CONCRETE INSTITUTE of AUSTRALIA

PLATINUM MEMBER

THE WORLD'S MOST DURABLE CONCRETE

cementaid.com

$80 BILLION BY 2030: THE COST OF CORROSION IN MARITIME INFRASTRUCTURE

- Australia's maritime sector supports $75 billion in annual trade, with 99% of exports relying on ports, yet corrosion threatens infrastructure reliability *(Infrastructure Australia)*
- An estimated $80 billion is required by 2030 to upgrade and replace corrosion damaged concrete infrastructure, including ports, jetties, and seawalls. *(Infrastructure Australia's Port Investment needs and corrosion studies)*
- Chloride induced corrosion affects over 80 % of marine concrete failures, reducing service life by up to 50% in tidal and splash zones *(ACA)*
- Corrosion related repairs for a single major port can cost millions for significant corrosion related projects (*Informa Australia)*

THE INDUSTRY CHALLENGE

WHAT THE INDUSTRY IS DOING NOW

- Common strategies: low heat cement, cover depth, diffusion resistance
- Focus is on slowing down corrosion, not stopping it
- Water ingress remains the root cause of failure
- Maintenance cycles still locked in from the beginning
- Delays are not durability—they're deferrals

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ADVANTAGES

OF HYDROPHOBIC CONCRETE

If concrete were truly hydrophobic – it would be completely dry inside!

Proofed against corrosion by sulphate, chloride & acid solutions

Maintenance-Free

Faster construction time

Significant lower Design & Construction costs

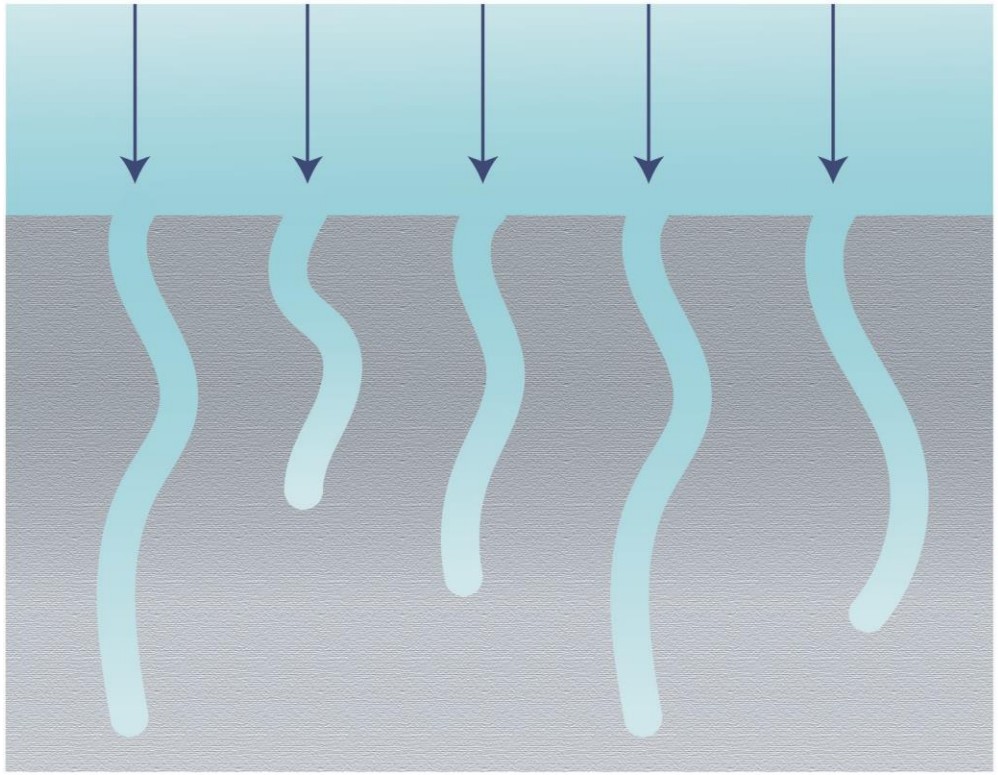
Easy to repair cracks, and other “holes” are simply filled

No dampness

No requirement for membranes

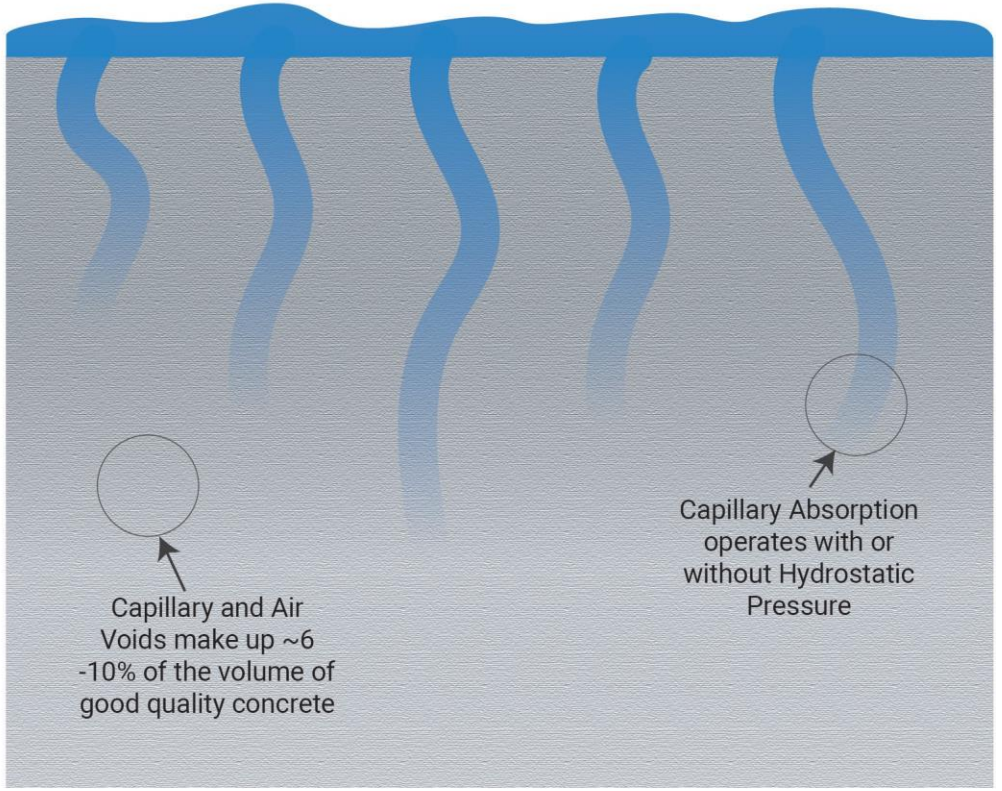
WATER PENETRATION INTO CONCRETE

HYDROSTATIC PRESSURE



Function of Saturated Concrete Test – Permeability

CAPILLARY ABSORPTION



Function of Un-Saturated Concrete Suction Through Capillary Action – Test Absorption

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CAPILLARY ABSORPTION BY CONCRETE

Q

Which is faster, capillary absorption or permeability?

A

Capillary Absorption is the primary mechanism by which water & chlorides infiltrate concrete.

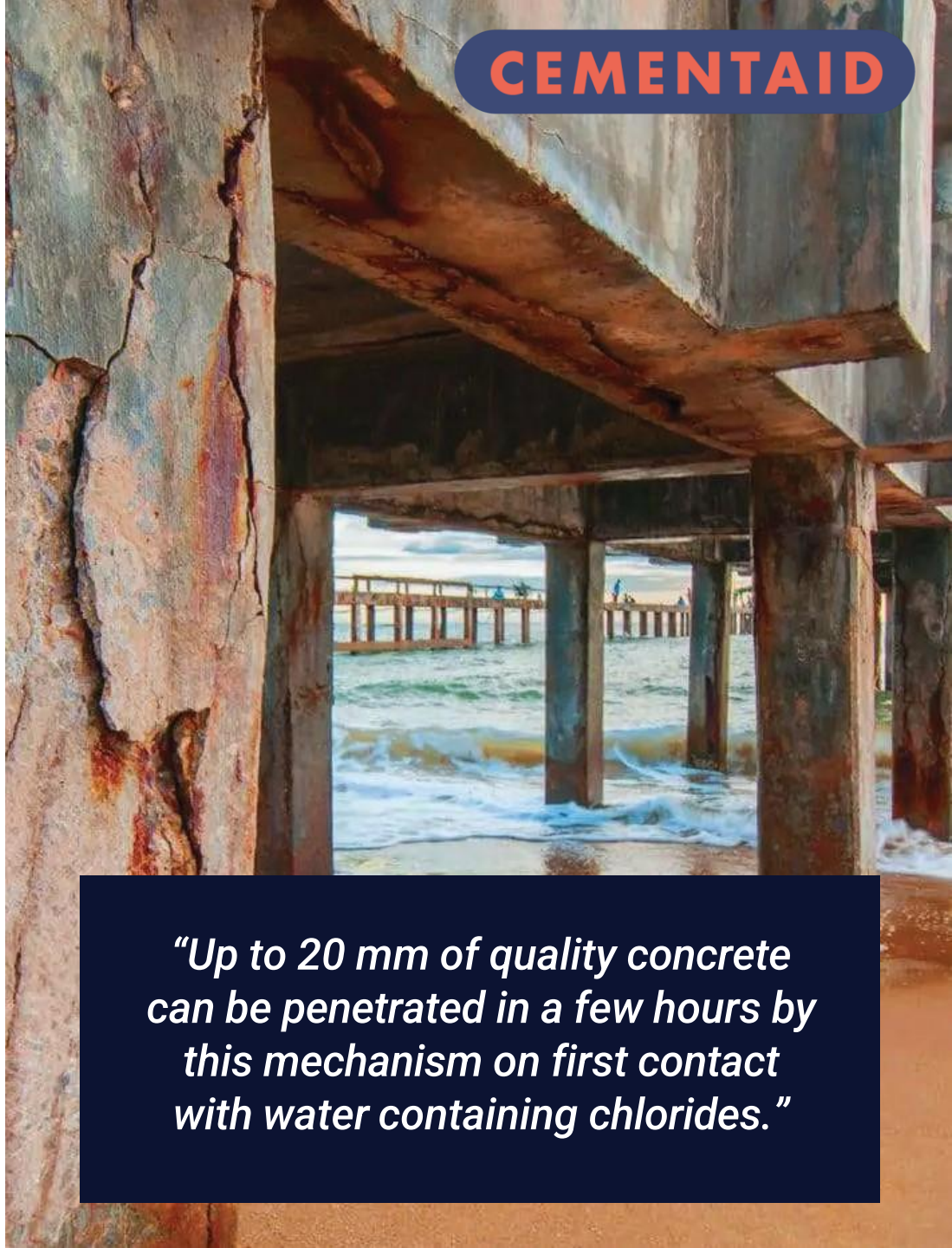
Q

How much faster is capillary suction?

A: 100 x
B: 1000 x
C: 1,000,000 x

A

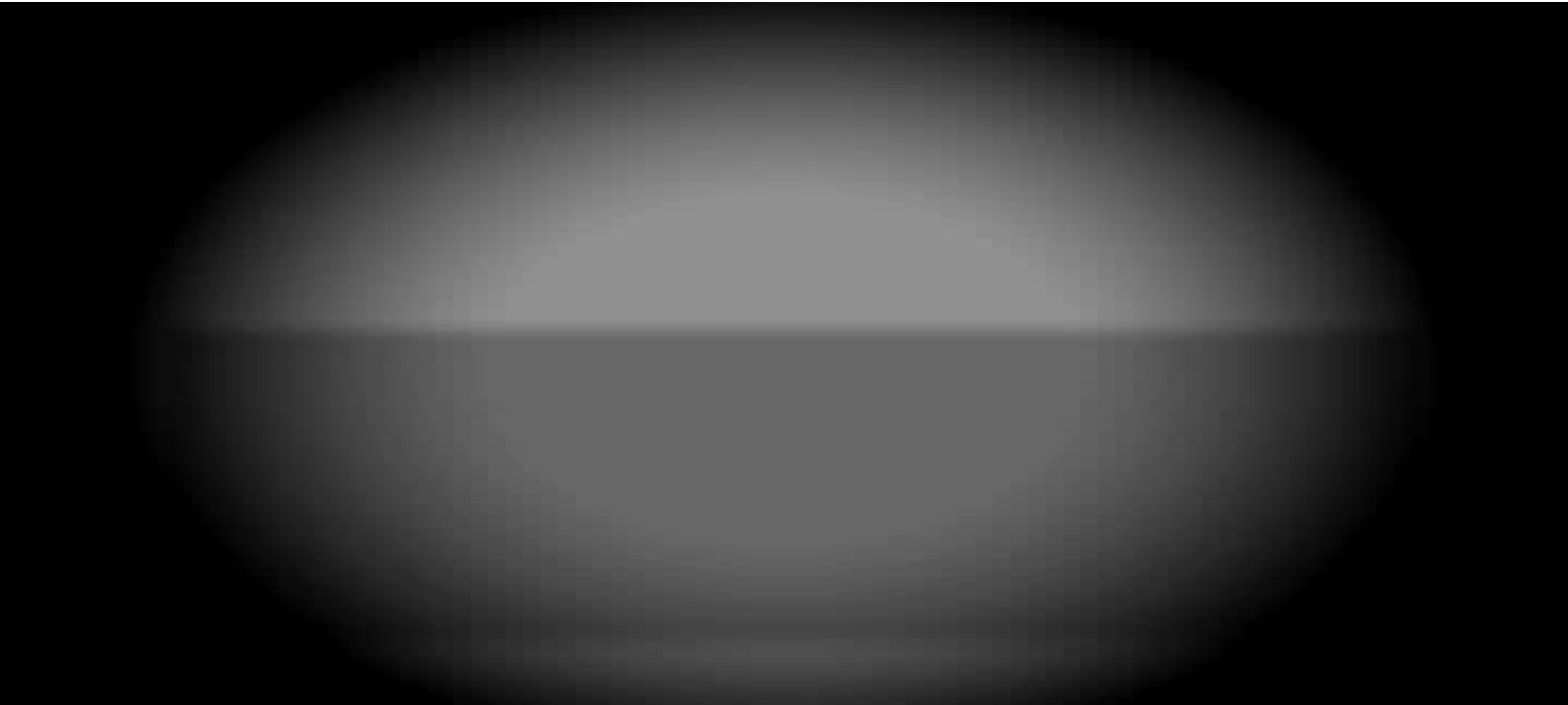
1,000,000 times faster



"Up to 20 mm of quality concrete can be penetrated in a few hours by this mechanism on first contact with water containing chlorides."

HYDROPHOBIC

PORE-BLOCKING



THE ULTIMATE TEST OF TIME

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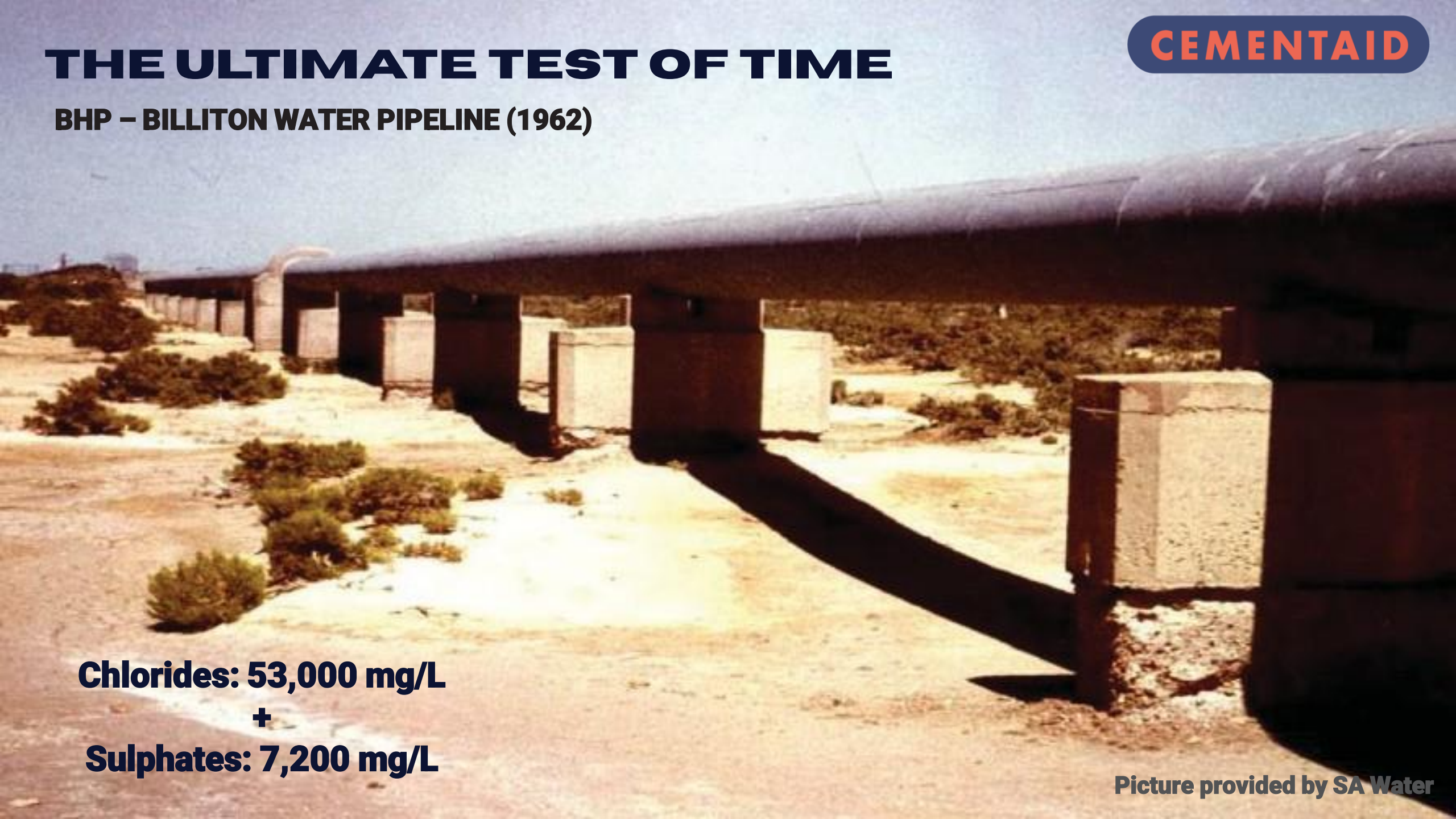
BHP – BILLITON WATER PIPELINE (1962)



Chlorides: 53,000 mg/L

+

Sulphates: 7,200 mg/L

Picture provided by SA Water


Original concrete after 20 years
Caltite concrete after 18 years
Picture provided by SA Water
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60 YEARS
CALTITE
Picture provided by SA Water
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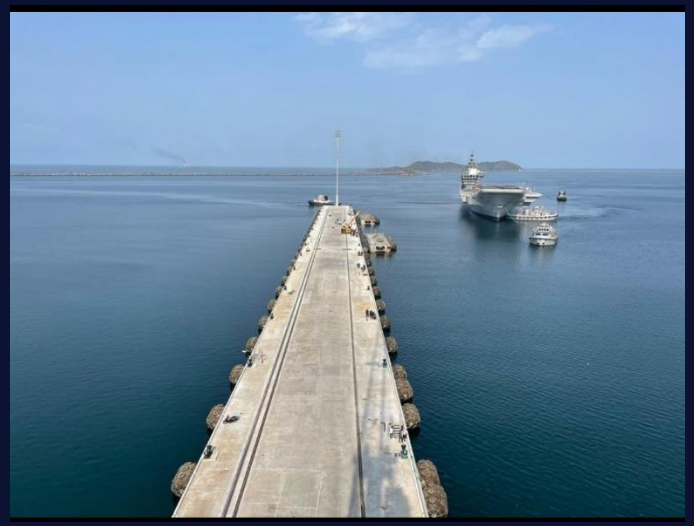
PROJECT SEABIRD NAVAL BASE, SHIP LIFT

KARWAR NAVAL BASE, INDIAN DEPARTMENT OF DEFENCE.

- Covering more than 8000 acres, it is the largest naval base east of the Suez Canal.
- Provides fleet support, maintenance and docking space for 30+ warships, Naval Air Station (including multiple runways, hangars, housing and ordinance handling areas)
- Dry berths for ships and submarines
- Caltite was specified throughout all 3 phases of construction and expansion from 2004, 2015-2017, 2023

CONSTRUCTION & EXPANSION PHASES

2004



- Pile caps
- Service duct base and walls
- Shiplift edge and support beams
- Light tower foundations
- Sewage / oils bilge intermediate storage tanks & waste collection pit
- Service ducts to Dry berth & Washdown berth
- Pipe outfalls

2015-2017

Black steel and Caltite used in all three stages

30,000 cu. M of concrete was supplied for testing, without a single non-conformance.

2023

Primary KPI was to achieve less than 1% absorption rate In the splash zone. A key issue essential to this design.

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WHY ABSORPTION TESTING?

While we may consider diffusion to be a key indicator of durability in a marine environment, the Quality Assurance standard at the time required absorption testing as the durability metric due to the reliance on alternative protection of the plain black steel reinforcement used.

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Description	M55 Navy Standard Mix	Caltite Mix
Cement content (kg/cu.m)	410-450	410-450
Silica fume(kg/cu.m)	0-25	25-34
Water/cement ratio	0.35	0.33.0.35
Hydrophobic pore blocking agent Cementaid "Caltite" (litres/cu.m)	N/A	30
Superplasticizer (litres/cu.m)	7-8	7-10

Description	M55 Navy Standard Mix	Caltite Mix
Average Compressive Strength (28 Days)	64 Mpa*	62 Mpa*
Average Drying Shrinkage (28 days)	391 Microstrain	317 Microstrain
Average Absorption	N/A	0.68%

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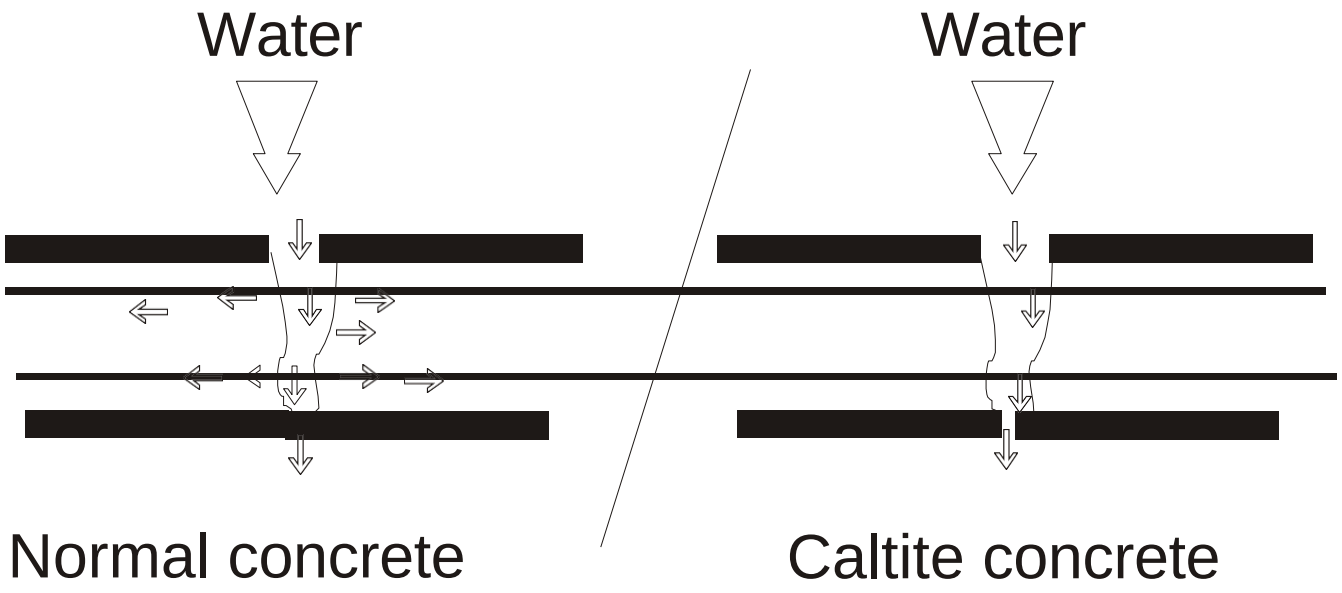
DURABILITY PROTECTION AT CRACKS

PLAIN CONCRETE VS CALTITE CONCRETE

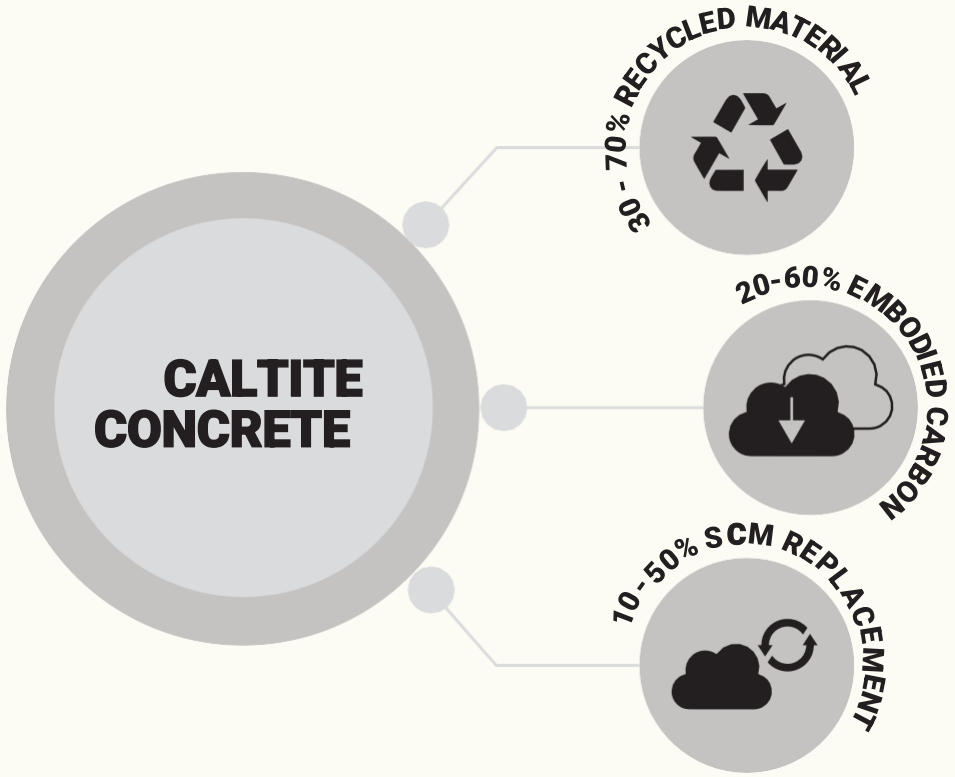


- Lateral water & salt movement into the matrix by absorption.
- This wets and electrically connects the remote points on bar.
- Establishes large “corrosion cells” with high corrosion current & rapid corrosion rate.

- No lateral water movement into matrix - Embedded steel remains permanently dry.
- Only minute section of bar exposed in crack space is subject to water.
- Negligeable corrosion current. Non-disruptive.

SUSTAINABILITY

Multiple envrionmental benefits of Caltite Concrete



- High-replacement SCM compatible
- Low embodied carbon
- Locally manufactured
- Contribute to circular economy
- Increases durability
- Reduces the need for constant repairs or replacement

SINGAPORE GREEN BUILDING PRODUCT SGBC EXCELLENT

Identifying and using the correct building materials is an important element of sustainable construction. A product that requires less maintenance over the lifecycle of the building will work out more cost-effective, especially if it also increased the performance of the building (Malin, 2000)

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70 Years

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1954 - 2024

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