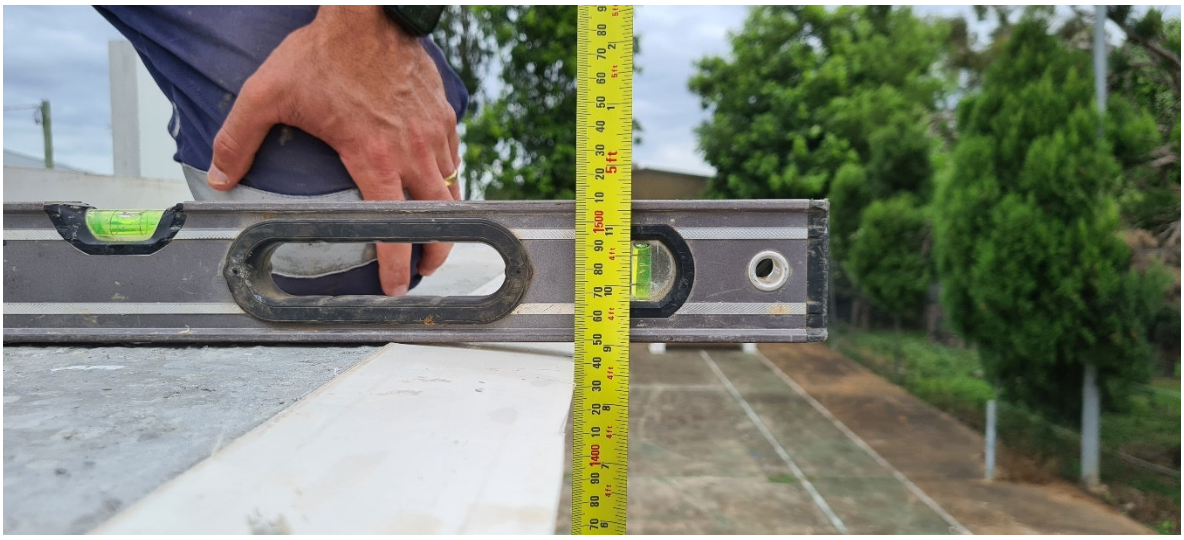
- I then marked the water level on the viewing pipe. I did this by scoring a line in the surface of the pipe with a fine blade and running a felt tipped marker over the cut to highlight it. I also marked the approximate level on the tank wall and initialed this marking.

- The viewing pipe can be seen in Photograph 10 and the water level, marked on the viewing pipe, as well as my initials on the wall behind, is shown in Photograph 11. The water level was 1,449mm down from the top of the tank (see Photograph 12). As the tank height is 3,200mm, the water level in the tank is 1,751mm.

Photograph 10



Photograph 11



Photograph 12

Once the final measurements were taken, a roof was placed onto the tank and sealed in place with a grey flexible sealant. I took photographs of the four sides of the tank to record the width and pattern of the sealant. I did this so that, when I returned at the end of the test period, I could confirm that the water roof had not been removed in the time that I was not on site. A cap was also glued onto the top of the viewing pipe, so that water could not be added via the pipe.

The photographs of the roof sealant are shown in Appendix C. The cap glued onto the top of the viewing pipe is also shown in these photographs.

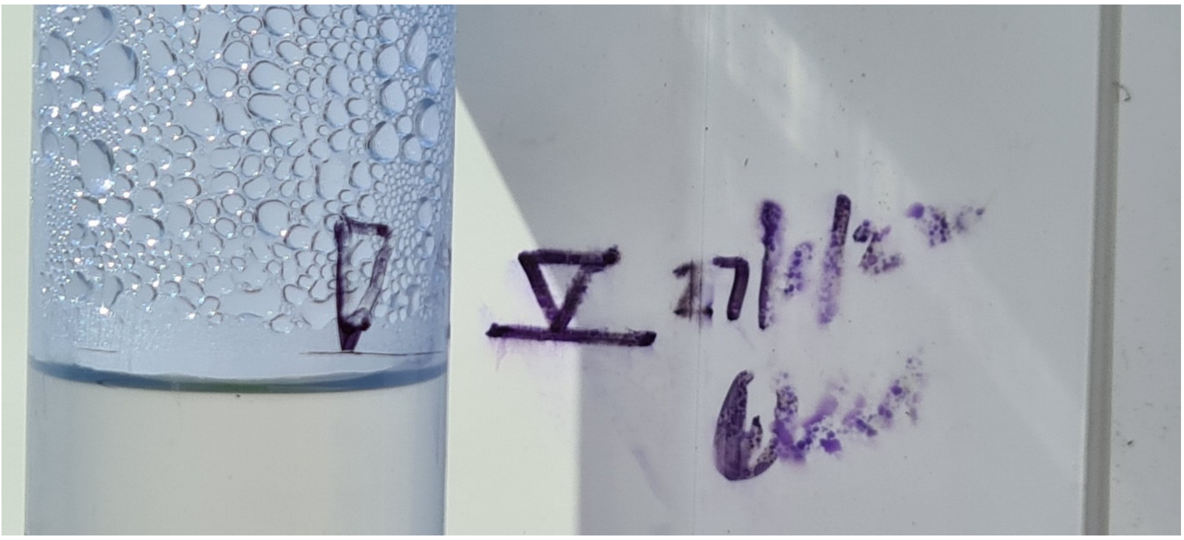
3.5 3 February 2022

I inspected the tank again on 3 February 2022, 7 days after the initial water height measurements were taken.

On this day, I checked the following:

- I photographed the sealant holding the lid in place. Based on a comparison of these photographs with the corresponding photographs I took on 27 January 2022, I can confirm that there is no evidence to suggest that the roof of the tank was removed in the time between my visits. The photographs I took on 27 January are shown side by side with the photographs I took on 3 February in Appendix C. These photographs also confirm that the cap was still in place at the top of the viewing pipe.

- I measured the water level down from the top of the mark on the viewing pipe. The drop in water level from this line was 3mm. The mark on the viewing pipe as well as my initials on the wall of the tank can be seen in Photograph 13. I used a ruler to measure the drop in water level from the initial water level marking to the water level on the day and this was just under 3mm (see Photograph 14).



Photograph 13

Photograph 14

4. ASSESSMENT

The requirements for testing of liquid retaining structures is specified in Clause 7.3 of AS3735, 2001. An extract is included in Appendix D.

The requirements of this standard are as follows:

- Fill the tank and maintain it at the specified water level of 7 days. This is to allow water to be absorbed into the concrete and for any autogenous healing of cracks to occur.

- During the following 7 day test period, the water level in the tank is to be recorded at 7 day intervals.

- At the end of the 7 day test period, the water level in the tank must not fall by more than 1/500th of the water level in the tank or 10mm, whichever is the lesser.

- If the tank does not have a lid, adjustments need to be made based on rainfall and evaporation. However, this was not necessary in this case, as the tank had a lid.

- Any evidence of water seepage during the test period also needs to be reported.

In this case, the water level measurements were made at the beginning and at the end of the test period. This allowed the drop in water level against the specified requirement to be assessed.

The drop in water level during the test period was just under 3mm. With the water height in the tank being 1,751mm, the permissible drop is 3.5mm. Therefore, the drop in water level during the test period was less than the permissible level.

There was no evidence of active water seepage from the tank at the end of the test period.

5. CONCLUSION

The requirement of AS3735-2001 is that the water level in the tank must not fall by more than 1/500th of the water level in the tank or 10mm (whichever is the lesser) over the 7 day test period.

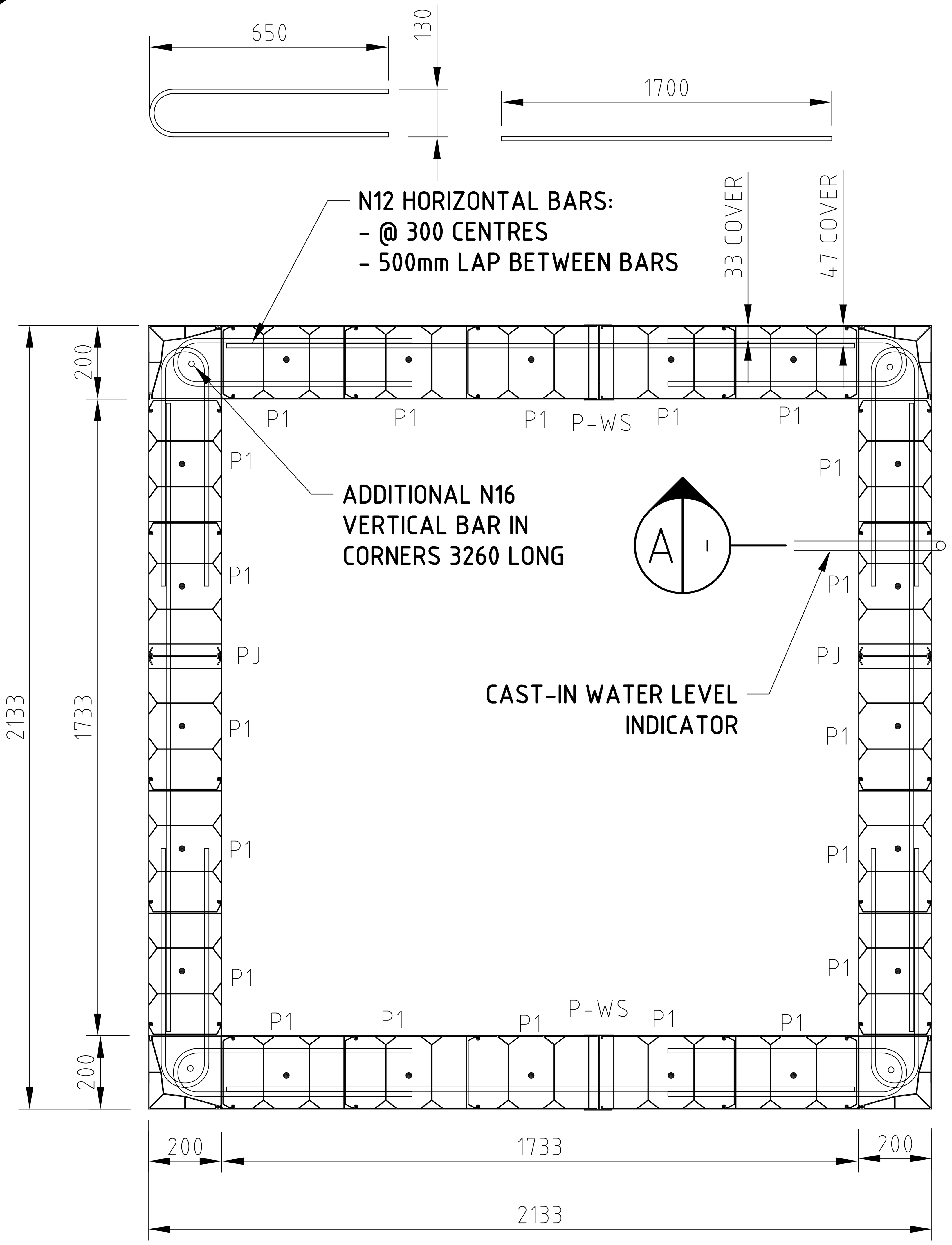
With the water height in the tank being 1,751mm, the permissible drop in accordance with AS3735 was 1,751mm/500 = 3.5mm.

The drop in water level following the test period was just under 3mm, which was less than the permissible drop of 3.5mm.

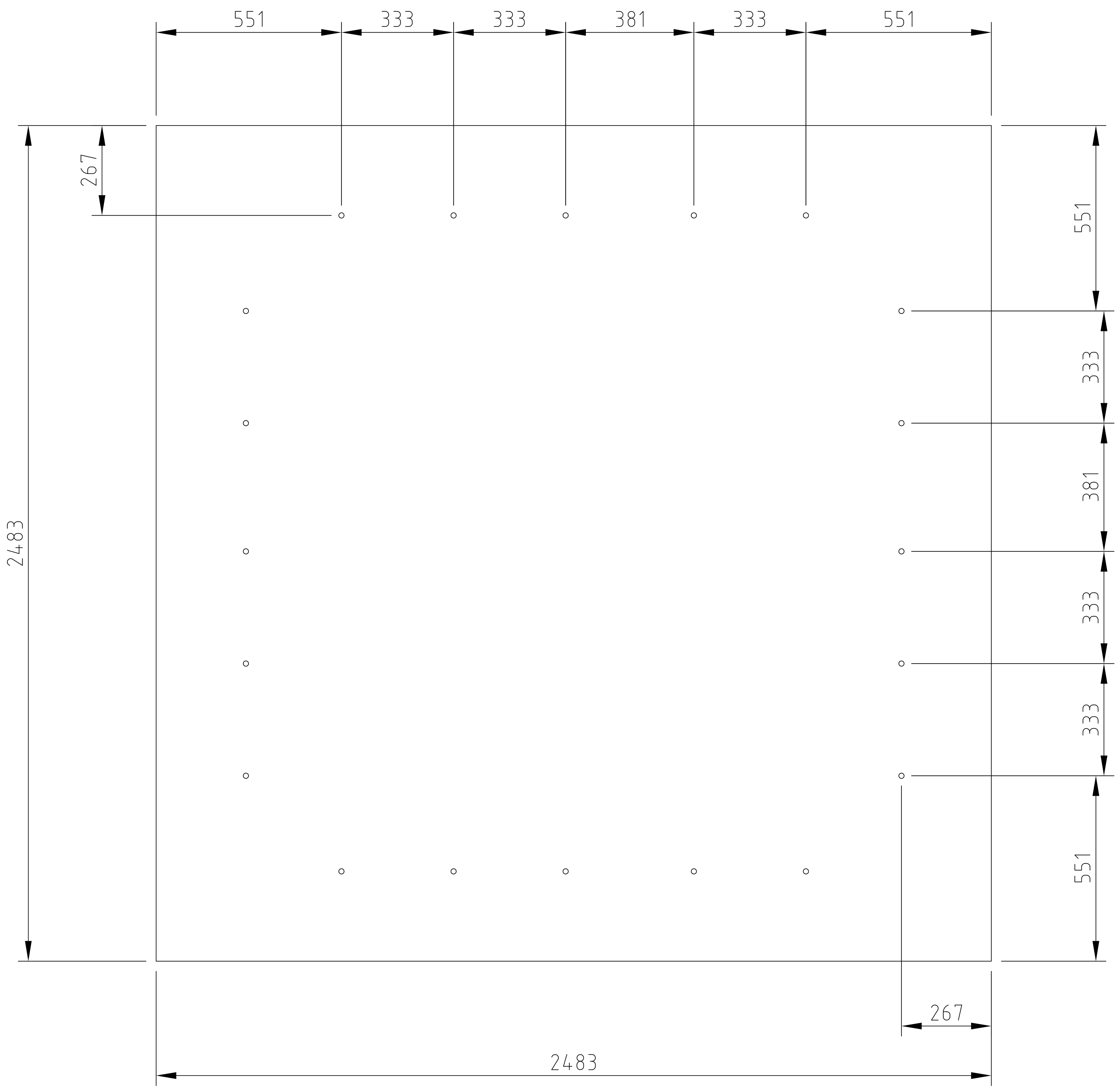
Therefore, this test program has shown that the water tank constructed by Dincel, as described in this report and with a water height of 1,751mm, meets the requirements of AS3735-2001 for liquid tightness when tested in accordance with the method in Clause 7.3 of AS3735.

APPENDIX A:

Tank Drawings



WALL LAYOUT



CONCRETE MIX DETAILS:
- SLAB: 180mm SLUMP, 20mm AGG, 40 MPa, VIBRATED. 1.3m3
- WALLS: BORAL SCC 227669, 10mm AGG, 40 MPa. 5.1m3

WATER:
- 8980 LITRES

BRACING:
- EACH SIDE TO BE SECURED WITH CONTINUOUS TOP HAT @ $\frac{2}{3}$ HEIGHT AND MIN 2 x BRACES
- EACH CORNER (BOTH FACES) TO BE SECURED WITH SCREWS @ 300mm CENTRES AND 200 x 45 LVL, SECURED TO BRACES. ADDITIONAL METAL STRAPS TO BE USED @ 750mm CENTRES

WATERPROOFING PROVIDED WHERE BARB JOINT CANNOT BE UTILISED. AREAS INCLUDE:
- P-WS ACCESSORY (@ CUT PANEL) - USE MEMBRANE + SEALANT

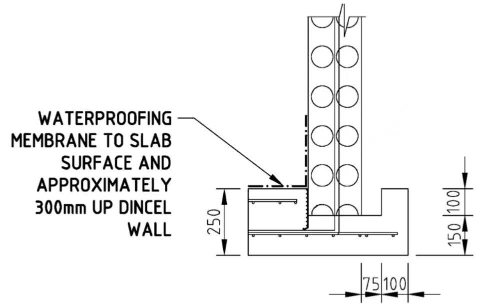
General Notes

No.	Revision/Issue	Date

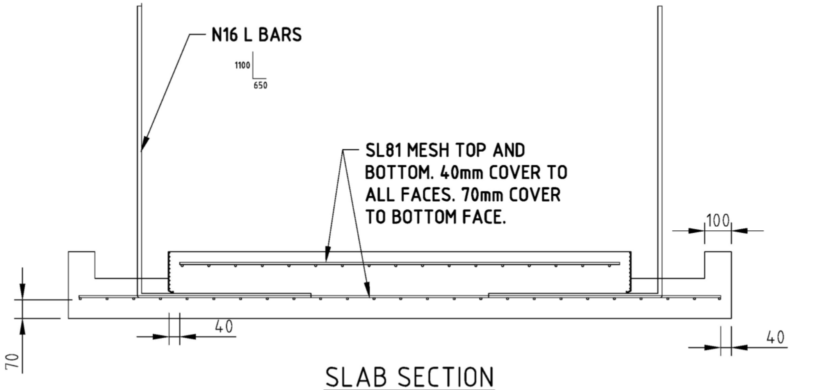
Firm Name and Address

Project Name and Address
DINCEL 200 TANK TEST
DRAWING 1

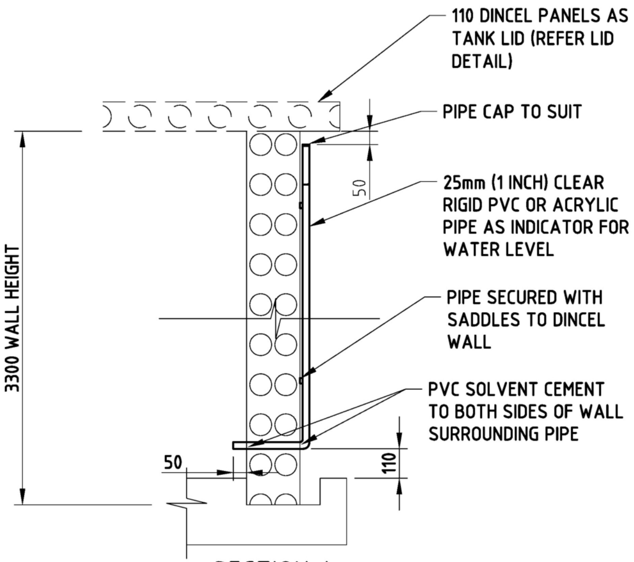
Project	Sheet
Date: 12.07.2021	1
Scale: As Noted	



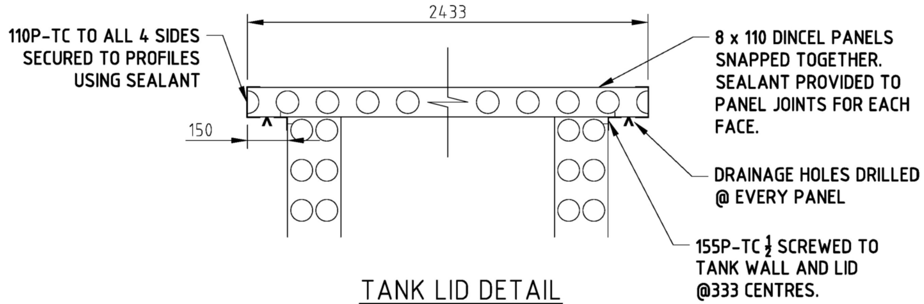
JUNCTION DETAIL



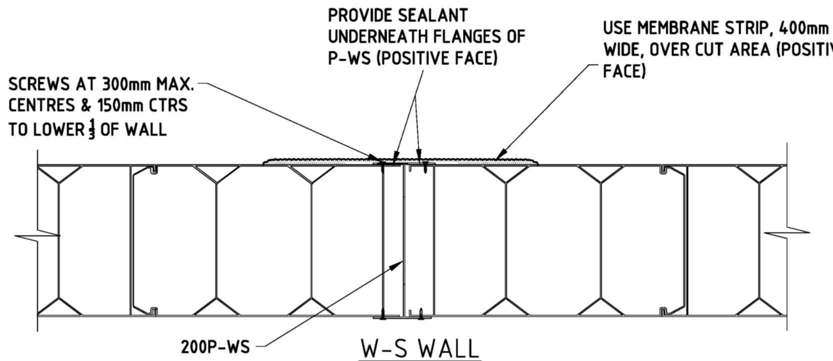
SLAB SECTION



SECTION A



TANK LID DETAIL



W-S WALL
SPLICE DETAIL

General Notes

No.	Revision/Issue	Date

Firm Name and Address

Project Name and Address
DINCEL 200 TANK TEST
DRAWING 2

Project	Sheet
Date 01.12.2021	2
Scale As Noted	

Tank Test.dwg
14.10.2003

APPENDIX B:

CV: David Mahaffey

DAVID MAHAFFEY

Position - Managing Director

Field of Expertise
- Concrete Technology, Durability and Repair
- Construction Materials Testing for Concrete, Shotcrete, Mortar and Grout, Masonry and Tiling

Education - BE (Civil), University of Technology, Sydney

Overview

David Mahaffey is the managing director of Mahaffey Associates Pty Ltd.

Mahaffey Associates was established in 1978 and since then has specialised in the field of concrete technology, durability and repair. David joined the firm in 1984. He has a degree in civil engineering from University of Technology, Sydney and was appointed Managing Director of Mahaffey Associates in 1993. He is also a representative on a number of standards committees for Standards Australia, is a member of the NSW state branch committee of the Concrete Institute of Australia and is an honorary life member of the Australian Concrete Repair Association. He has also been a member of the Concrete Institute Durability committee.

The company has worked on such prestigious projects as New Parliament House Canberra, Sydney Harbour Tunnel, Airport Rail Link, Stadium Australia, M5 and M7, Karuah Bypass Parramatta Rail Link, the North South Bypass Tunnel in Brisbane and the East Link project in Melbourne, the Victorian Desalination project, Westconnex, North West Rail Link and Sydney Metro 2. David is currently assisting in developing concrete mixes for the Cross Yarra project in Melbourne.

David has extensive experience in the development of specialist concretes for all possible applications with a focus on durability in a wide range of environments. He also has specific expertise in the following areas.

- Troubleshooting concrete related problems during construction
- Review of the causes of deterioration of construction materials, particularly concrete and masonry
- Developing remedial strategies for both new and existing concrete and masonry structures
- Field and laboratory testing of concrete, mortar and grouts, masonry products, stone and tiling

David oversees the operation of a NATA accredited materials testing laboratory that specializes in field and laboratory testing of a wide range of construction materials and systems, including concrete, aggregates, bricks, blocks, pavers, tiles, anchorages, panel systems and scaffolding.

APPENDIX C:

Roof Sealant Photographs

Side 1 – 27 January 2022

Side 1 – 3 February 2022

Side 2 – 27 January 2022

Side 2 – 3 February 2022

Side 3 – 27 January 2022

Side 3 – 3 February 2022

Side 4 – 27 January 2022

Side 4 – 3 February 2022

APPENDIX D:

Extract of AS3735: 2001

SECTION 7 TESTING

7.1 GENERAL

Inspection and testing for safety, serviceability and durability shall be carried out on completion of construction.

NOTE: Inspections should be carried out at regular intervals (maximum 5 years) during the service life of the structure.

7.2 TESTING FOR LIQUID-TIGHTNESS

At an appropriate time after completion of construction, the structure or section thereof as considered necessary shall be tested for liquid-tightness in accordance with Clauses 7.3 and 7.4.

7.3 TESTING OF LIQUID-RETAINING STRUCTURES

For a test of liquid retention, a structure shall be cleaned and initially filled with the specified liquid (usually water) at a uniform rate generally not greater than 2 m in 24 h.

Structures shall not be backfilled unless specified.

When first filled, the liquid level shall be maintained by the addition of further liquid for a stabilizing period of 7 days while absorption and autogenic healing takes place. After the stabilizing period, the level of the liquid surface shall be recorded at 24 h intervals, for a test period of 7 days. During this 7-day test period, the total permissible drop in level, after allowing for evaporation and rainfall (if the test is made for an uncovered structure) shall not exceed 1/500th of the average water depth of the full tank or 10 mm, whichever is less.

Notwithstanding the satisfactory completion of the test, any evidence of seepage of the liquid to the outside faces of the liquid-retaining walls or intensified underdrain flow shall be assessed against the requirements of the specification. Any necessary remedial treatment of the concrete to the cracks or joints shall, where practicable, be carried out from the liquid face. When a remedial lining is applied to inhibit leakage at a crack it shall have adequate flexibility and have no reaction with the stored liquid. (See Clause 6.5.)

Where the structure fails to satisfy the 7-day test then, after completion of the remedial work, it shall be refilled and a further 7-day test undertaken in accordance with this Clause.

7.4 TESTING OF ROOFS

Where applicable, the roofs of liquid-retaining structures shall be watertight and shall, where practicable, be tested on completion by flooding the roof with water to a minimum depth of 25 mm for a period of 24 h or longer if so specified. Where it is not possible, to contain 25 mm depth of water, because of roof falls or otherwise, a hose or sprinkler system shall provide a sheet flow of water over the entire area of the roof for a period of not less than 6 hours. In either case, the roof shall be considered satisfactory if no leaks or damp patches show on the soffit. Where the structure fails to satisfy either of these tests, then after the completion of the remedial work it shall be retested in accordance with this Clause. The roof covering, if any, should be completed as soon as possible after satisfactory testing.