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18.02.2025

"Independent Testing of ChemConcrete-WP Admix"

SUMMARY

CHEM CONCRETE is a rapidly growing company with a team of 6 globally recognized professors, 14 PhD holders, and 8 engineers. We specialize in the development, manufacturing, and supply of a new generation of concrete waterproofing and durability-enhancing admixture—known as Hybrid Admixture—which is proven to be more reliable, cost-effective, and environmentally friendly compared to traditional waterproofing products.

Our Hybrid ChemConcrete-WP Admixture (Patent No. 2023902368) is fundamentally different from the current admixtures on the market. Concrete treated with ChemConcrete-WP Admix exhibits significantly enhanced durability and waterproofing performance compared to traditional waterproofing solutions.

This admixture has been independently tested by several ready-mix concrete suppliers (both in Australia and internationally), private laboratories, companies, and leading universities—including Laval University (Canada), University College London (UK), New Mexico Institute of Mining and Technology (USA), Concordia University (Canada), RMIT University (Australia), etc. Some of these test results have been published or are currently under review in international journals and conferences, such as The 9th International Congress on Civil Engineering, Architecture, and Urban Development.

KEY FINDINGS FROM INDEPENDENT TESTING

Independent test results confirm that ChemConcrete-WP Admix permanently waterproofs concrete while significantly improving its fresh, strength, and durability properties compared to both untreated concrete and concrete treated with some other commercial waterproofing admixtures. **Depending on the dosage used, concrete treated with ChemConcrete-WP Admixture achieved:**

- **20–50% higher compressive strength.**
- **70–95% lower water absorption rate and permeability.**
- **Up to three times longer service life compared to untreated concrete or concrete treated with some other similar waterproofing admixtures.**

TESTING PROTOCOL

Samples of ChemConcrete-WP Admixture were distributed to various laboratories, companies, and universities across several countries. The samples were provided in 6-litre, 10-litre, and 20-litre pails, depending on the testing requirements and the volume of the concrete mixes needed. Most of these tests were conducted independently, without supervision from CHEM CONCRETE's technical team. The admixture was tested at different dosages, ranging from 4 to 20 litres per cubic metre of concrete (1 to 4 gallons per cubic yard). The following sections summarize the independent test results.

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New South Wales 2170
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Concrete Test Report

Report No: CON:CPN24/2828
Issue No: 2
This report replaces all previous issues of report no 'CON:CPN24/2828'.

Client: HY TEC INDUSTRIES P/L
NSW 2144

Project: QUALITY CONTROL

Accredited for compliance with ISO/IEC 17025 - Testing

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory No.: 18082

Approved By: KHUZAIMA KHAN (TECHNICAL SUPERVISOR)
Date of Issue: 30/07/2024

THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL

COMPRESSIVE STRENGTH OF CONCRETE CYLINDERS

Details of Sampled Concrete / Concrete Specimens and Results

Date & Time Batched / Truck No / Load / Prog. Load	Time Sampled / Time Moulded	Plant Code / Docket No / Mix Code / MPUV(kg/m³)	Grade(MPa) / Agg(mm) / Slump(mm) Design	AppAir(%) / Compact / Slump(mm) Measured	Specimen Ident.	Dimensions (mm) Avg. Diameter	Height	Density (kg/m³)	Curing Initial (hrs)	Std (days)	Prep or Cap Type	Date of Test	Age (days)	Strength (MPa)	Marks	Fail Mode	Location & Remarks
01/07/24	11:28	232	S50	1.8	CPN68923A	100.1	199	2320	22	0	S	02/07/24	1	6.8		N	Concrete Temp. (°C): 16
11:20	11:50		20	EXT VIB	CPN68923B	100.1	197	2360		3	G	05/07/24	4	32.0		N	CONTROL MIX
		N502B80C	100	85	CPN68923C	100.2	196	2320		6	G	08/07/24	7	41.5		N	
		2320			CPN68923D	99.8	197	2360		13	G	15/07/24	14	57.5		N	
					CPN68923E	100.2	197	2360		27	G	29/07/24	28	64.5		N	
					CPN68923F	100.1	199	2340		27	G	29/07/24	28	66.0		N	
					CPN68923G					55	G	26/08/24	56				
					CPN68923H					90	G	30/09/24	91				
01/07/24	09:40	232	S50	1.8	CPN68924A	100.1	200	2340	24	0	S	02/07/24	1	12.5		N	Sampling AS 1012.2
09:30	10:20		20	EXT VIB	CPN68924B	100.2	198	2360		3	G	05/07/24	4	43.0		N	Pan Mixer
		N502B80C	100	80	CPN68924C	100.2	198	2360		6	G	08/07/24	7	53.5		N	CHEMCONCRETE-WP
		2360			CPN68924D	100.1	198	2360		13	G	15/07/24	14	66.5		N	ADMIXTURE
					CPN68924E	100.0	200	2380		27	G	29/07/24	28	81.5		N	
					CPN68924F	100.2	199	2360		27	G	29/07/24	28	83.0		N	
					CPN68924G					55	G	26/08/24	56				
					CPN68924H					90	G	30/09/24	91				

Notes

1. Sampling in accordance with AS 1012.1
2. Slump test in accordance with AS 1012.3.1
3. Apparent air content in accordance with AS 1012.4.2
4. Mass per unit volume (MPUV) of fresh concrete in accordance with AS 1012.5
5. Compression specimen compaction by vibration, in accordance with AS 1012.8.1 Clause 7.4
6. Initial curing in accordance with AS 1012.8.1 Clause 9.2.2
7. Standard curing in accordance with AS 1012.8.1 Clause 9.3(a)
8. Prep/Cap Type: G = Ground
9. Prep/Cap Type: S = Filled sulphur mixture
10. Compressive strength in accordance with AS 1012.9
11. Density in accordance with AS 1012.12.1
12. Moisture condition SSD in accordance with AS 1012.12.1, unless otherwise stated

Remarks

FailureMode: N = Normal
Compaction: EXT VIB = External Vibrating

Interim Report

MAHAFFEY ASSOCIATES PTY LTD
Unit 9/108-110 Percival Rd (PO Box 2162) Smithfield NSW 2164
Ph: (02) 9756 4003 Email: admin@mahaffey.com.au
ABN: 90 001 629 036

WORLD RECOGNISED ACCREDITATION

Client:	Hy Tec	***Job No:***	20401
Project:	Quality Control	***Date Cast:***	1/07/2024
Section:	-	***Date Received:***	2/07/2024
Mix Identification:	68923	***Date Curing Commenced:***	2/07/2024
Mix Design:	N502B80C-S50MPa Control	***Date of Initial Measurement:***	8/07/2024
		Duration of Standard Moist Curing (Days):	6

Test Type: Determination of the Drying Shrinkage of Concrete

Specimen	***Drying Shrinkage (Microstrain)***				
	7 Days	***14 Days***	***21 Days***	***28 Days***	***56 Days***
I	260	350	400	440	510
J	250	340	390	430	500
K	260	360	410	450	530
Average	**260**	**350**	**400**	**440**	**510**

Note: "*" denotes information not suplied by the client
Samples cast by: Others
Tested in accordance with AS 1012 Part 13 - 2015
The average drying shrinkage results are based on individual results within 40 microstrain of the median, as required by the standard.

David Wilmshurst
Approved Signatory
Date of Issue: 04/09/2024

Accredited for compliance with ISO/IEC 17025 - Testing

MAHAFFEY ASSOCIATES PTY LTD
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ABN: 90 001 629 036

NATA
WORLD RECOGNISED ACCREDITATION

Client: Hy Tec
Job No: 20401
Project: Quality Control
Date Cast: 1/07/2024
Section: -
Date Received: 2/07/2024
Mix Identification: 68924
Date Curing Commenced: 2/07/2024
Mix Design: N502B80C-S50MPa Waterproofing
Date of Initial Measurement: 8/07/2024
Duration of Standard Moist Curing (Days): 6

Test Type: Determination of the Drying Shrinkage of Concrete

Specimen	***Drying Shrinkage (Microstrain)***				
	7 Days	***14 Days***	***21 Days***	***28 Days***	***56 Days***
I	180	260	290	310	370
J	200	270	320	330	390
K	190	260	300	330	380
Average	**190**	**260**	**300**	**320**	**380**

Note: "*" denotes information not suplied by the client
Samples cast by: Others
Tested in accordance with AS 1012 Part 13 - 2015
The average drying shrinkage results are based on individual results within 40 microstrain of the median, as required by the standard.

David Wilmshurst
Approved Signatory
Date of Issue: 04/09/2024

Accredited for compliance with ISO/IEC 17025 - Testing

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ABN: 90 001 629 036

Client: Hy Tec
Project: Quality Control N502B80C-S50MPa Control
Test Type: Sorptivity
Test Method: RMS T362
Mix ID: 68923

Job Number: 20401
Cast Date: 1/07/2024
Received Date: 2/07/2024
Exposure Category C
Curing Regime: Water
Test Date (Completed): 14/08/2024

Beam	***Curing Regime***	***Curing Period (Days)***	***Average Water Penetration (mm)***
S	Water	7	6.0
T	Water	7	6.3
Average of Mix			**6.2**

Notes: Values quoted as 0.5mm are at the lower limit of measurement and the actual value may be less than 0.5mm

David Wilmshurst
Approved Signatory
Date of Issue: 15/08/2024

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ABN: 90 001 629 036

Client: Hy Tec
Project: Quality Control N502B80C-S50MPa Waterproofing
Test Type: Sorptivity
Test Method: RMS T362
Mix ID: 68924

Job Number: 20401
Cast Date: 1/07/2024
Received Date: 2/07/2024
Exposure Category C
Curing Regime: Water
Test Date (Completed): 14/08/2024

Beam	***Curing Regime***	***Curing Period (Days)***	***Average Water Penetration (mm)***
S	Water	7	0.0
T	Water	7	0.0
Average of Mix			**0.0**

Notes: Values quoted as 0.5mm are at the lower limit of measurement and the actual value may be less than 0.5mm

David Wilmshurst
Approved Signatory
Date of Issue: 15/08/2024

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NATA
WORLD RECOGNISED ACCREDITATION

Client:	Hy Tec
Job Number:	20401
Details:	68923 N502B80C-S50 MPa Control
Test Method:	Determination of chloride and sulfate in hardened concrete and aggregates Nitric acid extraction method AS 1012.20.1
Cast Date:	1/07/2024
Received Date:	2/07/2024
Test Date:	24/07/2024

Sulfate Test Report

Specimen	***Depth (mm)***		***$SO_3^{=}$ (% w/w Specimen)***
	From	***To***	
68923	-	-	0.480

Notes:

Samples prepared in this laboratory using AS1012 Method 20.1 – 2016 Section 6
Work covered by Clause 7 of the standard by NATA accredited facility no. 1884

Signed: ____________________

David Wilmshurst
Approved Signatory
Date of Issue: 24/07/2024

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NATA
WORLD RECOGNISED ACCREDITATION

Client:	Hy Tec
Job Number:	20401
Details:	68924 N502B80C-S50 MPa Waterproofing
Test Method:	Determination of chloride and sulfate in hardened concrete and aggregates Nitric acid extraction method AS 1012.20.1
Cast Date:	1/07/2024
Received Date:	2/07/2024
Test Date:	24/07/2024

Sulfate Test Report

Specimen	***Depth (mm)***		***$SO_3^=$ (% w/w Specimen)***
	From	***To***	
68924	-	-	0.350

Notes:

Samples prepared in this laboratory using AS1012 Method 20.1 – 2016 Section 6
Work covered by Clause 7 of the standard by NATA accredited facility no. 1884

Signed: ______________________

David Wilmshurst
Approved Signatory
Date of Issue: 24/07/2024

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Report No: CON:MOO23/5880
Issue No: 6
This report replaces all previous issues of report no 'CON:MOO23/5880'.

Concrete Test Report

Client: HY TEC INDUSTRIES P/L
NSW 2144

Project: QUALITY CONTROL

Accredited for compliance with ISO/IEC 17025 - Testing

NATA Accredited Laboratory No.: 18082
Approved By: Edgar Hernandez (Lab Manager)
Date of Issue: 28/02/2024
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COMPRESSIVE STRENGTH OF CONCRETE CYLINDERS

Details of Sampled Concrete — Concrete Specimens and Results

Date & Time Batched / Truck No / Load / Prog. Load	Time Sampled / Time Moulded	Plant Code / Docket No / Mix Code	Grade(MPa) / Agg(mm) / Slump(mm) Design	Air(%) / Compact / Slump(mm) Measured	Specimen Ident.	Dimensions (mm) Avg. Diameter	Height	Density (kg/m³)	Curing Initial (hrs)	Curing Std (days)	Prep or Cap Type	Date of Test	Age (days)	Strength (MPa)	Marks	Fail Mode	Location & Remarks
29/11/23	11:13		S50	1.8	MOO62429A	100.1	200	2340	19	0	S	30/11/23	1	14.0		N	Sampling AS 1012.2
11:13	11:33			25H	MOO62429B	100.3	198	2340		4	G	04/12/23	5	38.0		N	Pan Mixer
		N502B80C	100	100	MOO62429C	100.3	198	2340		6	G	06/12/23	7	45.0		N	Concrete Temp. (°C): 25 SL CONTROL MIX
0.1					MOO62429D	100.6	197	2320		13	G	13/12/23	14	55.5		N	
					MOO62429E	100.1	197	2360		33	G	02/01/24	34	64.0	E	S	
					MOO62429F	100.1	197	2360		33	G	02/01/24	34	67.0		N	
					MOO62429G	100.0	198	2360		55	G	24/01/24	56	68.0		N	
					MOO62429H	100.5	197	2360		90	G	28/02/24	91	74.5		N	
29/11/23	12:28		S50	1.4	MOO62430A	100.1	201	2420	18	0	S	30/11/23	1	25.0		N	Sampling AS 1012.2
12:15	12:48			25H	MOO62430B	100.2	200	2420		4	G	04/12/23	5	73.5		N	Pan Mixer
		N502B80C	100	100	MOO62430C	100.1	200	2440		6	G	06/12/23	7	79.5		N	Concrete Temp. (°C): 25 Hybrid Integral
0.1					MOO62430D	100.3	198	2440		13	G	13/12/23	14	97.0		N	Waterproofing
					MOO62430E	100.2	196	2460		33	G	02/01/24	34	103.0	E	S	
					MOO62430F	100.1	199	2440		33	G	02/01/24	34	107.5		N	
					MOO62430G	100.0	198	2440		55	G	24/01/24	56	104.0		N	
					MOO62430H	100.1	197	2460		90	G	28/02/24	91	113.5		N	

Notes

1. Sampling in accordance with AS 1012.1
2. Slump test in accordance with AS 1012.3.1
3. Air content in accordance with AS 1012.4.2
4. Compression specimen compaction by rodding, in accordance with AS 1012.8.1 Clause 7.3
5. Initial curing in accordance with AS 1012.8.1 Clause 9.2.2
6. Standard curing in accordance with AS 1012.8.1 Clause 9.3(a)
7. Prep/Cap Type: G = Ground
8. Prep/Cap Type: S = Filled sulphur mixture
9. Compressive strength in accordance with AS 1012.9
10. Density in accordance with AS 1012.12.1
11. Moisture condition SSD in accordance with AS 1012.12.1, unless otherwise stated

Remarks

Marks: E = Exclude from AS1379
FailureMode: N = Normal, S = Shear
Compaction: 25H = 25 rods per layer

Performance of Commercial Concrete Modified with Hybrid ChemConcrete-WP Waterproofing Admixture

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[2] Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Canada.

ABSTRACT

A significant research program was undertaken to evaluate the effectiveness of a waterproofing (also known as water-resisting and permeability-reducing) admixture, with the commercial name of Hybrid ChemConcrete-WP Waterproofing Admixture, to improve water-tightness and durability of commercial concrete mixes in corrosive environments. The waterproofing performance of the admixture was compared with a few other widely used waterproofing admixtures available on the market through water absorption test results. For each type of concrete, a control batch was produced without waterproofing admixtures, and other batches included waterproofing admixtures at the recommended dose rates by the manufacturers. This report provides the tests results of slump, air content, water contact angle, compressive and flexural strengths, and chloride resistance of concrete mixes. Assessment of these test results indicates that, whilst concrete performance was influenced by cement type, these permeability reducing admixtures can also significantly improve the durability of concrete. The findings show that Hybrid ChemConcrete-WP Admixture has significant impact on enhancing the water-tightness and durability of concrete.

Key words: Concrete waterproofing admixtures; waterproof concrete; water absorption; durability; chloride resistance; ChemConcrete-WP.

1. Introduction

Penetration of water is the main cause of all the major chemical and physical deterioration processes affecting concrete structures and pavements. Water may be the agent causingdistress or it may allow the penetration of aggressive species that cause damage. Excessive penetration of water can also compromise the functionality of many structures such as water tanks, basements, and liquid-retaining structures [1]. Commonly used methods to achieve durable and waterproof concrete include using supplementary cementitious materials, adopting low water to cement ratio, limiting cracks by using reinforcing elements or using surface coatings or membranes [1, 2]. Nevertheless, it is very hard to eliminate water penetration because concrete is naturally micro-cracked and porous, it is often exposed to corrosive environments, and it is prepared using variable site practices [1-3].

Another approach to reduce water penetration is using integral waterproofing admixtures (also known as water-resisting admixtures) [4]. These admixtures are often available in liquid or powder forms and could be generally classified as: 1) hydrophobic or water repelling admixtures, 2) crystalline admixtures, 3) densifying or pore blocking admixtures, and 4) hybrid admixtures [4]. Among these, the first three groups are very well-known. However, thelast group (hybrid admixtures) is considered as the new generation of waterproofing admixtures in which some chemicals with quite different waterproofing mechanisms (i.e., water repelling, pore blocking, crystalline/self-healing, etc.) are used. ChemConcrete-WP waterproofing admixture, developed by Chem Concrete Pty Ltd may be considered as a new generation or the first hybrid waterproofing admixture in the market .

German Committee on Reinforced Concrete [5] limits the water absorption of waterproof concrete to below 50% in comparison to untreated concrete. However, waterproof concrete should have a water absorption rate of below 2.5% based on National Corporation of Highway Research Program in the USA [6]. In BS EN 14695 [7], it is stated that waterproof concrete should have the ability to prevent the movement of moisture from one place to another. Despite the definitions, it is obvious that waterproof concrete should have a very low water absorption [4].

Hydrophobic admixtures alter the surface energy or surface tension within cracks and pores to increase water/liquid contact angle and resist absorption. These admixtures usually consist of vegetable oils, fatty acids, wax emulsions, hydrocarbons, animal fats, silanes and siloxanes [1, 8]. Crystalline admixtures are reported to increase the resistance to water ingress by the deposition of solids via chemical reactions or removal from suspension [4]. The most widely used densifiers are nanomaterials and supplementary cementitious materials such asfly ash, slag, and silica fume. The effects of these agents in reducing the water absorption of concrete are well-understood. However, the effects of these agents on the water absorption reduction are limited to below 20%, which is far beyond the limitations specified by standardsfor waterproof concrete [4]. The use of integral waterproofing admixtures has many benefits over surface protection because they do not require regular maintenance, are not vulnerable todeterioration, and can be used where membranes or surface coatings are impossible or too complex to apply [1]. However, a more promising method to minimize water penetration into concrete is using hybrid integral waterproofing admixtures in concrete because these admixtures provide both hydrophobic and self-healing properties simultaneously .

A wide range of integral waterproofing admixtures are available in the market. The manufacturers have made many claims on the effectiveness of these products, such as providing an exceptional resistance to corrosion, permanent reduction in water absorption,and extended life span [1, 9]. However, a latest independent review by the Concrete Society in the UK [9] found a distinct lack of independent data to substantiate the claims made by the manufacturers. Much of the existing data are provided by the manufacturers, and most of the current research has investigated generic materials rather than proprietary products. The ingredients in these commercial waterproofing admixtures and the mechanisms by which these admixtures provide waterproof concrete are often not reported [1]. This is specifically true when the admixture is prepared by mixing several different agents [1]. Some waterproofingadmixtures decrease water absorption in concretes with a high w/c ratio and restricted curing (low-grade porous concrete) but have minor effect on normal grade concrete [1, 4]. Therefore, these admixtures can do little to improve the waterproofing performance of concrete beyond what could be achieved by adopting a good mix design [1].

A comprehensive review conducted by the Concrete Society in the UK demonstrated that most of the current commercial waterproofing admixtures have limited impact on developing waterproof concrete [9]. However, ChemConcrete^{-WP} waterproofing admixture, classified as a new generation of hybrid waterproofing admixtures, has not yet been examined by researchers and/or Concrete Society in the UK. Therefore, the aim of the current research has been to evaluate the effects of this commercial admixture on the water absorption, strength properties, and chloride resistance of concrete and compare the results with similar researchon other commercial waterproofing admixtures.

2 .Experimental program

2.1 . Materials

Type II ordinary Portland cement (OPC) was used in this research. Natural river sand(with maximum particle size below 3 mm) and coarse aggregates (with a nominal maximum size of 10 mm) were used in this study. Before using the fine and coarse aggregates in the mixtures, all the aggregates were dried in an oven for 48 hours at a temperature of 105 ºC. Some previous researchers have reported that the quality of water can affect the mechanical properties of concrete [10]. Therefore, in this research, tap water was used to prepare the specimens. Sodium chloride in powder form with over 96% purity was purchased from Alibaba in China. ChemConcrete^{-WP} waterproofing admixture in white liquid form (Figure 1) was supplied by Chem Concrete Pty Ltd, Australia. Experiments were carried out accordingto the relevant standards and the manufacturer’s instructions.

Figure 1: ChemConcrete-WP waterproofing admixture in liquid form.

2.2. Mix design

The amount of cement in all the mixes were kept constant at 385 kg/m^3 of concrete. Moreover, the amount of coarse and fine aggregates in the control concrete were 1075 and 667 kg/m^3, respectively. To make the results comparable to those provided in [8], similar amounts of materials were used in this research. Similarly, the amount of water was determined after conducting some trial tests in a way that both the treated and untreated (control) concrete mixtures could achieve a target slump of 100 mm. The amount of ChemConcrete^{-WP} waterproofing admixtures used in the mix design were set at 2.2% (by weight) of total cementitious materials as recommended by the supplier.

2.3. Specimen preparation and curing

To prepare the untreated concrete, coarse and fine aggregates were mixes well in a 30-litre automatic mixer for about 2 minute. Then, cement was added to the mixture and the mixing was resumed for 2 minutes before adding the required water. To prepare the treated concrete, ChemConcrete^{-WP} waterproofing admixture was added to 30% of mixing water and stirred for 2 minutes. Then, this mixture was added to dry materials (mixture of basalt, sand, and cement). The mixing was further continued for 3 minutes until a homogeneous mixture was attained. The rest of the mixing water was then gradually added during the mixing process to achieve a target slump of 100 mm. Fresh concrete was then poured into cylindrical steel moulds with 100 mm diameter and 200 mm height (for water absorption and compressive strength tests), in steel moulds with the dimensions of 100×100×300 mm (for flexural strengthtests), and in cubic moulds with the dimensions of 100×100×100 mm (for chloride resistance tests) without using demoulding agents or oils. Demoulding agents or oils were not used inthis study as they can affect the water absorption rate or hydrophobic behaviour of concrete. After 24 hours of casting, the specimens were stripped and wrapped with plastic sheets to avoid significant moisture variations during their curing process. The concrete specimenswere then cured in an ambient chamber at 25 ± 1 ºC for 28 days. Afterwards, some of the specimens were cut by a saw cutter to the specified sizes by ASTM C 642 standard for the water absorption tests.

2.4. Testing

In this research, the workability of the fresh concrete was measured through slump tests based on ASTM C143. The hydrophobic behaviour of the treated concrete specimens was measured using a water contact angle measurement equipment. The water absorption tests were carried out on the hardened concrete specimens following ASTM C 642. The flexural and compressive strengths tests were carried out on the concrete specimens following ASTM C78 and ASTM C39 standards, respectively. To measure the chloride resistance, concrete specimens were immersed in sodium chloride solutions for 90 days. The concentration of the chloride solution was 5%. Weight change and compressive strength reduction of the treated and untreated specimens were measured and reported.

3. Results and discussion

The tests results of the treated and untreated concrete, including fresh, mechanical and durability tests results, are presented and discussed in this section. The water absorption tests results are compared to the similar results from the literature.

3.1 Water absorption

In Figure 2, the waterproofing performance (water absorption tests results) of six commercial waterproofing admixtures, untreated (control) concrete, and concrete treated with ChemConcrete^{-WP} is presented. The test results of the untreated control concrete were necessary for comparison purposes. It should be noted that the results of the commercial products were carefully extracted from literature for the 28-day cured specimens. The reason behind selecting the results of 28-day cured specimens is because concrete is often considered mature after 28 days of curing. The results are comparable with those provided in the literature because the amount of materials used to prepare the specimens were kept constant. Based on relevant standards and manufacturers' instructions three replicate specimens were prepared and tested to ensure the accuracy of the test results. It is generally expected that a good waterproofing admixture should decrease the water absorption rate of concrete to below 2.5% or less than 50% of that of untreated (control) concrete, based on [5,6, 8]. The results demonstrate that Product-1 had even a slightly negative impact on the water absorption of concrete and increased the water absorption rate of concrete from 6.38% to 6.69%.

Other commercial admixtures (apart from ChemConcrete^{-WP}) decreased the water absorption rate of concrete, but the reduction is not significant and none of them could meet the limits specified in [5, 6]. These results are in line with the findings reported in similar studies [1, 4, 8]. The best results were achieved while using ChemConcrete^{-WP}, which reduced the water absorption rate of concrete from 6.38% to below 1%, meeting the water absorption limits specified in [5, 6]. However, it is difficult to provide reasons for the results received because the ingredients of these commercial waterproofing admixtures are unknown [1]. Nevertheless, based on the current available information, ChemConcrete^{-WP} is reported to provide a waterproof concrete by benefiting from different waterproofing mechanisms such as water repelling, pore blocking, self-healing, densifying, etc. Therefore, ChemConcrete^{-WP} is reportedly known as the first generation of "hybrid" waterproofing admixtures. The other commercial admixtures are reportedly found to provide water-resistant concrete typically by only following one waterproofing mechanism such as crystalline or hydrophobing technologies. Therefore, the superior waterproofing performance of ChemConcrete^{-WP} (in comparison to the other six commercial admixtures) could be because of the simultaneous use of different ingredients with different waterproofing mechanisms.

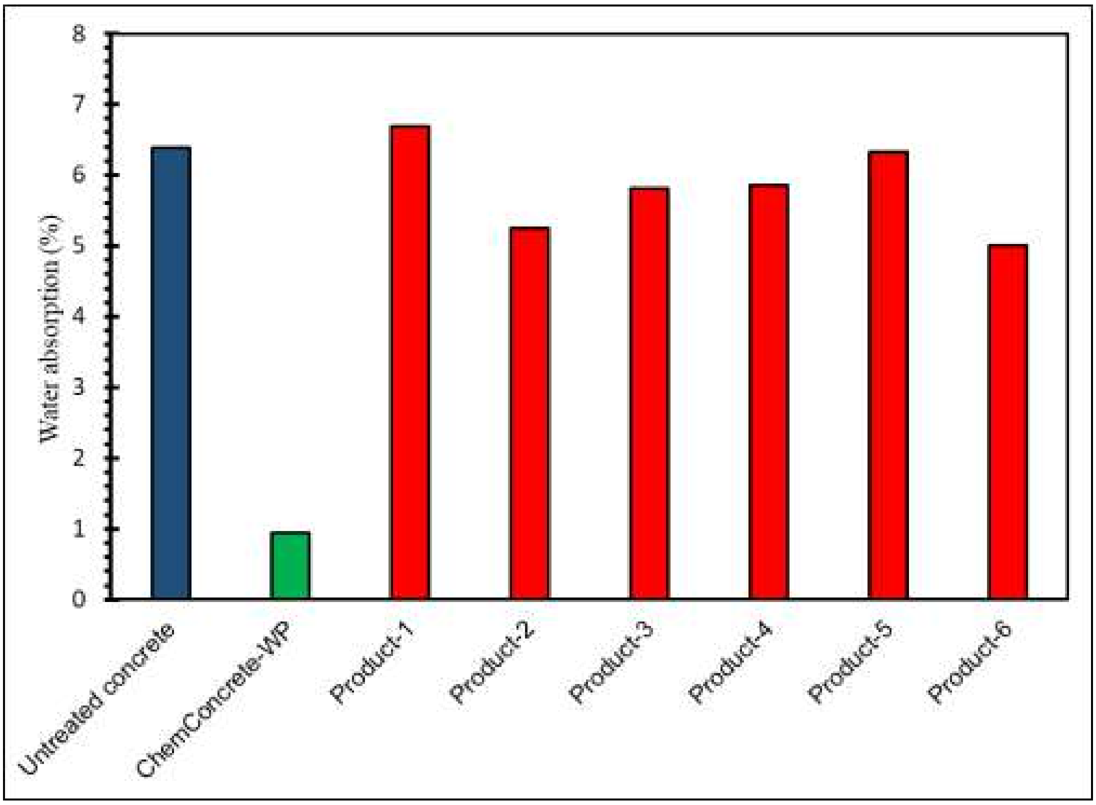

Figure 2: Waterproofing performance of untreated concrete and concrete treated with seven commercial admixtures.

3.2. Slump, water contact angle, and strength properties

If the water contact angle of a surface is between 0 ° to 90 °, it is called hydrophilic (also known as water lover). However, the water contact angle of a hydrophobic surface must be between 90 ° to 150 °. Slump and water contact angle measurement tests results on the cut surface of untreated (control) concrete and the concrete treated by ChemConcrete^{-WP} are presented in Table 1. As can be seen in this table, the water contact angle increased from 0 ° to 93 ° because of using ChemConcrete^{-WP} waterproofing admixture. Therefore, the treated concrete can be considered as a hydrophobic concrete. It could be concluded that the water repellent agents used in this admixture have turned the normal concrete into a water repellent/hydrophobic concrete. Through conducting some trial tests, the slump of both untreated and treated concretes were kept at 100 mm to make the results more comparable for similar applications.

The compressive and flexural strengths tests results of untreated (control) concrete and concrete treated with ChemConcrete^{-WP} waterproofing admixture are summarized in Table 1. As can be observed in this table, the compressive strength of 28-day cured concrete specimens increased from 41 MPa (for control/untreated concrete) to 48 MPa (for treated concrete). Similarly, the flexural strength of 28-day cured concrete specimens increased from 5.50 MPa (for control/untreated concrete) to 6.30 MPa (for treated concrete). The improvement in the compressive and flexural strengths of concrete could be due to the different ingredients in ChemConcrete^{-WP} waterproofing admixture that act as densifying, pore blocking, or self-healing agents. However, it should be noted that it is hard to further interpret these findings because the ingredients of this product are unknown [1], and there is currently no much information published on this product.

Table 1: Properties of control concrete and concrete treated with ChemConcrete-WP.

Test	Untreated (control) concrete	Treated with ChemConcrete-WP
Air content (%)	1.9	1.4
Slump (mm)	100	100
Water contact angle (º)	0	93
Compressive strength (MPa)	41	48
Flexural strength (MPa)	5.50	6.30

3.3. Chloride resistance

Corrosion of steel rebars in concrete is the most challenging problem when it comes to concrete durability [11]. Rebar corrosion shortens the life span of concrete structures, infrastructures, and pavements. Chloride-induced corrosion is one of the main mechanisms of degradation affecting the long-term durability performance of concrete structures, especially in marine environments [2, 12].

Mass change and strength reduction of the untreated (control) concrete and concrete treated with ChemConcrete-WP waterproofing admixture is presented in Table 2. It should be noted that the specimens were immersed in the solutions (for 90 days) after 28 days of curing. The results were compared with the strength of similar specimens that were cured for thesame age (118 days) and were not exposed to NaCl solution solution. Results of strength reduction (presented in Table 2) show that the chloride resistance of concrete treated by ChemConcrete- WP was significantly more than the untreated control concrete. Untreated (control) concrete specimens experienced a strength reduction of 12%, whereas the treated concrete specimens with ChemConcrete-WP experienced a strength reduction of 2%. The mass of both untreated and treated specimens increased by 2.44% and 0.06%, respectively. This increase in the mass of the specimens is due to the water (and maybe chemicals) absorption of the specimens because the specimens were not fully saturated before exposure to NaCl. However, the higher mass gain of untreated specimens could be because of tendency to absorb more water. On the contrary, the treated specimens experienced a small mass gain, which could be due to the lower water absorption rate because of employing the waterproofing admixture.

Table 2: Mass change and strength reduction of treated and untreated concrete.

Test	Untreated (control) concrete	Treated with ChemConcrete-WP
Mass change (%)	2.44	0.06
Strength reduction (%)	13.00	2.00

4. Conclusions

This research evaluated the effect of Hybrid ChemConcrete-WP (a commercially available, hybrid integral waterproofing admixture) on the air content, water absorption, water contact angle, compressive strength, flexural strength, and chloride resistance of conventional OPC concrete. The water absorption tests results were also compared with the existing literature on similar waterproofing admixtures. The main finding of this technical research is summarized below.

Water absorption rate of 28-day cured concrete treated by Hybrid ChemConcrete-WP waterproofing admixture reduced from 6.38% to below 1%, and the developed concrete met the requirements of waterproof concrete. The comparison showed that the second most effective commercial waterproofing admixture (among six other waterproofing admixtures) reduced the water absorption rate of concrete from 6.38% to 5.01% and did not meet the requirements of waterproof concrete.

Hybrid ChemConcrete-WP waterproofing admixture increased the water contact angle of concrete from 0 º to 93 º and developed a hydrophobic concrete. Compressive and flexural strengths of concrete increased from 41 MPa to 48 MPa and from 5.50 MPa to 6.30 MPa, respectively, when ChemConcrete-WP was used.

Chloride resistance of concrete treated by ChemConcrete-WP was significantly increased in comparison to the untreated control concrete. After 90 days of immersing the specimens inside 5% NaCl solution, the untreated and treated concrete with ChemConcrete-WP experienced a strength reduction of 13% and 2%, respectively.

It is concluded that ChemConcrete-WP waterproofing admixture has substantial impact on reducing the water absorption rate and developing a waterproof and durable concrete while simultaneously improving the strength properties of concrete. The findings of this research are in line with the claims made by ChemConcrete-WP manufacturer.

Funding

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Acknowledgement

The authors wish to express their gratitude to Chem Concrete Pty Ltd in Australia for their materials supply and technical assistance throughout the research project.

References

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BFRM — BIN FADEL AL MAZROUEI READY MIX - Sole P. L.L.C.	QHSE FORMS	BFRM-F QHSE 119
		Version: 01
	MIX DESIGN REVIEW FORM	Page 1 of 1
		Approval Date: 03-11-2021

Trial Mix Worksheet

Date : 21-Sep-23 **TIME:** 12:15 PM **Mix Code:** **LTM:** 232

Customer : Bin Fadel Ready Mix

Client : Na

Project : Lab Trial Mix

Consultant : Na

Grade : C40/50 OPC+60%GGBS+5%MS+WP **W/C =** 0.35

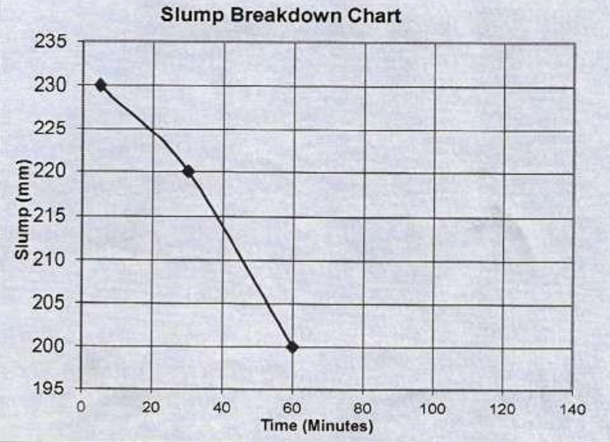
Trial Purpose: Internal Lab Trial Mix - To Verify The Strength & Workability of Mix Design

	1	2	3	4	5	6	7	8	9	10
Material	**Source**	**Type**	**SSD**	**Moisture %**	**Absorption %**	**Net Water (4-5) %**	**Excess Wt. (6x8)/100 Kg/M³**	**SSD Wt. Design Mix Kg/M³**	**Corrective Design Mix Kg/M³**	**Trial Mix For Plant (0.03 M³)**
Cement	Emirates	OPC	**20mm**	**33.95%**		**5mm**	**30.50%**	290	290	8.70
GGBS	Emirates Cement	Slag	**10mm**	**18.04%**		**5mm**	**0.00%**	110	110	3.30
MS	Silica Trading	S.Fumes	**DS**	**17.51%**		**Tot. Agg**	**1885**	10	10	0.30
20.0mm	Riyad Dhank - Oman	Crushed	2.72	0.00	0.90	-0.90	-5.76	640	634.24	19.03
10.0mm	Riyad Dhank - Oman	Crushed	2.70	0.00	0.90	-0.90	-3.06	340	336.94	10.11
5.0mm	W.B.G Crusher	Crushed (limestone)	2.69	0.70	1.30	-0.60	-3.45	575	571.55	17.15
5.0mm Wash										
Dune Sand	Al Ain Municipality	Natural	2.64	0.90	0.90	0.00	0.00	330	330.00	9.90
Total Excess Water Due To Moisture						*		-12.27		
Note: * If The Value is Negative then Add To Free Water, Else Subtract From Free Water										
Free Water								145.0		
Net Water									157.27	4.72
Admix 1 - **Sika Plast 750**								4.00	4.0	0.120
Admix 2 - **Sample 182 N (waterproofer)** (Australia) Chem - 1000								4.00	4.0	0.120
Admix 3 -								0.00	0.0	0.00
Theoretical Density								2448	2448	

BFRM BIN FADEL AL MAZROUEI READY MIX - Sole P. L.L.C.	QHSE FORMS	BFRM-F QHSE 119
		Version: 01
	MIX DESIGN REVIEW FORM	Page 1 of 1
		Approval Date: 03-11-2021

Slump Breakdown

Frequency			Checking Time	Slump mm
@	5	Initial Slump	12:20 PM	230
@	30	minutes	12:45 PM	220
@	60	minutes	1:15 PM	200
@	90	minutes		
@	120	minutes		



Additional Information

Slump Required at Site	150±25
Actual Wet Density (Yield)	2440 Kg/M^3
Humidity	%
Air Voids	3.0 %
Water Temperature	°C
Concrete Temperature	°C
Ambient Temperature	°C
Trial Mix Evaluation:	
Setting Time:	
Remarks :	

Compressive Strength

Age	No. of Cubes- 14	Due Date
1 day	-	22-Sep-23
3 days	2	24-Sep-23
7 days	2	28-Sep-23
14 days	-	5-Oct-23
28 days	2	19-Oct-23
56 days	-	16-Nov-23

Additional Tests Required

Purpose	Test	Standard	DATE	Age	No. of Cubes	Client Specification	Cube Size (mm)
Durability Test	Water Penetration (mm)	DIN 1048	19-Oct-23	28	2	NA	150x150x150
	Water Absorption (%)	BS 1881 Part 122	19-Oct-23	28	2	NA	150x150x150
	Rapid Chloride Permeability (Coulombs)	ASTM:C1202	19-Oct-23	28	2	NA	150x150x150
	Chloride Migration	---	-	-	-	-	-
	Porosity	CPC 11.1	-	-	-	-	-
	Chloride (%)	BS 1881 Part 124	-	-	-	-	-
	Sulphate (%)	BS 1881 Part 124					
	ISAT (ml/m^2/s)	BS1881:PART 208	19-Sep-23	28	2	NA	150x150x150

Lab Technician Nihas N	Verified By: Q.C.Engineer Abdul Rahoof	Reviewed By: Tech Manager Pradeep Kumar

BFRM

BIN FADEL AL MAZROUEI READY MIX - Sole P.L.L.C

QHSE FORMS

WORKSHEET FOR COMPRESSIVE STRENGTH OF CONCRETE CUBES

BFRM-F.QHSE 187

Version : 04

Approved Date : 29/03/2023

Customer Name : BFRM

Casting Date : 21-9-23

Project Name : LAB TRIAL mix

Batch Time(hh:mm) : 12:15PM

Delivery Note No. : NA

Slump / Flow(mm) : 200

Nominal Size of Specimen (mm): 150

Class of Concrete : 40/50 opc + 60% GGBS + 5% MS + WP

Load Applied Direction : Perpendicular to Casting Face

Element Cast : Inhouse cube LTM

Removal of Grift / Extraneous Material : NO FINS

No.of Specimen : 6

Condition of the Specimen : Satisfactory ✓ / Unsatisfactory

Curing Condition : BS EN 12390 - 2 :2019

Volume Determination : Calculation (using actual measurements) / Calculation (checked,designed size)

Cube No.	Test Date	Age of Test (Days)	Average Dimensions (mm)			Weight (kg)	Cross Sectional Area (mm^2)	Volume of Specimen (m^3)	Density (kg/m^3)	Max. Load at Failure (KN)	Compressive Strength (N/mm^2)	Type of Failure
			Length	Width	Height							
1	24-9-23	3	150 150 150	150 150 150	150 150 150	8.318	22500	0.003375	2465	877	38.67	S
2	"	3	150 150 150	150 150 150	150 150 150	8.298	22500	0.003375	2459	910	40.44	S
3	28-9-23	7	150 150 150	150 150 150	150 150 150	8.324	22500	0.003375	2466	996	44.28	S
4	"	"	150 150 150	150 150 150	150 150 150	8.337	22500	0.003375	2470	1018	45.26	S
5	11-10-23	20	150 150 150	150 150 150	150 150 150	8.329	22500	0.003375	2468	1011	44.92	S
6		"	150 150 150	150 150 150	150 150 150	8.341	22500	0.003375	2471	915	40.67	S

* S - satisfactory

Equipment Ref No. : 1) BF-CM-02
2) 1420130286
3) C1006081258
4) QTS-0027-22-TH

Sampling Method : BS EN 12350 - 1 :2019

Test Specimen Preparation : BS EN 12390 Part - 2 :2019 Cls.6

Test Method : BS EN 12390 - 1 :2021 / BS EN 12390 - 3 :2019/ BS EN 12390 - 7 :2019

Test Method Variation : None

Remarks : None

Calibration Status : ☑ Yes / ☐ No

Room Temp. (^{0}c) :

Tested by:
Laboratory Technician

Checked by
Lab Engineer/ Lab Supervisor

BFRM

QHSE FORMS

WORKSHEET FOR COMPRESSIVE STRENGTH OF CONCRETE CUBES

BFRM-F.QHSE 187
Version : 04
Page 1 of 1
Approved Date : 29/03/2023

Customer Name : BFRM
Casting Date : 21-9-23
Project Name : LAB TRIAL MIX (LTM-23.1)
Batch Time(hh:mm) :
Delivery Note No. : NA
Slump / Flow(mm) :

Nominal Size of Specimen (mm): 150
Class of Concrete : 40/20 OPC + WP
Load Applied Direction : Perpendicular to Casting Face
Element Cast : (LTM) INHOUSE CUBE
Removal of Grift / Extraneous Material : No fins
No.of Specimen :
Condition of the Specimen : Satisfactory ✓ / Unsatisfactory
Curing Condition : BS EN 12390 - 2 :2019
Volume Determination : Calculation (using actual measurements) / Calculation (checked,designed size)

Cube No.	Test Date	Age of Test (Days)	Average Dimensions (mm)			Weight (kg)	Cross Sectional Area (mm^2)	Volume of Specimen (m^3)	Density (kg/m^3)	Max. Load at Failure (KN)	Compressive Strength (N/mm^2)	Type of Failure
			Length	Width	Height							
1	20-10-23	29	150 150 150	150 150 150	150 150 150	8.296	22500	0.003375	2458	1221	54.30	S
2	"	"	150 150 150	150 150 150	150 150 150	8.292	22500	0.003375	2456	1100	48.91	S

* S - satisfactory

Sampling Method : BS EN 12350 - 1 :2019
Test Specimen Preparation : BS EN 12390 Part - 2 :2019 Cls.6
Test Method : BS EN 12390 - 1 :2021 / BS EN 12390 - 3 :2019/ BS EN 12390 - 7 :2019
Test Method Variation :
Remarks :

Equipment Ref No. : 1) BF-CM-02
2) 1420130286
3) C1006081258
4) QTS-0027-22-TH

Calibration Status : ☐Yes / ☐No
Room Temp. (^0c) :

Tested by:
Laboratory Technician

Checked by
Lab Engineer/ Lab Supervisor

BFRM	QHSE FORMS	BFRM-F.QHSE 185
		Version 04
	WORKSHEET FOR DETERMINATION OF INITIAL SURFACE ABSORPTION OF CONCRETE	page 1 of 1
		Approval Date 29/03/2023

Sample No : NA   Sampling Date : 21-09-23

Class of Concrete : C 40/50 OPC + 60% GGBS+5% MS + WP (4kg/m³)

Casting Date : 21-09-23   Date / Time of Test : 20-10-23 (4:35PM)

Place of Test : BFRM LAB   Age of Test : 28

Description of the Surface of concrete : SATISFACTORY   Area of Water Contact (mm²) : 5408

Orientaion of the test suface : HORIZONTAL   Dimention of the cap (mm) : 83

Details about the conditioing of specimen : BSEN 12390-3-2019   Length of Capillary tube (mm) : 460

Method of Sealing the Cap : CLAMPED

Date /Time Conditioning Started : 20-10-23 (4:20 PM)   Conditioning temperature (°C) : 21.2

Date / Time Conditioning Completed : 20-10-23 (4:35 PM)   Water temperature (°C) : 21.8

Specimen Id	Time of Test	Temperature of concrete surface(°C)	Elapsed Time (min)	No of Scale Divisons in 5 sec.	Period During Which Movement Measured	No of Scale Divisons Moved	No of Scale Divisons in 1 min.	Initial Surface Absorption	Absorption Corrected to Equivalent 20 °C
1	4:35PM	21.2	10	< 3	2 min	02	01	0.01	0.01 ✓
			30						
			60						
2	4:50 PM	21.3	10	< 3	2 min	01	0.5	0.005	0.005 ✓
			30						
			60						
			10						
			30						
			60						

Sampling Method : BS EN 12350 Part - 1 :2019   Calibration Status : ☑ Yes / ☐ No

Test Specimen Preparation : BS 1881 Part 208: 1996 Cls 8.1.3   Equipment Ref. No : 1) ISAT2016BF 01

Test Method : BS 1881 Part 208: 1996 Cls 8.1.3   2)

Test Method Variation : None   3)

Remarks : None

Tested By
Laboratory Technician

Checked By
Lab . Engineer /Lab. Supervisor

Testing Date: 20-10-23

BFRM	QHSE FORMS	BFRM-F.QHSE 245
		Version: 00
	REPORT ON INITIAL SURFACE ABSORPTION TEST	Page 1 of 1
		Approval Date:29/03/2023

Report No : NA

Sample No. : NA

Project Name : LAB TRIAL MIX (LTM 232)

Sampled By : BFRM Rep.

Client Name : NA

Consultant : NA

Customer : BFRM

Sample Description : Concrete Cubes

Source : Bin Fadel Ready Mix

Class of Concrete : 40/50 OPC +60% GGBS +5% MS +(W.P 4kg/m3)

Location : BFRM LAB

Method of Compaction : By Hand

Date of Casting : 21-9-23

Curing Condition : BSEN 12390 Part 2 :2019

Date Specimen Received : 21-9-23

Place of Test : BFRM LAB

Date Test Required : 20-10-23

Specimen Condition Prior to Test : Done

Date of Test : 20-10-23

Orientation of Test Surface : Horizontal

Age of Test : 28 Days

Area of Water Contact of Cap(mm^2) : 5408

Diameter of Cap(mm) : 83

Length of Capillary Tube(mm) : 460

Method of Sealing the Cap : Clamped

Description of the Concrete Surface Under Test : Cast surface of the cube having smooth finish without cracks, voids & honey combing.

Specimen id	1		2		3	
Time of Test	4:35		4:50 PM			
Temp. of Concrete Surface(^{0}C)	21.2		21.3			
Initaial Surface Absorption(ml/m^2-sec)	Actual	Corrected to 20^0C	Actual	Corrected to 20^0C	Actual	Corrected to 20^0C
@ 10 mins	0.01	0.01	0.005	0.005		
@ 30 mins	This concrete is too impermeable to be sensitive for a longer term test.					
@ 60 mins						

Testing Date : 20/10/23 - 20/10/23

Certificate of Sampling, Specimen Preperation & Site Curing : Not Given

Sampling Method : BSEN 12350 Part 1 :2019

Test Specimen Preparation : BS 1881 Part 208 :1996 Cls8.1.3

Test Method : BS 1881 Part 208 :1996 Cls8.1.3

Test Method Variation : None

Remarks : Report Shall Not be Reproduced Without Written Approval of Laboratory .

Tested By
Lab Technician

Checked by
Lab Engineer/Lab Supervisor

BFRM
شركة بن فاضل المزروعي للخرسانة الجاهزة شركة الشخص الواحد ذ.م.م
BIN FADEL AL MAZROUEI READY MIX - Sole P. L.L.C.

QHSE FORMS

WORKSHEET FOR DETERMINATION OF WATER PERMEABILITY TEST (DIN)

BFRM-F.QHSE 184
Version : 04

Approval Date 29/03/2023

Sample No : NA

Age of Test : 28

Class of Concrete: 40/50 OPC +60% GGBS + 5% MS +(W.P 4kg)

Casting Date : 21-9-23

Appearance of Specimen When Received : SATISFACTORY

Condition of storage & curing until testing : B.SEN 12390 - 2 - 2019

Direction of application of water pressure with respect to casting direction : PERPENDICULAR

Surface Treatment : DONE BY BFRM

Date/ time pressure application started : 19-10-23 (7:00 PM)

Date/ time pressure application completed : 22-10-23 (7:10 PM)

Applied pressure, bar : 5 NO's

Specimen ID	1	2	3
Dimensions (mm)	150 x 150 x 150	150 x 150 x 150	150 x 150 x 150
Maximum Depth of Penetration (mm)	4	3	
Average Penetration (mm)	3.5		

Sampling Method : BSEN 12350 Part -1 :2019

Equipment Ref. No : 1) BF-AVC-01

Test Specimen Preparation : DIN 1048 Part 5 : 1991 Cls 6.4

Calibration Status : ☑ Yes / ☐ No

Test Method : DIN 1048 Part 5 : 1991 Cls 7.6

Test Method Variation : None

Remarks : None

Tested By
Laboratory Technician

Checked By
Lab. Engineer /Lab. Supervisor

Testing Date: 22-10-23

BFRM
BIN FADEL AL MADROUB READY MIX - Sole P. L.L.C.

QHSE FORMS

Reference No.

DETERMINATION OF WATER ABSORPTION OF CONCRETE

Test Method : BS 1881 Part 122 : 2011+A1:2020

Date (dd/mm/yy)	
Start	Finish
25-10-23	29-10-23

Customer: BIN FADEL READY MIX

Project Name: LAB TRIAL MIX (LTM-232) USING SAMPLE 182 N (WATER PROOFER) 4 Kg/m³ [CHEM 1000]

Type of Specimen: ☐ Core from structure ☑ Core from casted cube ☐ Casted Cube ☐ Casted Cylinder

Spec. Id	Dimensions (nearest 1mm) Diameter (75 ± 3) 00	Length (32 to 150) 000	Orientation Relative to Structure	Condition of Specimen when received (compaction, voids and honeycombing)	Volume (mm³)	Surface Area (mm²)	Specimen Weight (g) After Drying & Cooling	After 30 ± 0.5min immersing	Oven Dry Density (kg/m³) Nearest 10	Measured absorption (%) 0.0	Correction factor 0.00	Corrected Absorption (%) 0.0
1	73.0	151.0	-	SATISFACTORY	631993	43000	1499.4	1509.4	-	0.67	1.17	0.78
2	73.0	150.3	-	SATISFACTORY	629064	42840	1476.2	1486.6	-	0.70	1.17	0.82
											Average	0.8 %

Details of reinforcement (if any.):

$$\text{Correction factor} = \frac{\text{Volume}(mm^3)}{12.5 \times \text{surface area}(mm^2)}$$

Condition of Storage & Curing until test date

Curing Method: ☑ Water ☐ Moist Air

Temperature: 20±2 °c

Date Concrete Produced (dd/mm/yy): 21-10-2023

Age at start of Absorption Test (days): 4
(28 to 32)

Preparation prior to Immersion Test	Date & Time Start	Finish	Duration (hr)
Drying (72 ± 2hr)	25-10-23 (11:30 AM	28-10-23 (11:30 AM)	72 HRS
Cooling (24 ± 0.5hr)	28-10-23/11:30 AM)	29-10-23 (11:30 AM)	24 HRS

Density is determined according to BS EN 12390-7 & Dimension is determined According to BS EN 12390-1
Volume determined by : ☑ Measurement ☐ Water Displacement

Apparatus
Caliper : ✓
Balance : ✓
Oven : ✓

REMARKS:						
	Tested By	[signature]	Checked By	[signature] -	Witnessee	
					Name	
	Date	29-10-23	Date		Initial	

School of Engineering
STEM College
GPO Box 2476
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5th May 2024

Re: Testing for of Hybrid ChemConcrete Waterproofing Admixture

Acid, chloride, and sulphate resistance tests were performed on Portland cement-based concrete specimens (untreated and treated mixes with ChemConcrete Waterproofing Admixture) per ChemConcrete Pty Ltd request. The test results are presented in Table 1. Please contact me if you require additional information.

Yours sincerely,

Dr Mohammad Saberian

B.Eng, M.Eng, PhD
Lecturer at School of Engineering
RMIT University
T: +613 9925 5776
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Table 1. Acid, sulphate, and chloride resistance of concrete with and without ChemConcrete WP Admixture (Conducted at RMIT University).

Designation		Mass loss (%)	Compressive strength reduction (%)
2% Acid (H_2SO_4)	Untreated concrete	8.77	61
	ChemConcrete	2.42	22
5% Sulphate (Na_2SO_4)	Untreated concrete	0.530	12
	ChemConcrete	0.083	3
5% Chloride (NaCl)	Untreated concrete	0.51	13
	ChemConcrete	0.094	3

MAHAFFEY ASSOCIATES PTY LTD
Unit 9/108-110 Percival Rd (PO Box 2162) Smithfield NSW 2164
Ph: (02) 9756 4003 Email: admin@mahaffey.com.au
ABN: 90 001 629 036

NATA
WORLD RECOGNISED ACCREDITATION

Client:	Hy Tec
Job Number:	20401
Details:	68923 N502B80C-S50 MPa Control
Test Method:	Determination of chloride and sulfate in hardened concrete and aggregates Nitric acid extraction method AS 1012.20.1
Cast Date:	1/07/2024
Received Date:	2/07/2024
Test Date:	24/07/2024

Chloride Test Report

Specimen	***Depth (mm)***		***Cl^- (% w/w Specimen)***
	From	***To***	
68923	-	-	<0.001

Notes: Specimens prepared in this laboratory using AS1012 Method 20.1 – 2016 Section 6
Work covered by Clause 7 of the standard by NATA accredited facility no. 1884

Signed: ______________________

David Wilmshurst

Approved Signatory
Date of Issue: 24/07/2024

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WORLD RECOGNISED ACCREDITATION

Client:	Hy Tec
Job Number:	20401
Details:	68924 N502B80C-S50 MPa Waterproofing
Test Method:	Determination of chloride and sulfate in hardened concrete and aggregates Nitric acid extraction method AS 1012.20.1
Cast Date:	1/07/2024
Received Date:	2/07/2024
Test Date:	24/07/2024

Chloride Test Report

Specimen	***Depth (mm)***		***Cl^- (% w/w Specimen)***
	From	***To***	
68924	-	-	<0.001

Notes: Specimens prepared in this laboratory using AS1012 Method 20.1 – 2016 Section 6
Work covered by Clause 7 of the standard by NATA accredited facility no. 1884

Signed: ______________________

David Wilmshurst

Approved Signatory
Date of Issue: 24/07/2024

SGS TEC SERVICES
Testing • Engineering • Consulting

January 7, 2025

Mr. Jim Kaylor
Durability Consultants
19441 Citronia Street
Northridge, CA 91324

Phone: (310) 650-4263
Email: jim@durabilityconsultants.com

Subject: **Interim Report for ChemConcrete Waterproofing Admixture Compliance Verification for Type S Admixture**
ASTM C494/C494M-19- *Standard Specification for Chemical Admixtures for Concrete*
SGS TEC Services Laboratory No: 24-1302

Dear Mr. Kaylor:

SGS TEC Services is an AASHTO R18 (Lab #100142), ANS/ISO/IEC 17025:2017 and Army Corps of Engineers accredited laboratory. SGS TEC Services is pleased to present this report of our compliance verification testing of ChemConcrete Waterproofing Admixture an ASTM C494/C494M-19- *Standard Specification for Chemical Admixtures for Concrete* (ASTM C494), Type S *(Specific Performance)* admixture. Our services were performed in accordance with our service agreement date July 23, 2024.

Sample preparation and testing was performed in accordance with applicable sections of ASTM C494, and documents referenced therein. Material and procedures outlined in ASTM C494 were used. Based on our results to date, ChemConcrete Waterproofing Admixture complies with the requirements in Table 1 of ASTM C494. These test results pertain only to the samples tested.

The compliance verification was performed by SGS TEC Services in Lawrenceville, Georgia. Concrete batching was performed on three different days in September of 2024. One control mixture and one test mixture containing ChemConcrete Waterproofing Admixture both meeting the requirements of ASTM C494 for fresh concrete properties were produced each day. One 5-gallon sample of ChemConcrete Waterproofing Admixture was supplied to SGS TEC Services by ChemConcrete Pty Ltd. The air-entraining agent used in this testing was a vinsol resin, meeting the requirements of ASTM C260/C260M-10a (2016) *Standard Specification for Air-Entraining Admixtures for Concrete*.

Testing of the concrete's plastic properties, time of setting, compressive strengths, flexural strengths, length change, and freeze thaw resistance were performed by SGS TEC Services. Mixture proportions and results of our testing are given in Tables 1 to 3. Information and test data on fine and coarse aggregates are listed in Tables 4 to 6. Table 7 contains information on ChemConcrete Waterproofing Admixture. Product information and test data on the Type I/II cement is included in Table 8. Test results for each of the six batches prepared for this report are included in Tables 9 thru 12.

Table 1: ChemConcrete Waterproofing Admixture performance and ASTM C494 requirements for a Type S admixture.

Test Results	ChemConcrete Admixture	Specification Requirements
Time of setting, deviation of control		
Initial (hr:min)	-0:32	-1:00 to +1:30
Final (hr:min)	-0:45	-1:00 to +1:30
Compressive strength (percent of control)		
3 days	171	90 (min)
7 days	142	90 (min)
28 days	130	90 (min)
56 days	135	90 (min)
90 days	130	n/a
6 months	Due 03-27-25	90 (min)
1 year	Due 09-26-25	90 (min)
Flexural strength (percent of control)		
3 days	124	90 (min)
7 days	115	90 (min)
28 days	120	90 (min)
56 days	117	90 (min)
Length change (increase over control)	0.001	+0.010 (max)
Relative durability factor	101	80 (min)

Table 2: Mixture proportions, fresh concrete properties, and ASTM C494 requirements for Type S admixture

Average of Three Separate Tests	Control Mixture	ChemConcrete Admixture	Specification Requirements
Cement factor (lb/yd^3)	515	516	517 ± 5
Water (lb/yd^3)	286	240	
Water-cement ratio	0.554	0.465	
Coarse aggregate	1844	1848	
Fine aggregate	1160	1285	
Fine aggregate-total aggregate ratio	0.39	0.41	
ChemConcrete Admixture (lbs)	0.00	10.33	
Vinsol Resin (oz/cwt)	0.52	0.56	
Slump (in.)	4.00	3.50	3 ½ ± ½
Air content (%)	5.8	5.6	5-7 (± 0.5 of control)
Density (lb/ft^3)	140.9	144.1	
Time of setting			
Initial (hr:min)	4:29	3:57	
dev. of control (hr:min)		-0:32	-1:00 to +1:30
Final (hr:min)	6:16	5:31	
dev. of control (hr:min)		-0:45	-1:00 to +1:30

Table 3: Properties of hardened concrete

Test Performed	Control Mixture	ChemConcrete Admixture
Compressive strength (psi)		
3 days	2210	3770
7 days	3080	4370
28 days	4290	5570
56 days	4630	6240
90 days	4830	6290
6 months	Due 03-27-25	Due 03-27-25
1 year	Due 09-26-25	Due 09-26-25
Flexural strength (psi)		
3 days	475	590
7 days	555	640
28 days	675	810
56 days	680	795
Length change (%)	-0.021	-0.022
Durability factor (%)	92	93

Table 4: Properties of fine and coarse aggregates

Aggregate Information	Fine aggregate	Coarse aggregate
Manufacturer	**Lambert Sand, Shorter**	**Vulcan, Lithonia**
Aggregate Type	Natural sand	Crushed Granite
Specific Gravity $_{SSD}$	2.630	2.648
Absorption (%)	0.76	0.43

Table 5: Gradation of fine aggregate and ASTM C494 requirements

Percent passing		
Sieve	**Fine Aggregate**	**Specifications Requirements**
No. 4 (4.75 mm)	100	100
No. 16 (1.18 mm)	71	65 to 75
No. 50 (300 µm)	19	12 to 20
No. 100 (150 µm)	4	2 to 5

Table 6: Gradation of coarse aggregate and ASTM C494 requirements

Percent passing		
Sieve	**Coarse Aggregate**	**Specifications Requirements**
1.5 in. (37.5 mm)	100	100
1.0 in. (25.4 mm)	98	95 to 100
0.5 in. (12.5 mm)	34	25 to 60
No. 4 (4.75 mm)	3	0 to 10
No. 8 (2.36 mm)	3	0 to 5

Table 7: Admixture information

Information	Admixture Information
Brand Name	ChemConcrete Waterproofing Admixture
Manufacturer	ChemConcrete Pty Ltd.
Lot Size	500 lbs
Solid content (%)	57.914
pH	5.51
Chloride Content (% per BS EN 480-10:2009)	0.001

Table 8: Cement information and test data

ASTM C 150 Type I/II cement			
Brand name		Portland Type I/II	
Manufacturer		Cemex Clinchfield Plant	
Chemical Analyses by Mass (%)			
Silicon dioxide (SiO_2)	20.2	Sulfur trioxide (SO_3)	3.3
Aluminum oxide (Al_2O_3)	4.8	Loss on ignition (950ºC)	2.8
Iron oxide (Fe_2O_3)	3.3	Insoluble residue	0.34
Calcium oxide (CaO)	65.4	Alkalies as Na_2O	0.26
Magnesium oxide (MgO)	1.0		
Calculated Potential Compounds as per ASTM C 150-05 (%)			
Tricalcium silicate (C_3S)	65	Tricalcium aluminate (C_3A)	7.0
Dicalcium silicate (C_2S)	8	Tetracalcium aluminoferrite (C_4AF)	10
Physical Testing and Results			
Fineness Specific Surface (Blaine)	472 m^2/Kg	Air Content (%)	4.9
Setting Times (Vicat) Initial	79 minutes	Autoclave Expansion (%)	0.01
Compressive 3 Day Strength (psi)	3830	Compressive 7 Day Strength (psi)	4650
C1038 Expansion @ 3.39% SO_3 (%)	0.006	Density of Hydraulic Cement (g/cm^3)	3.13

*Provided by Cemex

Table 9: Yield adjusted mixture proportions, fresh concrete properties, and time of set for three control batches.

Materials & Plastic Properties	Control 1	Control 2	Control 3	Average
Cement factor (lb/yd^3)	515	514	517	**515**
Water (lb/yd^3)	288	284	285	**286**
Water-cement ratio	0.559	0.552	0.552	**0.554**
Coarse aggregate (lb/yd^3)	1842	1839	1851	**1844**
Fine aggregate (lb/yd^3)	1152	1160	1167	**1160**
Fine aggregate-total aggregate ratio	0.385	0.387	0.387	**0.39**
ChemConcrete Admixture (lbs)	0.00	0.00	0.00	**0.00**
Vinsol Resin (oz/cwt)	0.57	0.53	0.45	**0.52**
Slump (in.)	4.00	4.00	4.00	**4.00**
Air content (%)	5.9	6.1	5.5	**5.8**
Density (lb/ft^3)	140.6	140.6	141.5	**140.9**
Time of setting				
Initial (hr:min)	4:34	4:21	4:31	**4:29**
Final (hr:min)	6:11	6:04	6:32	**6:16**

Table 10: Yield adjusted mixture proportions, fresh concrete properties, and time of set for three test batches containing ChemConcrete Waterproofing Admixture.

Materials & Plastic Properties	Test 1	Test 2	Test 3	Average
Cement factor (lb/yd^3)	516	517	516	**516**
Water (lb/yd^3)	239	241	241	**240**
Water-cement ratio	0.464	0.466	0.466	**0.465**
Coarse aggregate (lb/yd^3)	1847	1850	1848	**1848**
Fine aggregate (lb/yd^3)	1286	1285	1283	**1285**
Fine aggregate-total aggregate ratio	0.410	0.410	0.410	**0.41**
ChemConcrete Admixture (lbs)	10.32	10.34	10.32	**10.33**
Vinsol Resin (oz/cwt)	0.55	0.55	0.58	**0.56**
Slump (in.)	3.25	3.50	3.50	**3.50**
Air content (%)	5.6	5.5	5.6	**5.6**
Density (lb/ft^3)	144.0	144.2	144.0	**144.1**
Time of setting				
Initial (hr:min)	3:52	3:57	4:03	**3:57**
Final (hr:min)	5:15	5:32	5:47	**5:31**

Table 11: Properties of hardened concrete from three control test batches

Test Age	**Control 1**	**Control 2**	**Control 3**	**Average**
Compressive strength (psi)				
3 days	2000	2160	2470	**2210**
7 days	3030	3040	3180	**3080**
28 days	4390	4140	4340	**4290**
56 days	4370	4540	4970	**4630**
90 days	4840	4730	4920	**4830**
6 months	Due 03-27-25	Due 03-27-25	Due 03-27-25	**NA**
1 year	Due 09-26-25	Due 09-26-25	Due 09-26-25	**NA**
Flexural strength (psi)				
3 days	495	440	495	**475**
7 days	565	545	560	**555**
28 days	650	665	710	**675**
56 days	705	685	645	**680**
Length change (%)	-0.021	-0.020	-0.022	**-0.021**
Durability Factor (%)	92	92	92	**92**

Approximate Total Cycles Completed	Fundamental Transverse Frequency, kHz			Relative Dynamic Modulus, (%) Average of 2 Beams per Mix			Average
	Control 1	Control 2	Control 3	Control 1	Control 2	Control 3	
0 cycles	2.086	2.086	2.041	NA	NA	NA	NA
32 cycles	2.086	2.086	2.041	100	100	100	100
66 cycles	2.041	2.041	2.041	96	96	100	97
96 cycles	2.041	2.041	1.997	96	96	96	96
128 cycles	2.041	2.041	1.997	96	96	96	96
162 cycles	1.997	1.997	1.953	92	92	92	92
192 cycles	1.997	1.997	1.953	92	92	92	92
220 cycles	1.997	1.997	1.953	92	92	92	92
253 cycles	1.997	1.997	1.953	92	92	92	92
287 cycles	1.997	1.997	1.953	92	92	92	92
300 cycles	1.997	1.997	1.953	92	92	92	92

Table 12: Properties of hardened concrete from three batches containing ChemConcrete Waterproofing Admixture.

<table>
<tr><th>Test Age</th><th colspan="2">Test 1</th><th colspan="2">Test 2</th><th colspan="2">Test 3</th><th>Average</th></tr>
<tr><td colspan="8">Compressive strength (psi)</td></tr>
<tr><td>3 days</td><td colspan="2">3650</td><td colspan="2">3800</td><td colspan="2">3870</td><td>3770</td></tr>
<tr><td>7 days</td><td colspan="2">4370</td><td colspan="2">4360</td><td colspan="2">4370</td><td>4370</td></tr>
<tr><td>28 days</td><td colspan="2">5610</td><td colspan="2">5520</td><td colspan="2">5590</td><td>5570</td></tr>
<tr><td>56 days</td><td colspan="2">6250</td><td colspan="2">6420</td><td colspan="2">6060</td><td>6240</td></tr>
<tr><td>90 days</td><td colspan="2">6300</td><td colspan="2">6080</td><td colspan="2">6490</td><td>6290</td></tr>
<tr><td>6 months</td><td colspan="2">Due 03-27-25</td><td colspan="2">Due 03-27-25</td><td colspan="2">Due 03-27-25</td><td>NA</td></tr>
<tr><td>1 year</td><td colspan="2">Due 09-26-25</td><td colspan="2">Due 09-26-25</td><td colspan="2">Due 09-26-25</td><td>NA</td></tr>
<tr><td colspan="8">Flexural strength (psi)</td></tr>
<tr><td>3 days</td><td colspan="2">630</td><td colspan="2">575</td><td colspan="2">570</td><td>590</td></tr>
<tr><td>7 days</td><td colspan="2">670</td><td colspan="2">610</td><td colspan="2">640</td><td>640</td></tr>
<tr><td>28 days</td><td colspan="2">840</td><td colspan="2">800</td><td colspan="2">795</td><td>810</td></tr>
<tr><td>56 days</td><td colspan="2">810</td><td colspan="2">805</td><td colspan="2">765</td><td>795</td></tr>
<tr><td>Length change (%)</td><td colspan="2">-0.027</td><td colspan="2">-0.020</td><td colspan="2">-0.020</td><td>-0.022</td></tr>
<tr><td>Durability Factor (%)</td><td colspan="2">96</td><td colspan="2">92</td><td colspan="2">92</td><td>93</td></tr>
<tr><td rowspan="2">Approximate Total Cycles Completed</td><td colspan="3">Fundamental Transverse Frequency, kHz</td><td colspan="3">Relative Dynamic Modulus, (%) Average of 2 Beams per Mix</td><td rowspan="2">Average</td></tr>
<tr><td>Test 1</td><td>Test 2</td><td>Test 3</td><td>Test 1</td><td>Test 2</td><td>Test 3</td></tr>
<tr><td>0 cycles</td><td>2.175</td><td>2.175</td><td>2.175</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>32 cycles</td><td>2.175</td><td>2.175</td><td>2.175</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
<tr><td>66 cycles</td><td>2.175</td><td>2.175</td><td>2.130</td><td>100</td><td>100</td><td>96</td><td>99</td></tr>
<tr><td>96 cycles</td><td>2.175</td><td>2.130</td><td>2.130</td><td>100</td><td>96</td><td>96</td><td>97</td></tr>
<tr><td>128 cycles</td><td>2.130</td><td>2.130</td><td>2.130</td><td>96</td><td>96</td><td>96</td><td>96</td></tr>
<tr><td>162 cycles</td><td>2.130</td><td>2.130</td><td>2.086</td><td>96</td><td>96</td><td>92</td><td>95</td></tr>
<tr><td>192 cycles</td><td>2.130</td><td>2.086</td><td>2.086</td><td>96</td><td>92</td><td>92</td><td>93</td></tr>
<tr><td>220 cycles</td><td>2.130</td><td>2.086</td><td>2.086</td><td>96</td><td>92</td><td>92</td><td>93</td></tr>
<tr><td>253 cycles</td><td>2.130</td><td>2.086</td><td>2.086</td><td>96</td><td>92</td><td>92</td><td>93</td></tr>
<tr><td>287 cycles</td><td>2.130</td><td>2.086</td><td>2.086</td><td>96</td><td>92</td><td>92</td><td>93</td></tr>
<tr><td>300 cycles</td><td>2.130</td><td>2.086</td><td>2.086</td><td>96</td><td>92</td><td>92</td><td>93</td></tr>
</table>

We appreciate the opportunity to provide our services to you on this project. Should you have any questions or comments regarding this report, please feel free to contact us at your convenience.

Sincerely,

SGS TEC Services, Inc.

Shawn P. McCormick
Laboratory Principal

Michael Lyon
Project Manager

Boral Construction Materials
Materials Technical Services

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21-January-2025

Dr. Sam Soheil Jahandari, Dr Saeed Karimian, Professor Adam Ahmad Dalvand

Chem Concrete Pty Ltd and Perchinz Developments Limited

Re: Report for ChemConcrete-WP Waterproffing Admixture Compliance Certificate for Type SN AS 1478.1-2000 Chemical admixtures for concrete, mortar and grout, Part 1: Admixtures for concrete

Dear Dr. Sam Soheil Jahandari, Dr Saeed Karimian, Professor Adam Ahmad Dalvand

Boral is proud to operate the largest construction materials research and testing facility of its kind in the southern hemisphere at Baulkham Hills, Sydney. This facility plays a key role in maintaining the high standards Boral customers have come to expect and its accredited by NATA (ISO/IEC 17025) and certified by NCSI (ISO 9001) to conduct an extensive range of compliance testing on cement, aggregates, soil, pavement materials, concrete, and asphalt.

The Boral MTS Lab. conducts construction materials testing and chemical testing under NATA accreditation numbers 547 and 9968, respectively. Our full scope of accreditation can be viewed at the NATA website https://nata.com.au/

Four concrete trials were performed in accordance with applicable sections of AS 1478.1 - two trials for the concrete and two trials for ChemConcrete-WP admixture. One 20-litre pail of ChemConcrete Waterproofing Admixture was supplied to Boral by Chem Concrete Pty Ltd. All materials were homogenised and batched on the same day before mixing date. All four trials were performed on the same day in the order of control mix, control mix duplicate, concrete with ChemConcrete-WP and concrete with ChemConcrete-WP duplicate. The dosage of ChemConcrete-WP is at 2% of cement by weight. Each trial was carried out as per AS 1012.2. The fresh properties include slump AS 1012.3.1, air content AS 1012.4.2, fresh density AS 1012.5, bleed AS 1012.6, and setting time AS 1012.18. A total of 12 concrete cylinders were cast and cured as per AS 1012.8.1 and tested for compressive strength as per AS 1012.9 at 1x1d, 2x3d, 3x7d, 3x28d and 3x90d. One set of shrinkage prisms were cast and cured as per AS 1012.8.4 and tested for the drying shrinkage as per AS 1012.13 up to 56d drying.

All results from above tests can be read from NATA reports and summarised on page 3. They were compared with the requirements in Table 2.1 AS 1478.1 (column SN) for the compliance or not. The comparison report is presented on page 2.

In conclusion, we confirm that ChemConcrete-WP Admixture complies with the requirements as per AS1478.1-2000 for Type SN admixture.

Sincerely

Tony Songaini 21. 01. 2025

Tony Song
Senior Laboratory Engineer - Concrete

BORAL®

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Materials Technical Services

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CONCRETE TEST SUMMARY
ChemConcrete-WP Admixture, Type SN, AS1478.1
AT 2.0% BY WEGHT OF CEMENT

CLIENT: Chem Concrete Pty Ltd and Perchinz Developments Limited
PROJECT: AS1478 Compliance Test for ChemConcrete-WP
Client No: 911/24
REQUEST No: 115259
LAB SAMPLE No: 311691 & 311692 (control), 311693 & 311694 (ChemConcrete-WP)
Standard AS 1478.1-2000: Chemical admixtures for concrete, mortar and grout, part 1: admixtures for concrete

Cement: Bulk Type GP ex Berrima 2402496 BTSL **Date of Test:** 16.10.2024

PARAMETERS	Control	ChemConcrete -WP at 2%	Comparison	AS1478.1 REQUIREMENTS	Pass or Fail
Cement Content	305	305	same	(cement 300 ± 15 kg/ m³)	Pass
Slump	80	80	same	80 ± 10 mm	Pass
Time of Setting	4:00 5:50	4:20 6:00	+20min +10min	Initial: ± 1 hour Final: ± 1 hour	Pass
Water Content	206	183	-23kg	Test and report	Pass
Bleeding (%)	1.7	0.4	-1.3%	Not exceed that of the control by more than 2%	Pass
Air Content (%)	2.0	2.2	+0.2%	Test and report	Pass

COMPRESSIVE STRENGTH:

Age	Min. of Control	Control (MPa)	ChemConcrete-WP at 2% (MPa)	Comparison	Pass/Fail
1	No limit	9.5	12.8	133%	Pass
3	90%	20.6	26.1	127%	Pass
7	90%	29.5	35.4	120%	Pass
28	90%	34.2	40.4	118%	Pass
90	90%	34.3	41.0	119%	Pass

DRYING SHRINKAGE: (Microstrain)

Age	Min. of Control	Control	ChemConcrete-WP at 2%	Difference
7	Test and report no limit established	215	195	-20
14	Test and report no limit established	335	295	-40
21	Test and report no limit established	425	370	-55
28	Test and report no limit established	505	445	-60
56	Test and report no limit established	615	555	-60

Note: All samples were prepared, cured and tested at this Laboratory as per AS 1012.2,.3,.4,.5,.6,.8,.9,.13,.18 respectively.
Remarks: ***This admixture (ChemConcrete-WP at 2%) complies with the requirements as per AS1478.1 2000, type SN admixture.***
Dr. Sam Soheil Jahandari, Dr Saeed Karimian, Professor Adam Ahmad Dalvand, File 911, File 8477, Ref 115259SD

Tony Songlinji 21. 01. 2025
Tony Song
Senior Laboratory Engineer - Concrete

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Project: AS 1478 Compliance Tests for ChemConcrete-WP
Attention: Dr. Sam Soheil Jahandari, Dr Saeed Karimian, Professor Adam Ahmad Dalvand
Client: : Chem Concrete Pty Ltd and Perchinz Developments Limited
Request: 115259
Client: 911/24
Concrete section: 8477

Re: AS 1478 Compliance Tests for ChemConcrete-WP

MTS Concrete Trials No.		T13575	T13576	T13577	T13578
Cementitious ID		Control	Control duplicate	ChemConcrete-WP Admix	ChemConcrete-WP Admix duplicate
MTS LSN for concrete trials		311691	311692	311693	311694
MIX DATE:		16.10.2024			
Boral Cement SL	kg/m³	305	305	305	305
ChemConcrete-WP (liquid class SN	ml/m³	0	0	6000	6000
20mm Peppertree	kg/m³	730	730	730	730
10mm Peppertree	kg/m³	280	280	280	280
Peppertree Man Sand	kg/m³	460	460	460	460
Dunmore washed fine sand	kg/m³	390	390	390	390
Water	kg/m³	206	206	184	182
Slump AS 1012.3.1	**mm**	**85**	**80**	**80**	**80**
Fresh concrete density AS 1012.5	kg/m³	2370	2360	2360	2360
Water / Cement	**ratio**	0.68	0.68	0.60	0.60
Air content AS 1012.4.2	%	2.0	2.0	2.2	2.2
Bleeding AS 1012.6	%	1.7	1.6	0.3	0.4
Setting time AS 1012.18 (initial)	hr:mm	4:00	4:00	4:20	4:20
Setting time AS 1012.18 (final)	hr:mm	5:50	5:50	5:50	6:10
AS1012.9 Compressive strength (MPa @ days)	1	10.0	9.2	12.5	13.0
	3	21.0	20.5	26.0	27.0
	3	20.5	20.5	25.5	26.0
	7	29.5	30.0	35.0	36.5
	7	29.0	29.5	34.5	35.5
	7	30.0	29.0	35.5	35.5
	28	35.5	33.0	40.0	39.5
	28	35.5	33.5	41.5	40.0
	28	34.0	33.5	40.0	41.5
	90	34.0	35.5	39.5	42.5
	90	33.5	35.5	39.5	42.0
	90	34.0	33.5	40.5	42.0
AS1012.13 Drying shrinkage (micro strains @ days)	7	220	210	200	190
	14	340	330	290	300
	21	430	420	370	370
	28	510	500	440	450
	56	630	600	550	560

TS updated 20.01.2025

Tony Song 21.01.2025

Tony Song
Boral MTS file

CONCLUSIONS

In conclusion, independent testing results show that ChemConcrete-WP Admix provides permanently waterproof concrete with significantly improved fresh, strength, and durability properties compared to untreated concrete and concrete treated with some other commercial waterproofing admixtures. Depending on the dosage of the admixture used, concrete treated with ChemConcrete-WP Admixture has 20 – 50% higher compressive strength, 70 – 95% lower water absorption rate and permeability, and tripled service life compared to untreated concrete or concrete treated with some other similar waterproofing admixtures. Contact CHEM CONCRETE's team for detailed "Life-Cycle Cost" and "Environmental Impact Analysis" of ChemConcrete WP Admix.

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