PowerCem Technologies

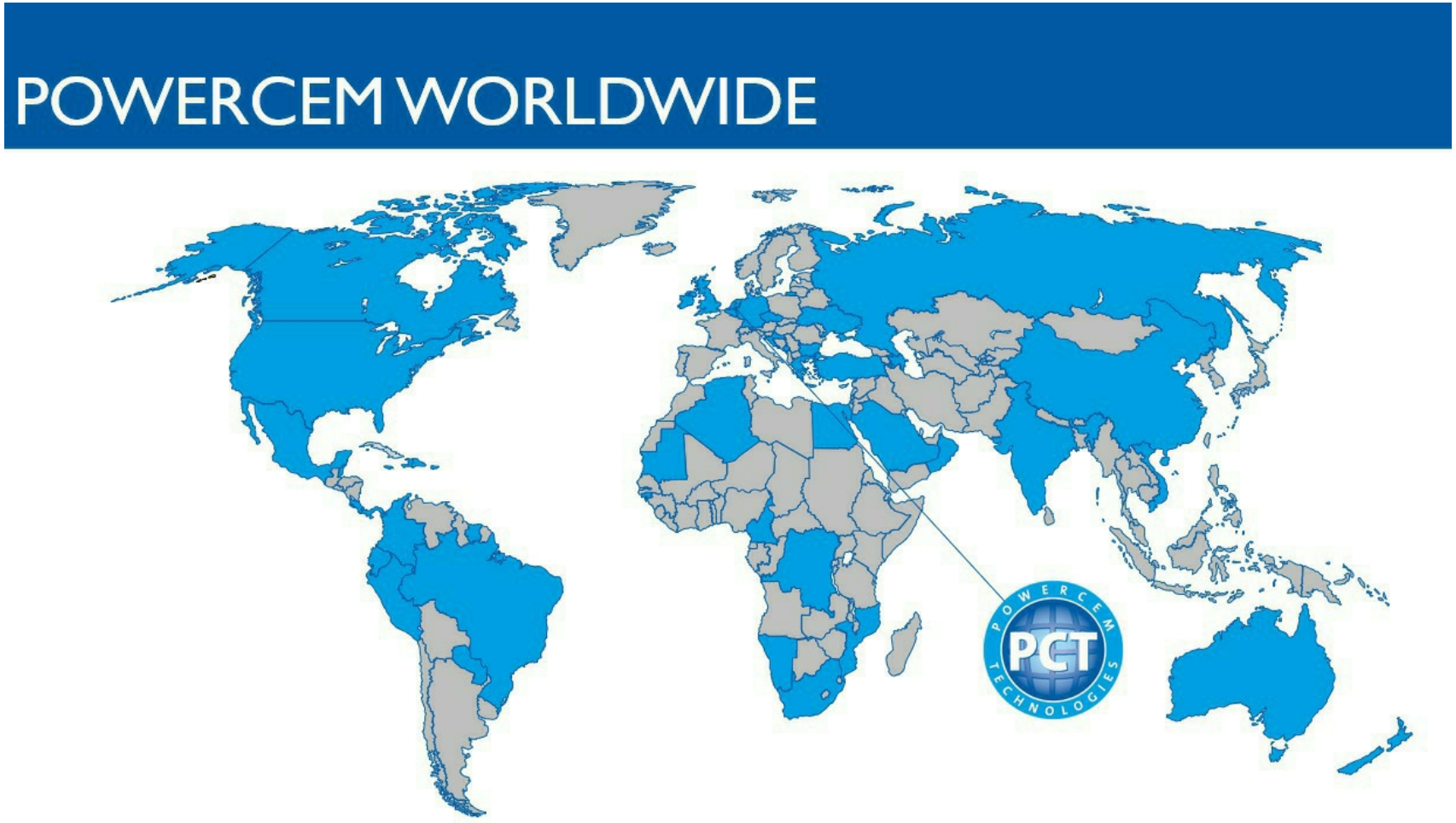
Innovations for better solutions!

- Superior Soil Stabilisation
- High Stiffness, High Elastic bound layers from all soil types
- Full warrantees available for all applications.

PowerCem Technologies – Who are we?

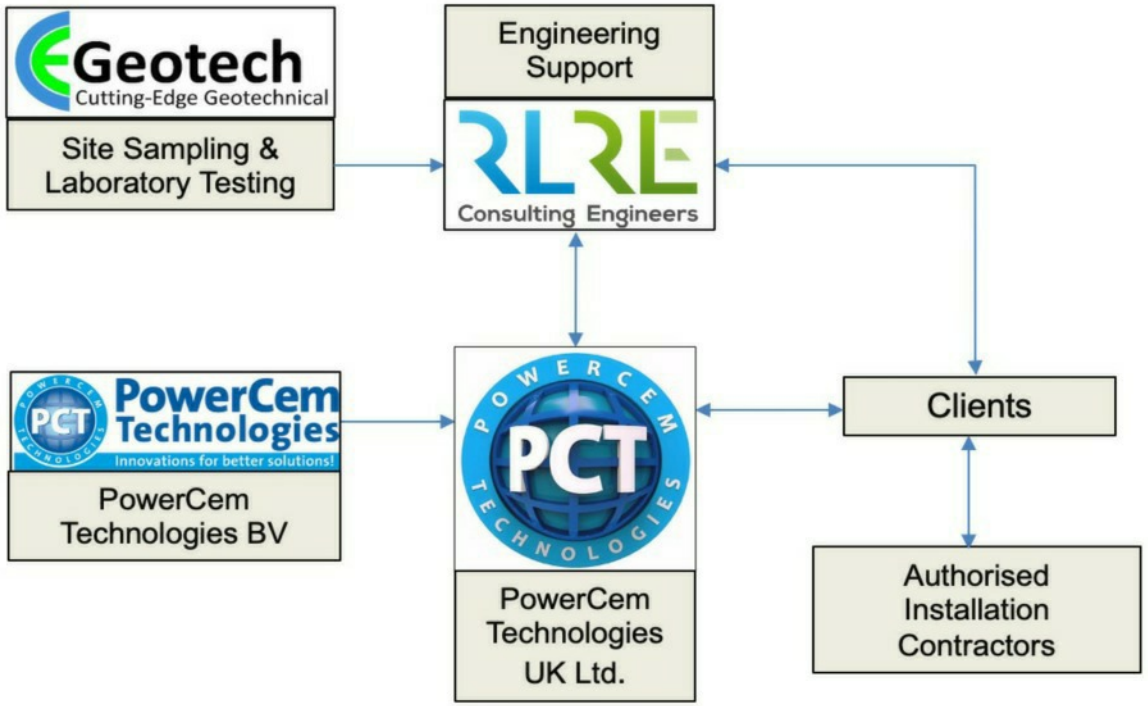
- PowerCem Technologies BV, established in 1996
  - UK Office:– Founded 2011 in Derby
- Based in Moerdijk, The Netherlands
- Specialisation: Improving cement-bound materials
- Products used worldwide

PowerCem Global Partner Network



Globally RoadCem has stabilised over 11,500,000m² of soils

PowerCem Technologies in the UK



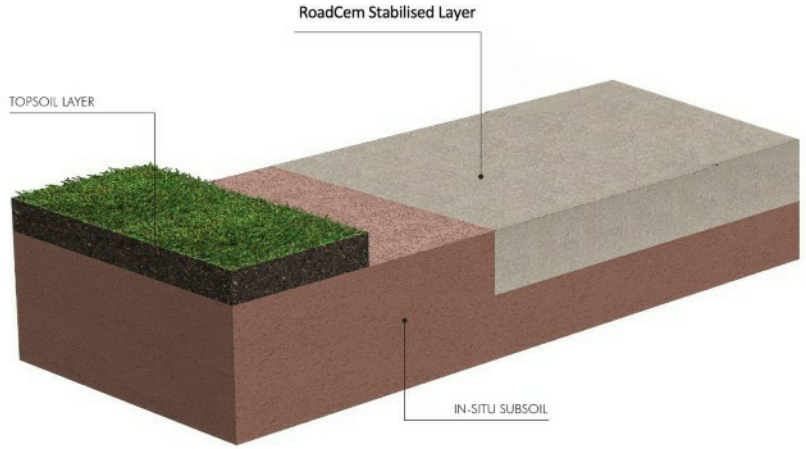
PowerCem Technologies in the UK

Rodgers Leask Consulting Engineers

- Engineering partners to PowerCem UK
- Independent third-party organisation with offices in Derby, Birmingham and Bristol
- Providing:-
  - Site sampling and lab testing co-ordination
  - Design analysis, calculations and specifications
  - Optimised mix designs to meet client requirements
  - Technical liaison for client, contractor and consultants
  - Design Performance Warranties

RoadCem Soil STABILISATION: Single Layer Sub-soil Stabilisation

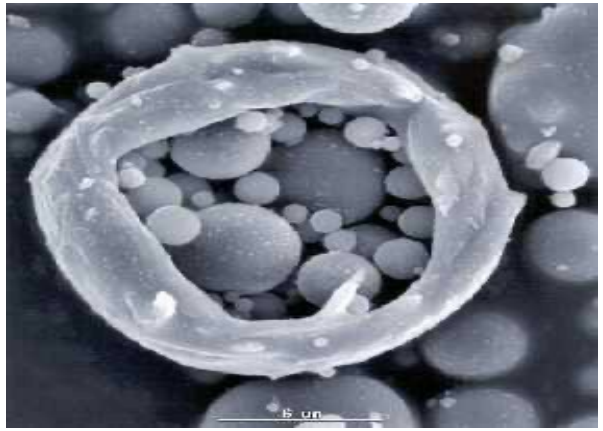
- Controlled mixing of a cementitious binder and RoadCem additive directly into soils at varying degrees of moisture content
- Improves the compressive strength and flexural stiffness of the in-situ subsoils
- Produces robust PERMANENT changes in soil material properties such as STRENGTH, DURABILITY and DUCTILITY
- Waterproof layer – no softening of stabilised layer in saturated soils or flood events
- **High resistance to expansive secondary sulphate reaction**
- Can be used with over-wet soils or those with higher organic contents >5%
- Lower residual pH levels after curing compared to pure cement binders



PowerCem Technology in action

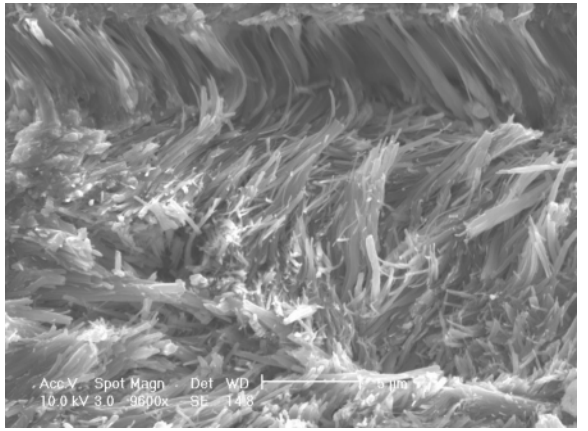
- PowerCem products are an inert blend of synthetic zeolites, earth metals and other natural minerals
- They act as a catalyst to improve the end performance characteristics of the cementitious products in question
- This is often referred to as '*Nanotechnology*'

Traditional Cement



Cement glues the aggregate particles together forming a 'brittle bond'

Cement with RoadCem additive:

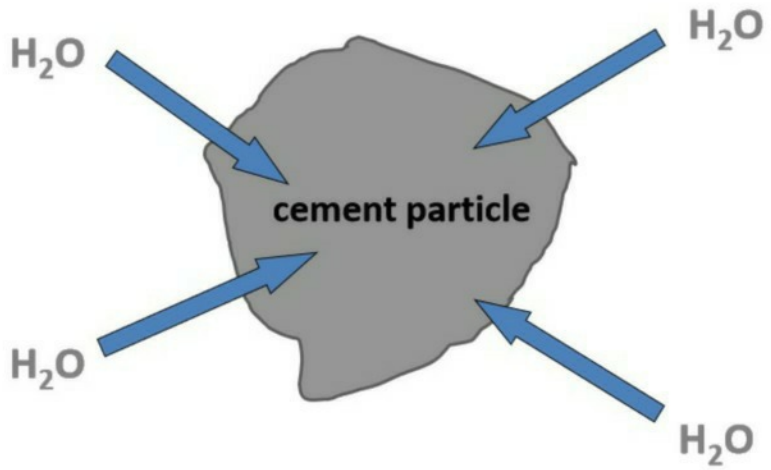


Cement with RoadCem forms needle like elements , **interlocking** the aggregate particles in a 'flexible matrix'

PowerCem Technology in action

Traditional cement hydration

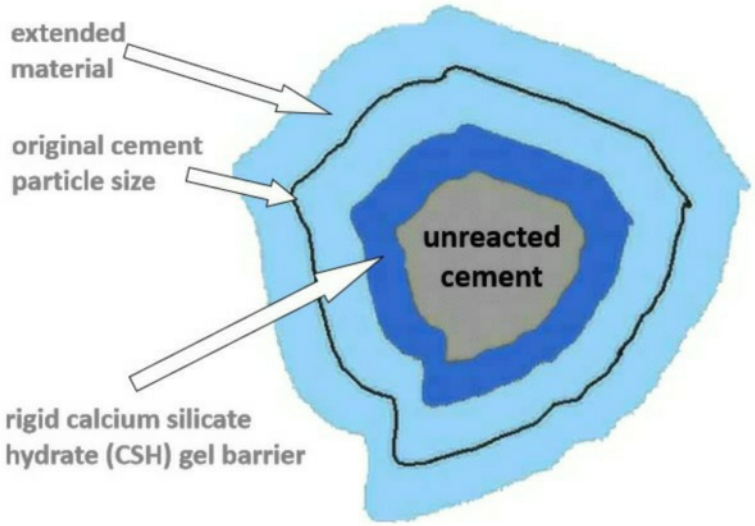
Water enters the cement particle and reacts to form calcium silicate hydrate (CSH)



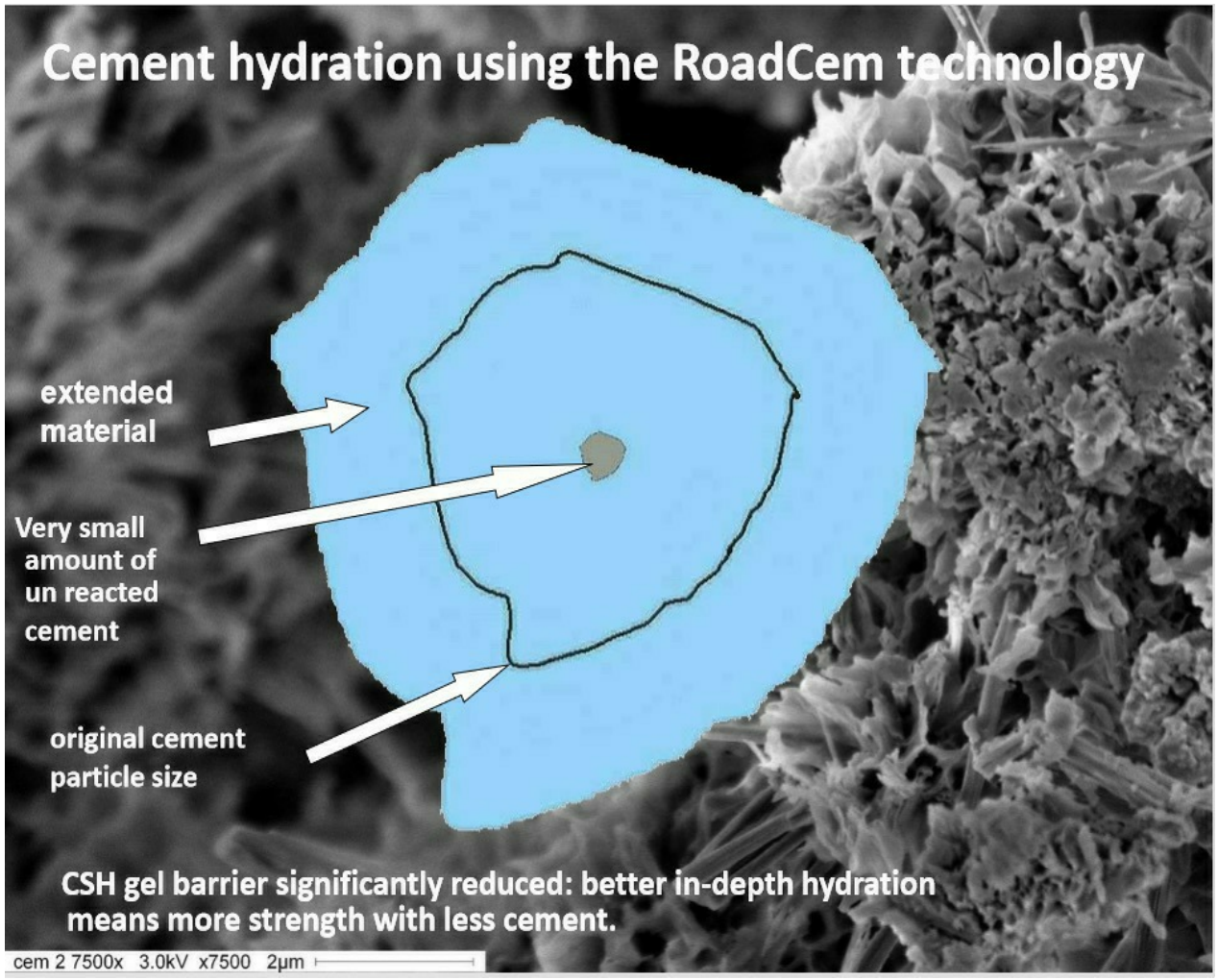
$$2(CaO)_3 \cdot SiO_2 + 7H_2O \Longrightarrow (CaO)_3 \cdot 2(SiO_2) \cdot 4H_2O + 3Ca(OH)_2$$

Traditional cement hydration

CSH gel which is formed creates a barrier to in-depth hydration



PowerCem Technology in action



Benefits of RoadCem soil stabilisation:

- **The RoadCem product facilitates a more efficient chemical reaction between the water and cement within the bound material leading to:-**
  - Reduction of un-hydrated ‘free’ cement powder within the mix
  - Reduction of latent water within pores of stabilised materials
  - Can be used to stabilise **sulphate bearing soils: Clays, Glacial Tills (Boulder Clays) and Mudstones**
  - Greater cement hydration means lower residual pH levels
  - Increased strength characteristics without brittle behavior
  - Higher flexural stiffness - increased Youngs Modulus –enhanced flexibility
  - Highly waterproof product – **no secondary sulphate reaction** and no leaching of cement minerals into surrounding soils when saturated for prolonged periods of time
  - **ROBUSTNESS, FLEXURAL STRENGTH, IMPERMEABLE, UNREACTIVE, REVERSIBLE**

RoadCem – Stabilisation of sulphate bearing soils

40 mm Asphalt bonded directly to 250 mm RoadCem stabilised spoil

48 hours after the in-situ soils have been stabilised a thin bonding course is applied

The Car Park is marked and ready for use, saving time cost and carbon. Saving 64,000 tonnes of imported stone.

RoadCem has been used successfully on a number of UK projects to stabilise soils with high sulphate levels – where the use of standard GGBS has achieved insufficient strength or too expensive to control the reaction.

The high stiffness layer produced by the use of RoadCem means additional benefits can be realised by thinner bituminous layers as well as a elimination of the granular layers.

Ten times stiffer than stone with greater durability and lower lifetime maintenance,

RoadCem – Stabilisation of sulphate bearing soils

Independent research published in 2020 has verified the performance of RoadCem in the stabilisation of soils with TPS levels of +10%.

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Full Length Article

Incorporation of a nanotechnology-based product in cementitious binders for sustainable mitigation of sulphate-induced heaving of stabilised soils

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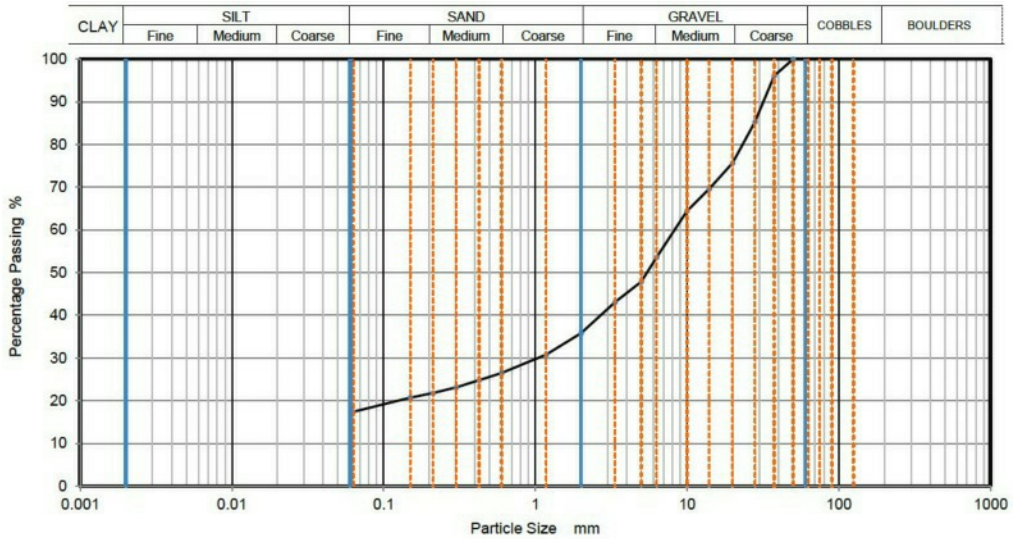
Download paper from our website – Powercem.co.uk or read within the FAQ section:-
https://www.powercem.co.uk/wp-content/uploads/2021/02/Mitigation-of-Sulphate-Heave-in-Cement-Stabilised-Soils-Coventry-University-Sept-2020.pdf

RoadCem – Stabilisation of sulphate bearing soils

Independent laboratory testing carried out in 2020 has also confirmed the performance of RoadCem in the stabilisation of natural soils with TPS levels of +3%. Showing less than 0.1mm soaked swell after 7 days.



Project: [redacted]

Client: CE Geochem			**Chemtest Job No.:**		20-26877
Quotation No.:			**Chemtest Sample ID.:**		1075624
			Client Sample ID.:		Composite
			Sample Type:		SOIL
			Date Sampled:		01-Oct-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Total Sulphur	U	2175	%	0.010	1.0
Moisture	N	2030	%	0.020	4.6
Acid Soluble Sulphur	N		%	0.010	0.050
Water Soluble Sulphur	N		%	0.010	0.044
Oxidisable Sulphides as SO4	N		%	0.030	2.9
Total Potential Sulphate as SO4	N	2175	%	0.030	3.0
pH	U	2010		4.0	9.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.66
Sulphate (Acid Soluble)	U	2430	%	0.010	0.15

RoadCem – Stabilisation of sulphate bearing soils

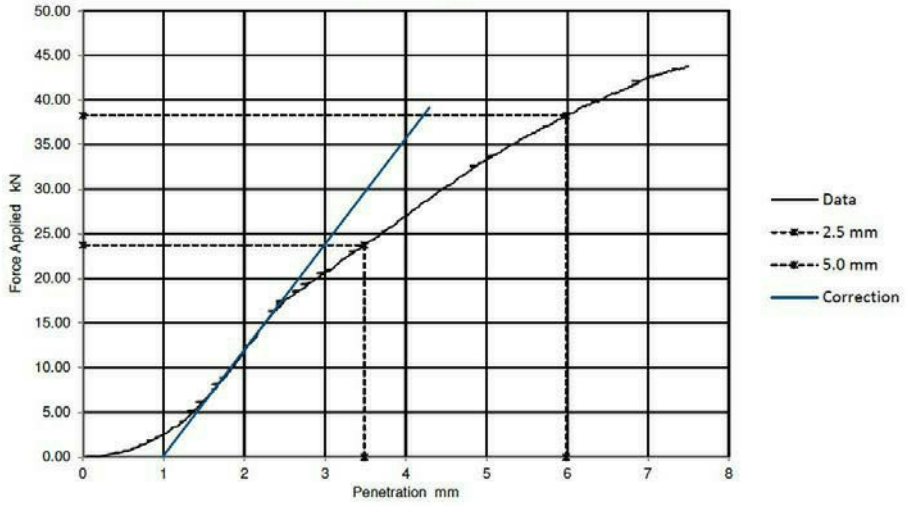
Independent laboratory testing carried out in 2020 has also confirmed the performance of RoadCem in the stabilisation of natural soils with TPS levels of +3%. Showing less than 0.1mm soaked swell after 7 days.

Geotech	California Bearing Ratio (CBR)				Job Ref	A200802
					Borehole/Pit No.	Composite
Site Name	Wilton International Port				Sample No.	Roadcem/CEM1
Soil Description	Grey mudstone				Depth m	0.00
Specimen Curing Time	4 day	Target Moisture	OMC +4%	%	Sample Type	AMAL
Specimen Description	Specimen 5 (Swell) - Top of mould				KeyLAB ID	CEGL202010013
Test Method	BS EN 13286 - Part 47 : 2004				Date of Test	19/10/2020

Specimen Preparation

Condition	REMOULDED				Soaking details		
Details	Recompacted with specified standard effort using 4.5kg rammer				Period of soaking	7	days
					Time to surface	N/A	days
					Amount of swell recorded	0.09	mm
Material retained on 20mm sieve removed		24	%		Dry density after soaking	2.13	Mg/m³
Initial Specimen details	Bulk density	2.32	Mg/m³		Surcharge applied	0	kg
	Dry density	2.13	Mg/m³			0	kPa
	Moisture content	8.9	%				

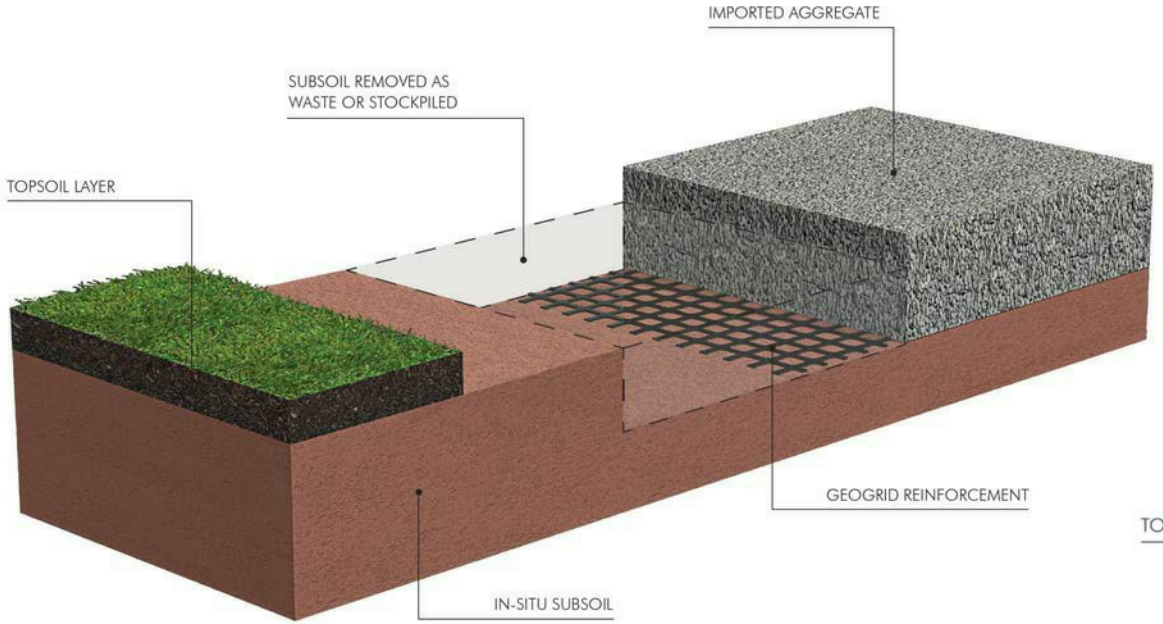
Force v Penetration Plots

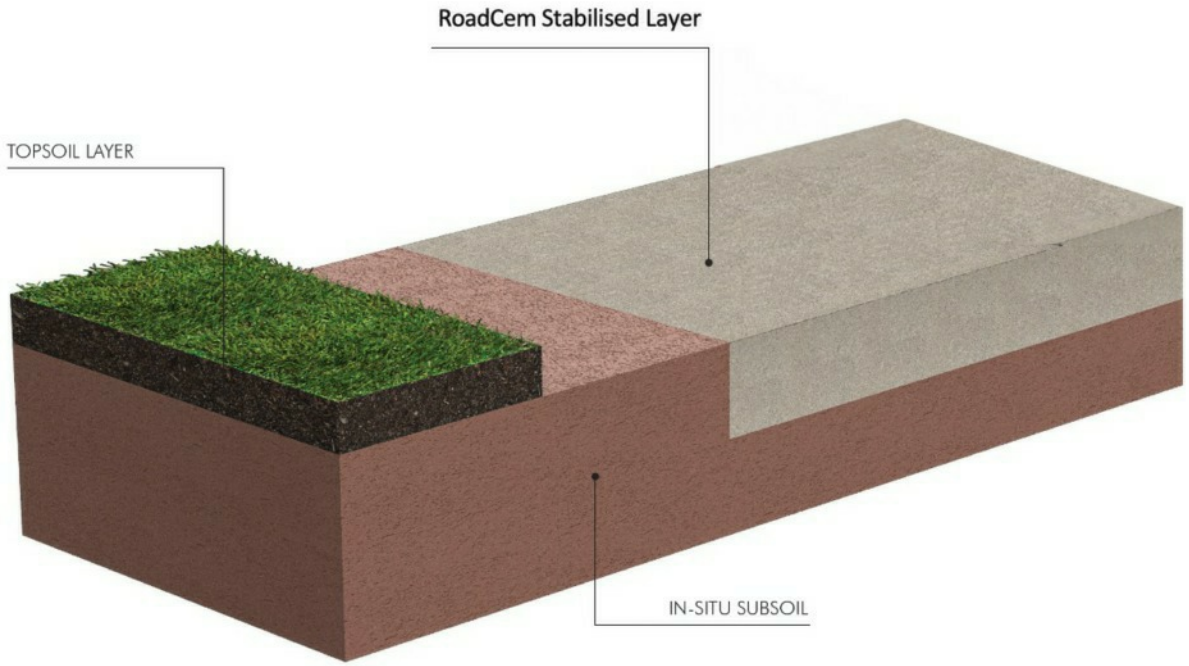


Results

	Curve correction applied	CBR Values, %			Moisture Content %
		2.5mm	5mm	Highest	
TCR					

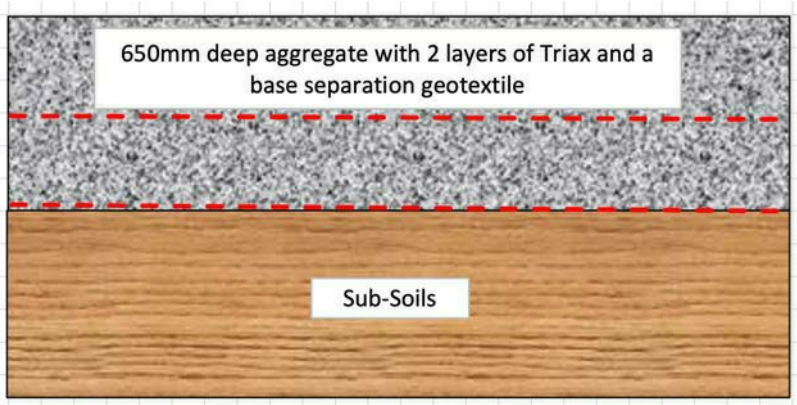
Traditional aggregate and geogrid solution vs **RoadCem** method





RoadCem – Sustainability Comparisons

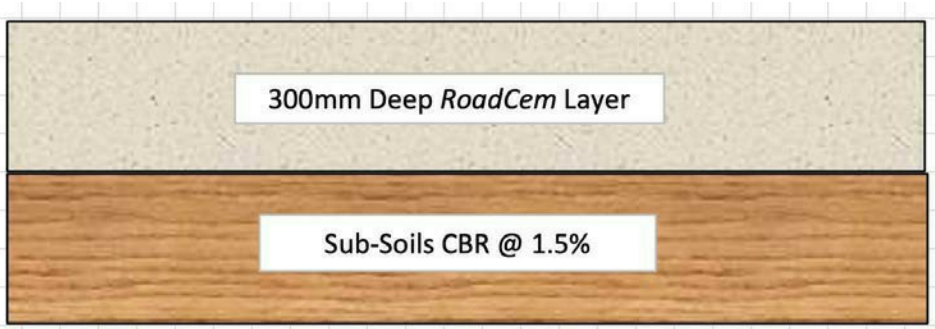
- **Traditional aggregate haul road compared to a RoadCem single layer solution**



Top up rates set at 20% per year. Aggregate delivered distance 50km, placed and compacted and removed after use with a 30km return trip to nearest waste recycling facility.

61 $KgCO_2/m^2$

37 $KgCO_2/m^2$



Cement and RoadCem binder delivery distance 50km, placed and compacted and reinstated on site after use no waste off site

RoadCem – Environmental benefits

REDUCE Vehicle Movements

Eliminate the need for aggregate imports to site and the export disposal of any surface layers after use.

+85% Typical Reduction Achievable

MINIMISE CO_2 – Use the most sustainable solution

LCA assessments show that by adopting a single layer solution embedded CO_2 can be kept to an absolute minimum

>20% CO_2 reduction over soil enhancement
>60% CO_2 reduction over aggregate solutions

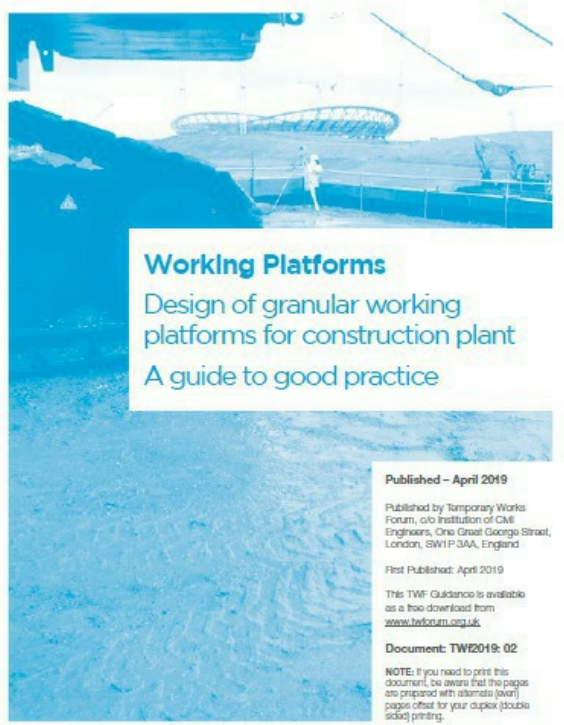
SAVE TIME – Reduce Construction Programmes

A RoadCem solution can save weeks of programme time with +2000m² of single layer product installed each day

Up to 90% reduction in programme time

RoadCem – Working Platforms

- **Designed using the new TWF Design Methodology**

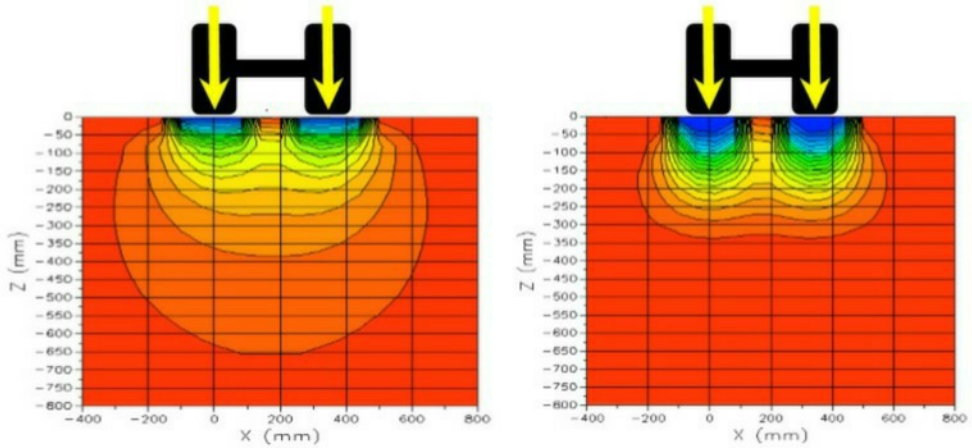


Temporary Works forum

RoadCem – Working Platforms

- **Designed by limiting the soil strain developing under the stabilised layer using BiSar linear strain analysis software.**

Effect of higher dynamic elastic modulus with RoadCem



RoadCem – Working Platforms

- All types of piling rigs and cranes can safely be used on a RoadCem in-situ soil working platform

RoadCem – Working Platforms

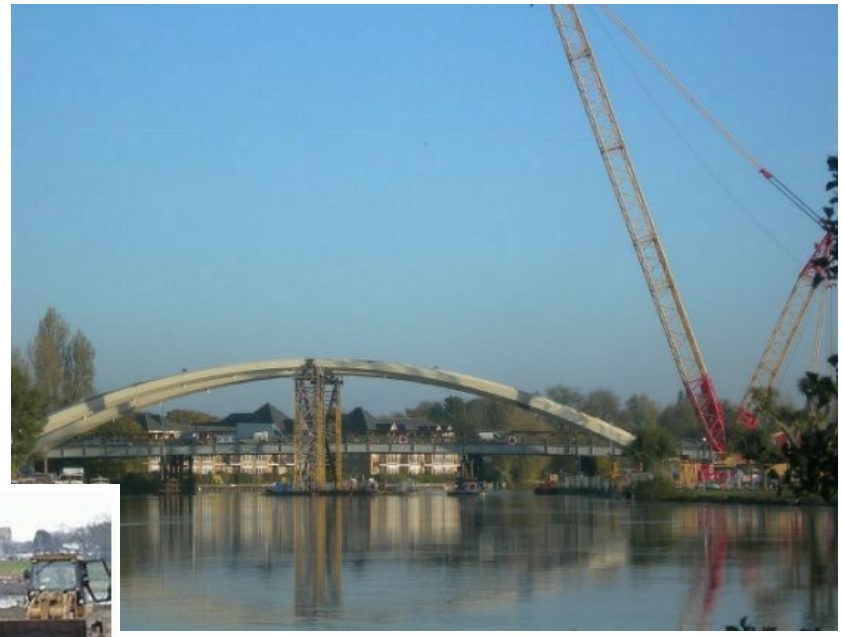
- Existing very soft made ground at Hull WWTW
- Mott MacDonald Bentley project
- Soft ground stabilised to enable site piling and lifting operations to be safely carried out.

- RoadCem working platform ready for use.
- Allowing piling rig and crawler crane to operate directly on the RoadCem layer. No surface stone layer required.

RoadCem – Working Platforms

- During even the wettest conditions RoadCem platform allows heavy construction work to meet challenging programmes. Try this with stone or standard cement stabilisation
- Piling, Crane lifts, MEWP, laydown all perfectly supported straight off the RoadCem surface.

RoadCem – Working Platforms



Construction News

Walton on Thames Bridge
Project of the Year Winner £10-£50 million

RoadCem – Working Platforms

- RoadCem working platform for construction of new terminal surface water pumping station on the Sandringham Estate at Wolferton
- Heavy plant working over soft silty soils with high water table
- Platform rotovated back to granulised soil and returned to nature upon completion within arable land areas.

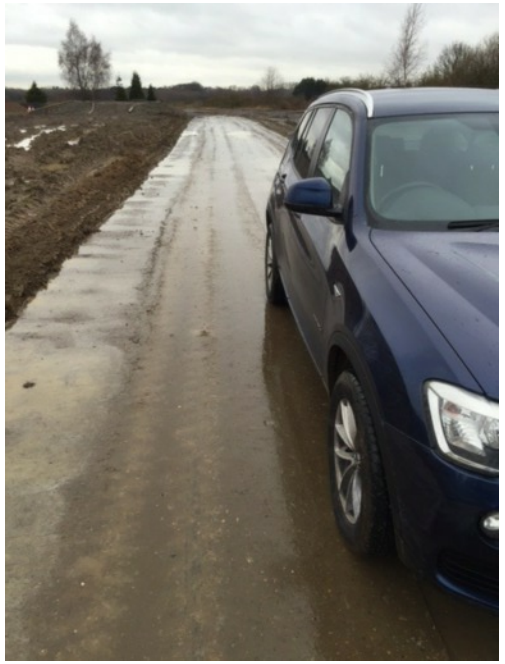
RoadCem – Working Platforms

- Note: soft organic silty soil underlying platform
- Sheet piling driven through RoadCem platform without any localized overbreak

RoadCem – Working Platforms

- Office headquarters project
- RoadCem piling mat and working platform
- RoadCem stabilised layer replaced all permanent road subbase stone
- RoadCem layer under external block paved areas forming new car parks

RoadCem – Temporary access road



- RoadCem haul road trial for Balfour Beatty Power
- Trial withstood intensive use within heavy plant training area
- Trial included rotovating back to nature the stabilised soil upon completion of the testing and inspection period

Balfour Beatty
Ground Engineering

RoadCem – Temporary to permanent roads

- RoadCem used as construction haul road and compound for Cambridge STW upgrade
- Peaty sandy subsoil conditions
- RoadCem surfaced using ‘tar and chip’ upon completion of construction work to form permanent finished surface

RoadCem – Reinforced soil structures

- Loughborough University new car park plateau formation.
- RoadCem used to form reinforced earth wall in conjunction with Maccaferri Green Terramesh and Paragrid solution.
- Surplus topsoil used in place of traditional 6I / 6J granular imported backfill.
- RoadCem and cement mixed with topsoil ex-situ then placed and compacted to form strong safe structural fill.

RoadCem – Safe strong roads for sensitive sites

- After careful testing for strength, impermeability and durability RoadCem was chosen for the construction of estate roads across the large historic St Osyth's Priory in Essex.
- The largest collection of ecclesiastical buildings in the UK, the grounds of St Osyth Priory are a site of scientific interest and all roads had to be shallow in depth and leachproof.
- RoadCem was used to treat the existing in-situ soils to form long lasting soil co

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Innovations for better solutions!