

## Waterproof Concrete Structures





## Introduction

David Ball Group plc manufacture products to ensure watertight, reinforced concrete structures.

The structures can be water-retaining, such as swimming pools, reservoirs, waste-water treatment works and tanks. Or they can be structures that keep water out such as basements, tunnels and underground car parks. Waterproof concrete provides integral protection ensuring that structures are watertight and completely dry.

## PUDLO cement waterproofing system

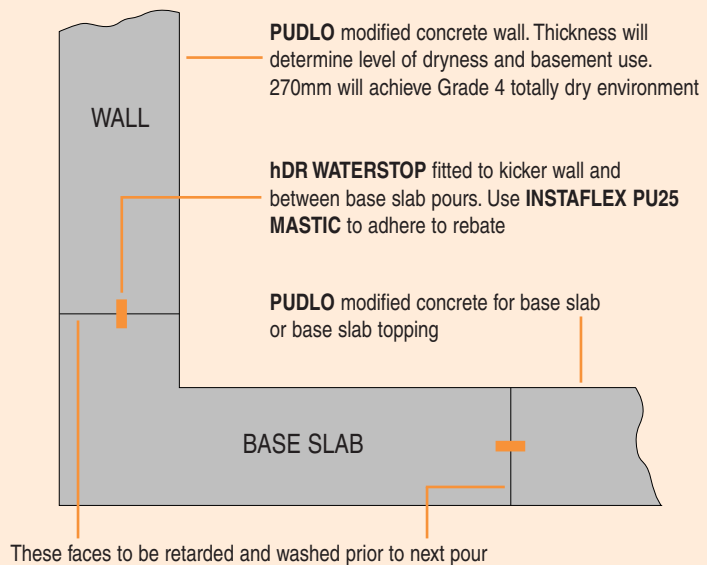
The system comprises **PUDLO** cement waterproofing powder, an integral admixture for concrete together with **hDR WATERSTOP** and **INSTAFLEX PU25 MASTIC** for construction joints.

## Compelling reasons for using PUDLO cement waterproofing powder

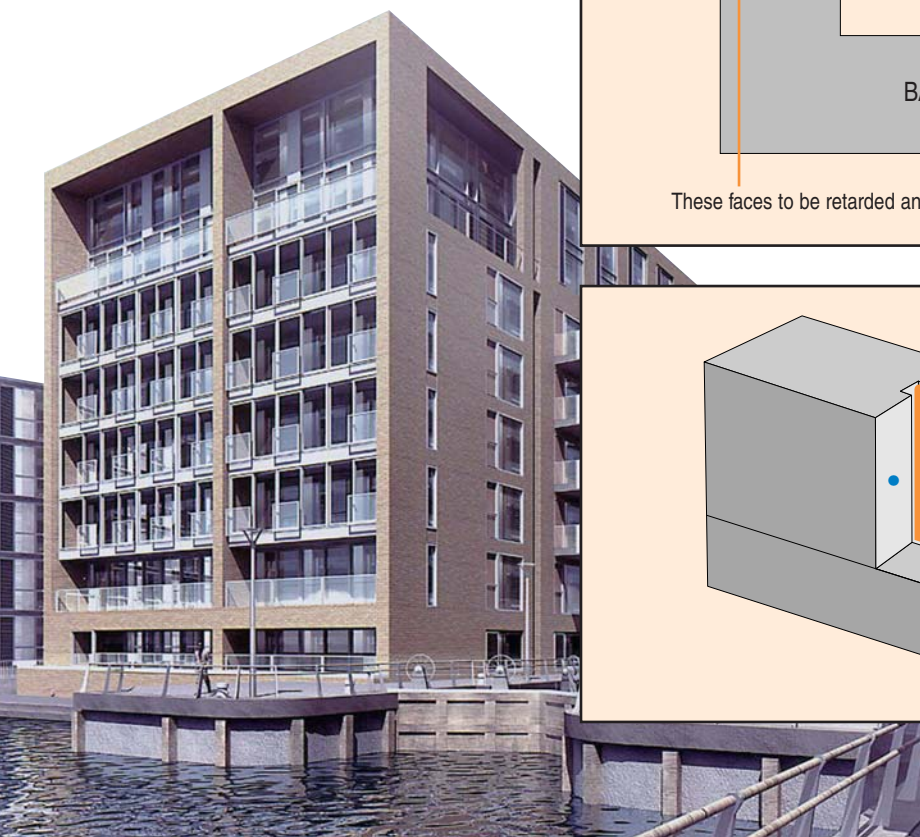
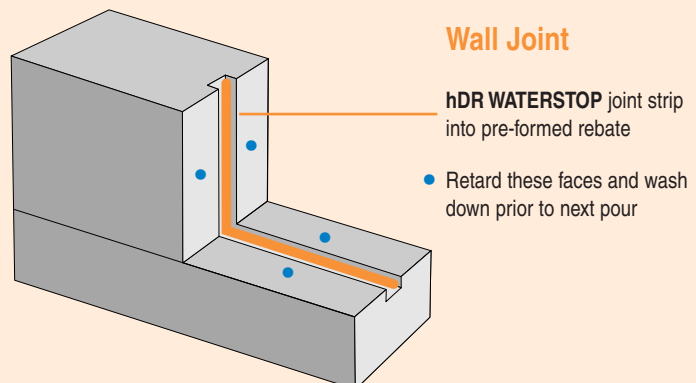
- Quality assured system
- Proven performance
- Unrivalled track record
- Outstanding customer service and on-site support
- Expert advice
- Straightforward and cost-effective waterproofing solution
- Full warranties and guarantees



### Basement construction using structurally integral protection



### Wall Joint



Artist's impression Grosvenor Waterside, London

## PUDLO concrete

**PUDLO** cement waterproofing powder is a BBA approved admixture that can be used to produce watertight, corrosion-resistant structures.



**PUDLO** is a hydrophobic and pore blocking admixture which alters the microstructure of concrete to stop water transport mechanisms and increase durability.

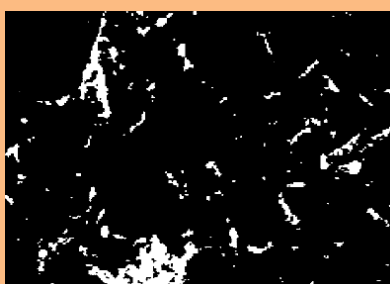
**By incorporating PUDLO into the concrete mix, it is possible to build watertight structures, without the need for membranes or drainage systems.**

PUDLO reduces corrosion mechanisms within concrete and, as a result, increases structural durability. The system is suitable for use in aggressive and hostile conditions such as coastal defence areas and waste-transfer sites. PUDLO has been used successfully worldwide to provide protection against water ingress and corrosion, even in high exposure class environments.

## Typical Results

	Control (no admixture)	PUDLO concrete
Strength 7 days N/mm <sup>2</sup>	33	52
Strength 28 days N/mm <sup>2</sup>	43	61
Water absorption 28 days % (BS 1881-122)	2.42	1.25
Water Permeability mm penetration (DIN 1048-5)	12.6	< 0.5
Carbonation mm depth	4	< 1
Chloride Diffusion m <sup>2</sup> /s <sup>-1</sup> x 10 <sup>-13</sup>	2.05	0.42

Microslides showing the reduction in water transport mechanisms due to the addition of PUDLO. White scale denotes voids.



Control concrete



PUDLO modified concrete



## PUDLO performance

The modified concrete provides the waterproof, corrosion-resistant solution.

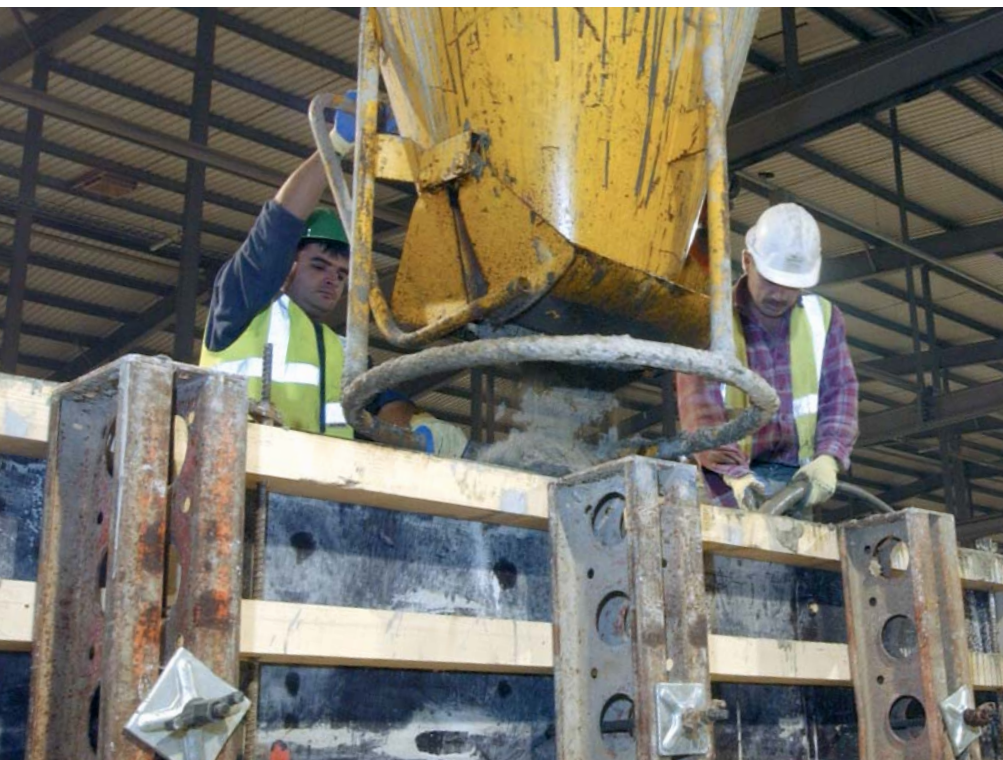
### PUDLO cement waterproofing powder

- Increases the density of concrete by 1%
- Improves chloride resistance by 100%
- Reduces rate of carbonation by a factor of 4
- Improves surface finish and texture
- Increases strengths by a minimum of 10%



**PUDLO** outperforms any other waterproofing admixture.





## Concrete Specification

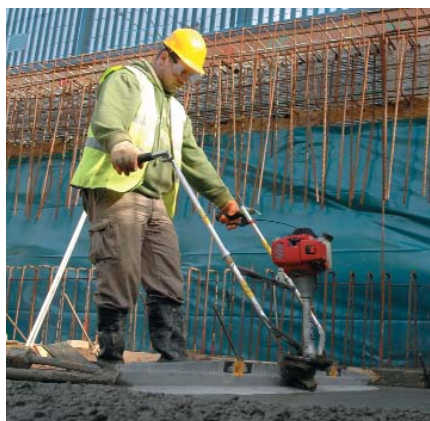
The concrete mix is the same as normal concrete with the addition of **PUDLO** at a rate of 2% by weight of cement (this equates to 8kg per 1m<sup>3</sup> of concrete). The concrete should contain a minimum of 350kgm<sup>3</sup> of cement and the water/cement ratio should not exceed 0.4. The target slump should be 100mm (+/- 20mm).

**PUDLO** is added at the batching plant with an adequate mixing time of 15 minutes. The material is a non-toxic, odourless, dry powder and packed in 1kg, 2kg, 8kg and 25kg bags. The 8kg bags are soluble and disintegrate in the mix.

## Screed and Wall Render Specifications

Floor screeds and wall renders are made using normal sand / cement mixes.

**PUDLO** is mixed with the dry constituents at a rate of 3% by weight of the cement (this equates to approximately 0.75kg per 25kg cement). Full method statements for screeds and renders are available on request.



**PROVEN  
PERFORMANCE**

**PUDLO**







## Our Service and Warranty

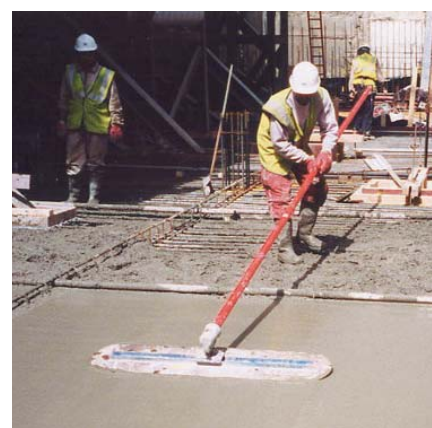
Technical expertise is provided throughout the project from design stage through to completion. No obligation help and advice is available to the specifier, contractor and concrete supplier.

The quality assured **User Guide** gives comprehensive details on how to correctly use and install **PUDLO** modified concrete and a technical manager will give on-site support prior to and during pours.

David Ball Group plc issue a 30 year company warranty (covering products used and installation) and an independent, insurance-backed guarantee is also available on request. All those involved in the project can be assured that a leak-free structure will be achieved.

## Placing PUDLO Concrete

The quality assured **User Guide** gives comprehensive directions for pouring and placing **PUDLO** modified concrete and a **PUDLO** representative will carry out in-depth training on site. Particular instruction will be given on compaction and curing, how to form construction joints using **hDR WATERSTOP** and how to deal with service pipes and tie bolt holes.



**QUALITY  
ASSURED  
SYSTEM**





## Case Study 1

Working with Mott MacDonald and Duffy Construction, **PUDLO** was used in the construction of **AIG's new European headquarters** in London. By providing an easy-to-use, membrane-free waterproofing system, contract costs were reduced and one month was knocked off the construction time. The two basement levels had to be completely watertight for document storage and housing electrical equipment.



## Case Study 2

**PUDLO** is particularly useful where existing protrusions and features have to be worked around, as in the case of the extensive refurbishment of the **Royal Albert Hall**. **PUDLO** modified concrete was employed by Building Design Partnership and John Doyle Specialist Contractor to ensure the waterproofing of the 5 storey underground car park and utilities building.



## Case Study 3

The **Fulham Pools Leisure Centre**, designed and built by Amec, contains an 8-lane competition pool, a 6-lane fitness pool and a teaching pool. The concrete mix design for the floor, walls, surface slabs and undercroft of the pool tanks utilised **PUDLO** waterproofing admixture, **hDR WATERSTOP** and **INSTAFLEX PU25 MASTIC** to provide a high performance, water retaining structure.



## Case Study 4

**PUDLO** is used extensively on projects around the world. In Dubai, where ground conditions are exceptionally aggressive and saline, the admixture has been used on numerous sites including the **Jumeirah Road development**. Watertight construction was imperative for this exclusive residential and commercial development. **PUDLO** modified concrete was used to construct the large basement area designed for car parking facilities. **The first membrane-free project in Dubai.**



## BS 8102: 1990 – Code of Practice for the protection of structures against water from the ground

**PUDLO** cement waterproofing powder produces **Type B structurally integral protection**.

The grade will be determined by the thickness of the walls and floor slab.

Structures can be designed to BS8007 or BS8110.

Grade	Basement Nature	Basement Use	Waterproof Performance	Size mm
1	Basic utility	Car parking; Plant rooms (excluding electrical equipment); workshops	Some seepage and damp patches tolerable	150
2	Better utility	Workshops and plant rooms requiring drier environment; retail storage areas	No water penetration but moisture vapour tolerable	200
3	Habitable	Ventilated residential areas including offices, restaurant, leisure centres etc	Dry environment	250
4	Special	Archives and stores requiring controlled environment	Total dry environment	300*

### Note 1

The wall sizes are recommendations only – technical manager can advise on each project individually

### Note 2\*

Can achieve Grade 4 at 270 (this allows enough concrete cover to act as a vapour membrane)

### Note 3

Grades 3 & 4 need ventilation

**UNRIVALLED  
TRACK RECORD**



Underground art gallery – first UK project to use waterproofed, self-compacting concrete, winning Concrete Society Award for Innovation



Zero leakage for water testing tanks – national R & D facility for specialist hydraulic and marine environment engineers, H. R. Wallingford



Wimbledon Centre Court Stadium – using lightweight, watertight concrete the loading stresses were reduced by 50% at the prestigious sporting venue



## PUDLO concrete waterproofing products

**PUDLO CWP:** dry powder admixture for structural concrete and waterproof renders.

**hDR WATERSTOP:** hydrophilic polyacrylate elastomeric waterstop. Designed for the internal sealing of construction joints for cast-in-place concrete. **hDR WATERSTOP** expands upon contact with water to form a positive seal even in saline conditions. The waterstop will perform successfully under hydrostatic pressure and under both continuous immersion and wet/dry cycling. **hDR WATERSTOP** is manufactured in 10 metre lightweight, flexible coils of 5mm by 20mm wide dimensions, 100metres per box.

**INSTALASTIC:** liquid-applied, seamless, flexible, waterproof coating which is abrasion-resistant, providing long service-life for extreme service class concrete structures. Supplied in 35kg units (comprising 25kg powder and 10 litres of liquid) one unit is sufficient to apply to an area of 10m<sup>2</sup> with two 1mm coats.

**INSTAFLEX PU25 MASTIC:** high performance, polyurethane single pack, multi-purpose sealant. **INSTAFLEX** can be used to provide a low skin formation that is fast cure, non-sag and moisture curing. An excellent adhesive for **hDR WATERSTOP**.

**PUDLO SCC:** extension of **PUDLO CWP** the admixture is specifically designed to produce high workability, easy to use, self-compacting concrete with the benefits of ultra-low permeability and exceptional surface finish.

**INSTACEM Primer Latex:** blend of acrylic polymer resins that can be used as a primer or sealer. The latex is applied to previously prepared substrate before the application of the cementitious repair material or as final coating. Supplied in 5 litre units, one unit is sufficient to apply to an area of 25m<sup>2</sup> with two coats.

**INSTAPRUF:** cement based, water-resistant, hard wearing, self smoothing floor topping. Supplied in 29kg units (comprising 25kg powder and 4 litres of liquid), one unit is sufficient to apply to an area of 3m<sup>2</sup> at 3mm depth.

**INSTACEM concrete repair:** specially formulated, pre-mixed cement powder. The material mixes readily with water to produce a non-shrink, water-resistant, repair material that hardens to give a high strength product.



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PUDLO is a registered trade name



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