







# PowerCem Technologies

Innovations for better solution!

# PowerCem Technologies – Who are we?

-  **PowerCem Technologies BV, established in 1996**
-  **Based in Moerdijk, The Netherlands**
-  **Specialisation: Improving the performance of cement-bound materials**
-  **Products used worldwide**











**RoadCem Soil Stabilisation for  
Haul Roads, Site Compounds & Working Platforms**

## PowerCem Technologies – Who are we?

-  PowerCem Technologies BV, established in 1996 – 25<sup>th</sup> Anniversary in 2021
-  PowerCem Technologies UK Ltd, established in 2011
-  Specialisation: Improving the performance of cement-bound materials in construction
-  Products used on a worldwide basis

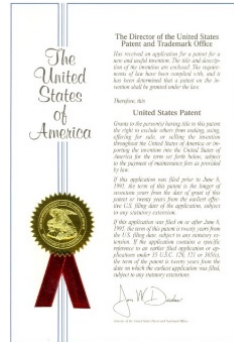


*Protecting Natural Resources for the Future*





# Worldwide Patented Technology



# Certified Production



**14001:2004  
CERTIFIED**





## Scientific Research Partners



Radboud Universiteit Nijmegen



## Global Project Partners



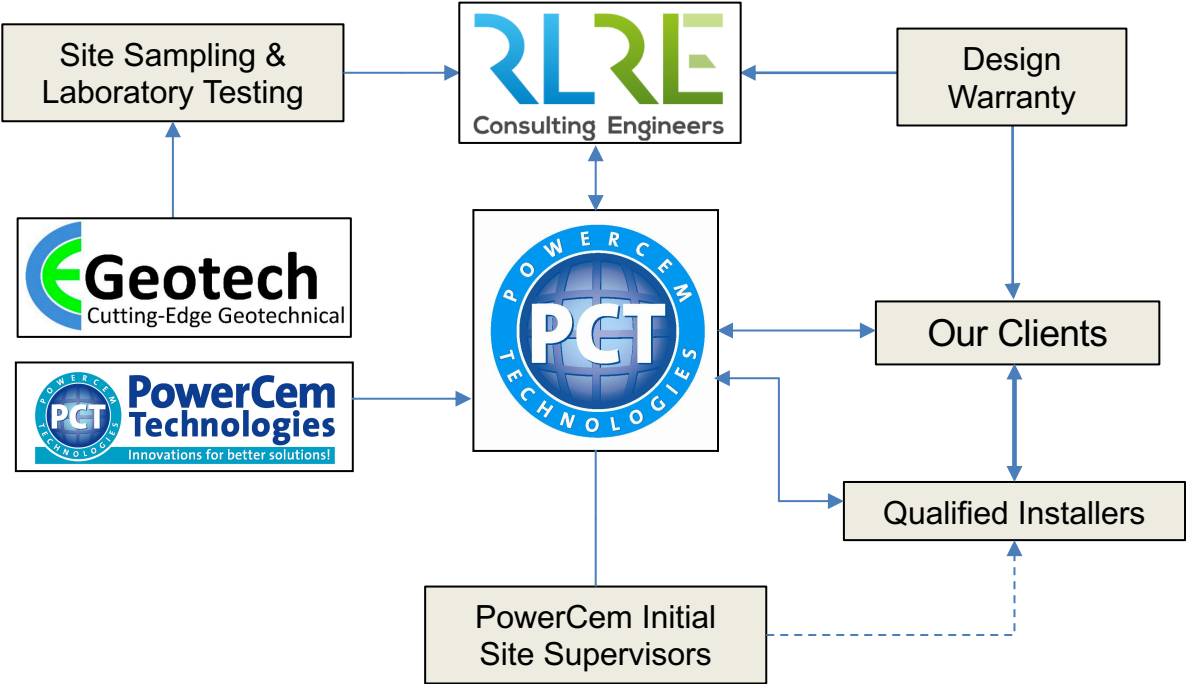
SKANSKA



## UK Project Partners



# PowerCem Technologies in the UK



# PowerCem Technologies in the UK

## Rodgers Leask Consulting Engineers



- Engineering partners to PowerCem UK
- Independent Engineering Consultants with offices in Derby, Birmingham and Bristol
- Providing:-
  - Site sampling and lab testing co-ordination with CE Geotech
  - Mix design proposals and laboratory data review
  - Optimised mix designs specifications
  - Technical liaison for client, contractor and consultants
  - Design performance warranties





# PowerCem Technologies in the UK

## CE Geotech



- Testing and verification partners to PowerCem UK
- Site sampling, laboratory testing and verification services to support mix design specifications and site reinstatement works.
- Providing:-
  - Site sampling, laboratory testing and reporting services
  - On site soil sulphate surveys
  - Optimised mix design assessment in laboratory
  - Determination of neutralisation agents for reinstatement of temporary stabilised structures
  - On-site verification of return to pH and DEFRA nutrient levels



# Industry Terminology

## Soil 'MODIFICATION'

- ❶ In-situ surface spreading and mixing of a LIME binder to reduce the in-situ moisture content of soils
- ❷ Improves workability of the soil to enable their site movement or compaction operations
- ❸ Provides only TEMPORARY changes to site soils
- ❹ Typically done by the spreading of quick lime powder, (AKA Calcium Oxide)
- ❺ **This is not** the **RoadCem** way!





# Industry Terminology

## Soil 'ENHANCEMENT' – Soft Stabilisation

- Controlled application and mixing of a low dose modified cementitious binder into soils close to their optimum moisture content (+/- 2%)
- Enhances soil compressive strength enough to form a low strength bearing layer suitable for surface stone or concrete (armoured) layer surfacing
- Provides semi-permanent changes in soil properties – moisture dependent
- Needs to have project **lifetime drainage** system to stop saturation & softening of treated material – *doesn't like getting its feet wet!*
- Requires sub-soil **CBR > 2.5%** under the stabilised layer
- Organic content of soils to be < **2%**



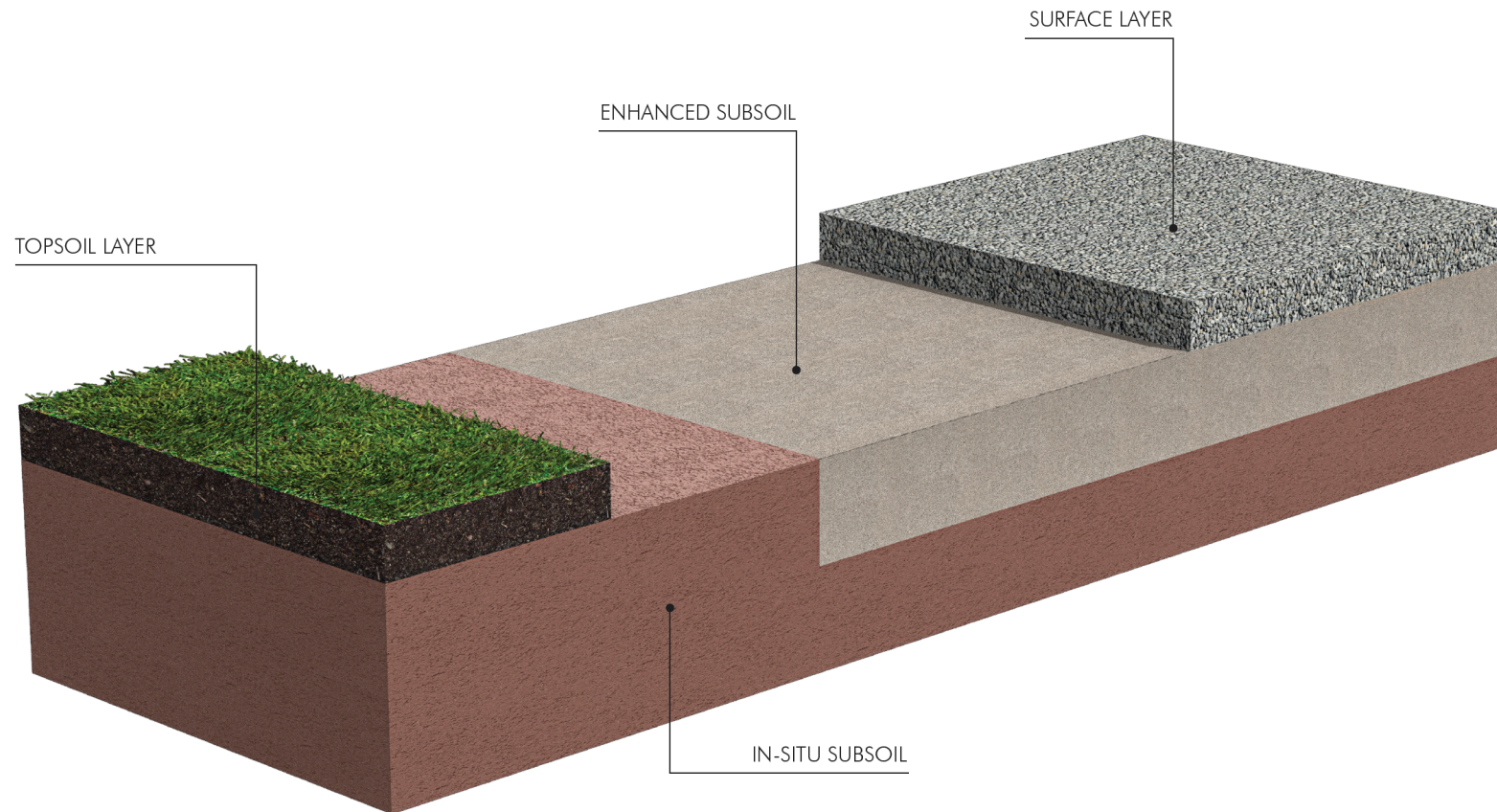
# Industry Terminology

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# What is 'Soft Stabilisation'?



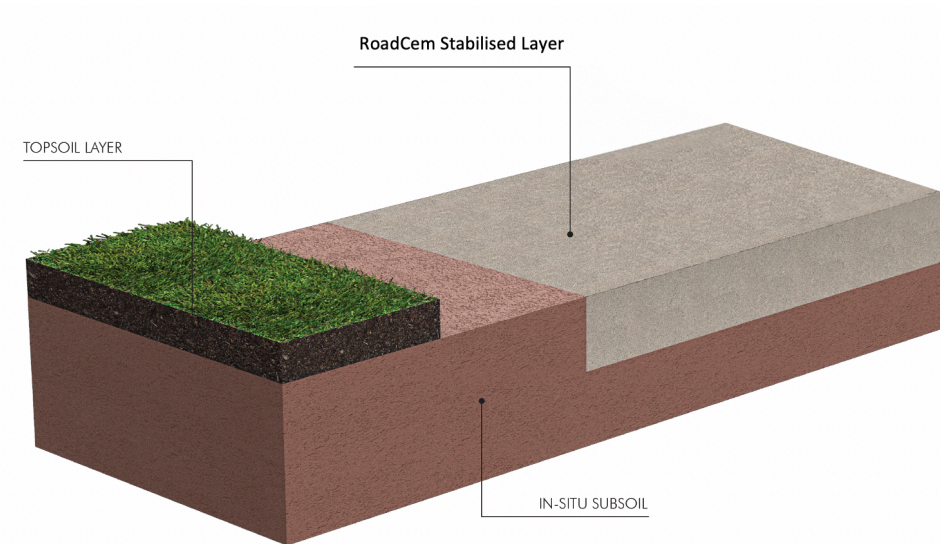
**This is not** the **RoadCem** way!



# Industry Terminology

## RoadCem Soil 'STABILISATION'

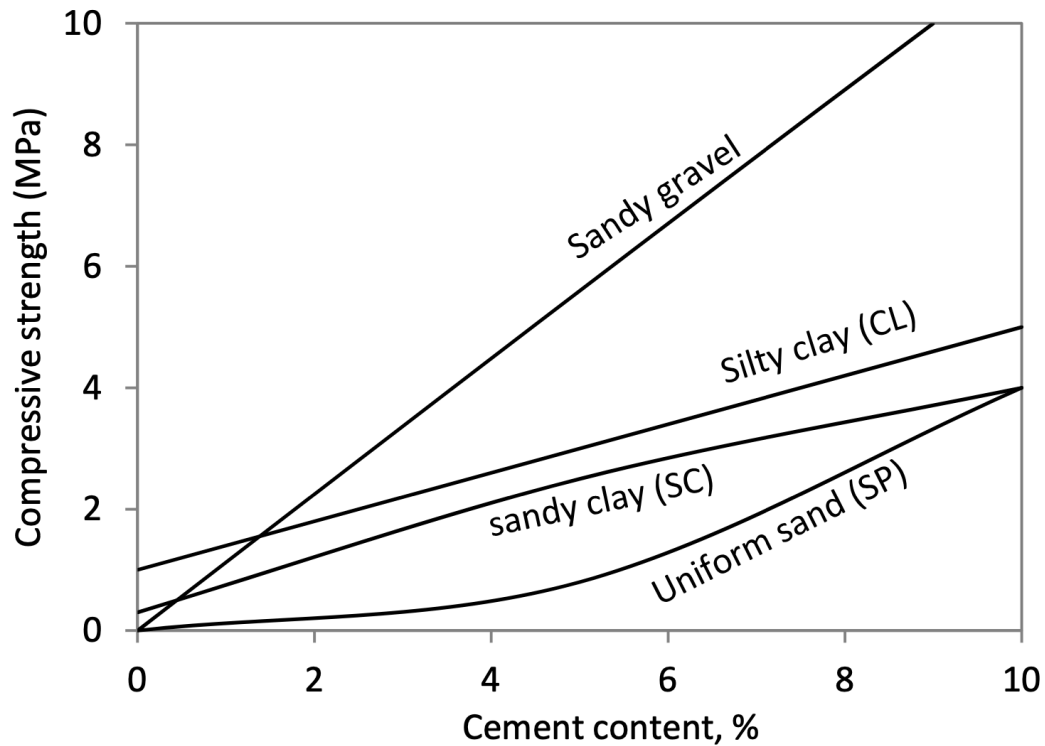
- Controlled mixing of a cementitious binder and RoadCem additive directly into soils at varying degrees of moisture content
- Improves compressive strength and flexural stiffness of soils
- Produces robust PERMANENT changes in soil material properties such as STRENGTH, DURABILITY and DUCTILITY
- Waterproof – no softening of treated layer in saturated soils
- High resistance to secondary expansive sulphate reaction
- Can be used with over-wet or soils with higher organic contents >2%
- Lower residual pH levels after curing than cement binders alone
- SINGLE LAYER SOLUTION – No need for surface stone or 'armouring'





# Stiffness Modulus & Strength of Stabilised Soils

## RoadCem Soil 'STABILISATION'



With increased cement content you typically get:-

- Higher compressive strength and stiffness
- BUT the soil becomes more brittle – cracking from shrinkage...
- Unless you are using **RoadCem** in the mix

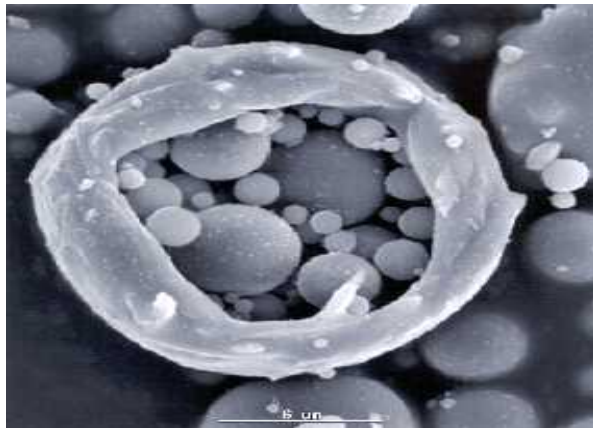
Compressive strength at 7 days as a function of cement content for different soil types (Ingles & Metcalf, 1972)



## PowerCem Technology in action

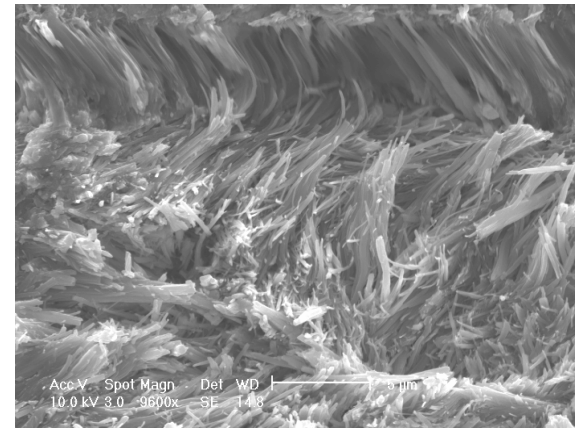
- PowerCem products are an inert blend of synthetic zeolites, earth metals and other natural minerals
- They act as a catalyst to improve the end performance characteristics of the cementitious products in question
- This is often referred to as '*Nanotechnology*'

Traditional Cement



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

Cement with RoadCem additive:



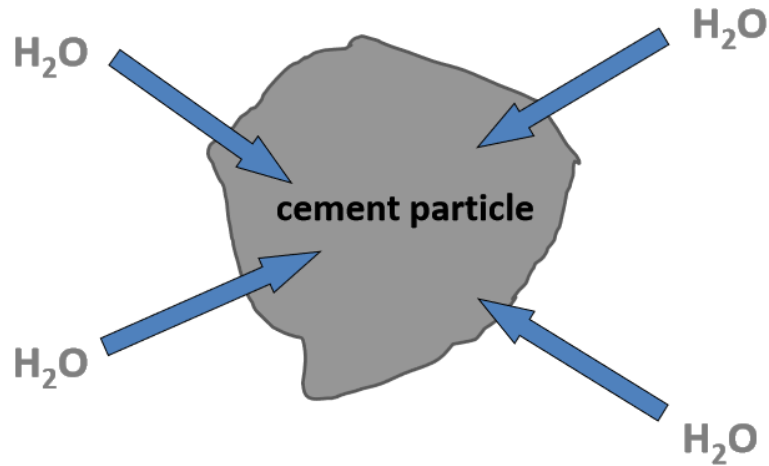
Cement + RoadCem forms long needle shaped strings, **interlocking** the particles in a 'flexible matrix'



# PowerCem Technology in action

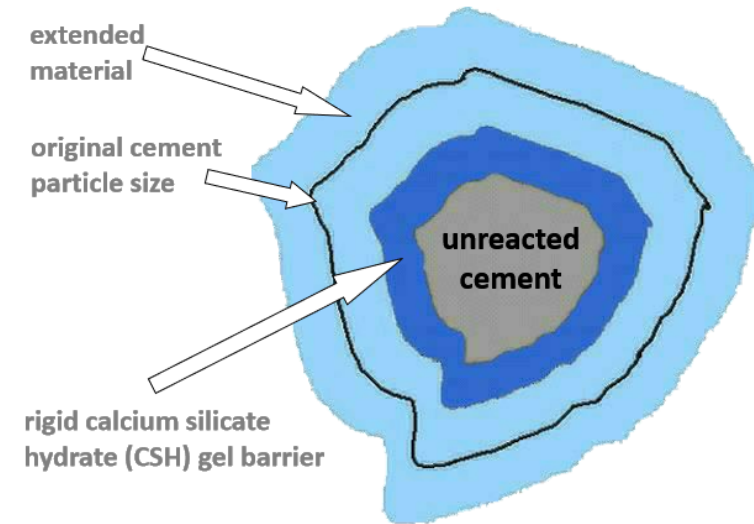
## Traditional cement hydration

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



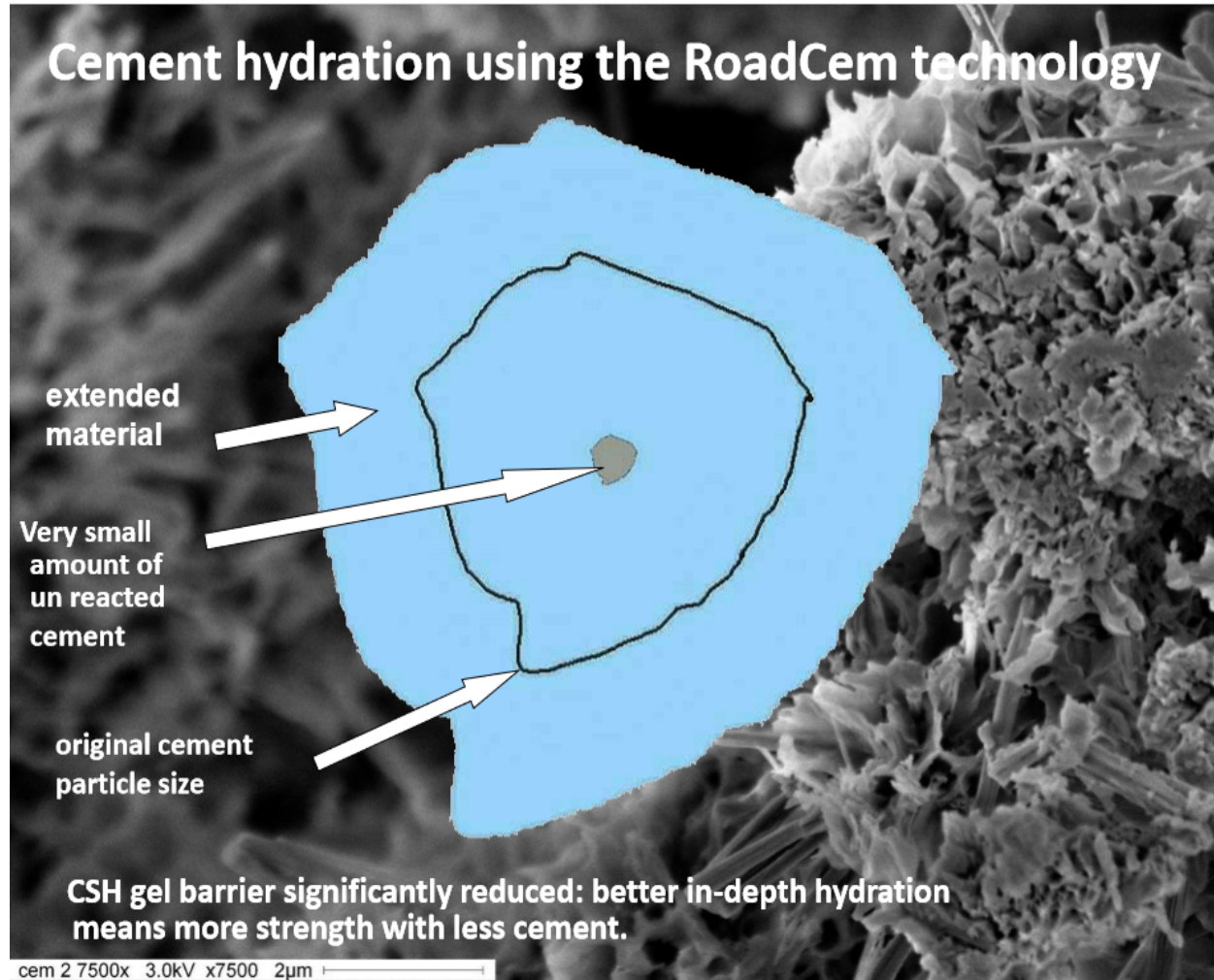
## Traditional cement hydration

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



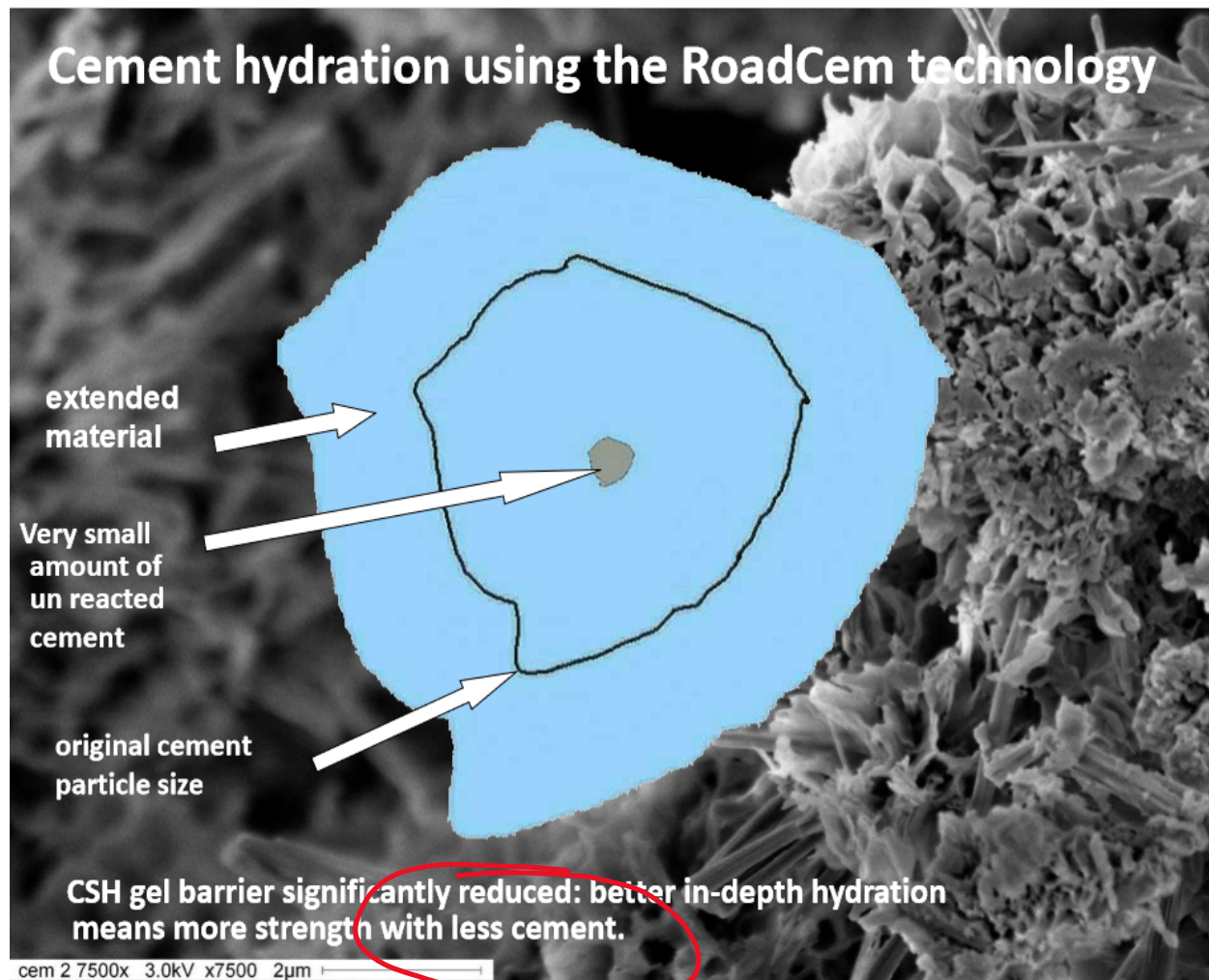


## PowerCem Technology in action





## PowerCem Technology in action





## Benefits of **RoadCem** in soil stabilisation:

- The use of **RoadCem** 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
  - Greater cement hydration means lower residual pH levels
  - Increased flexural strength characteristics without brittle behavior
  - High resistance to secondary sulphate expansion
  - A single, highly waterproof layer – with no leaching of cement minerals into surrounding soils when saturated for a prolonged period of time
  - **ROBUSTNESS, FLEXURAL STRENGTH, IMPERMEABLE, UNREACTIVE, REVERSIBLE**





## PowerCem Technology in action







## PowerCem Technology in action







# PowerCem Technology in action







# PowerCem Technology in action – Sulphate Resistance

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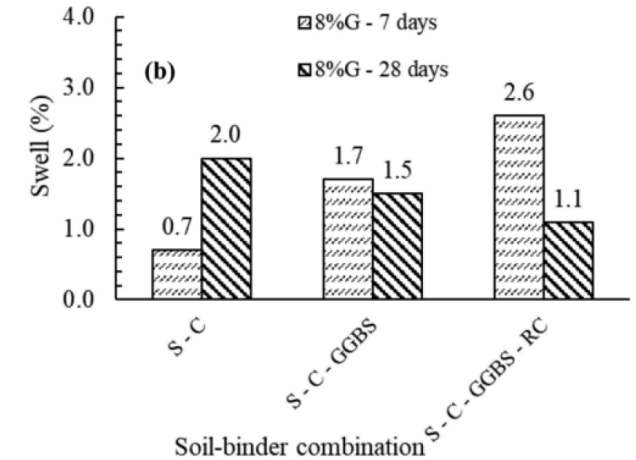
Full Length Article

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

Eyo U. Eyo<sup>a,\*</sup>, Samuel J. Abbey<sup>b</sup>, Samson Ngambi<sup>a</sup>, Eshmaiel Ganjian<sup>a</sup>, E. Coakley<sup>a</sup>

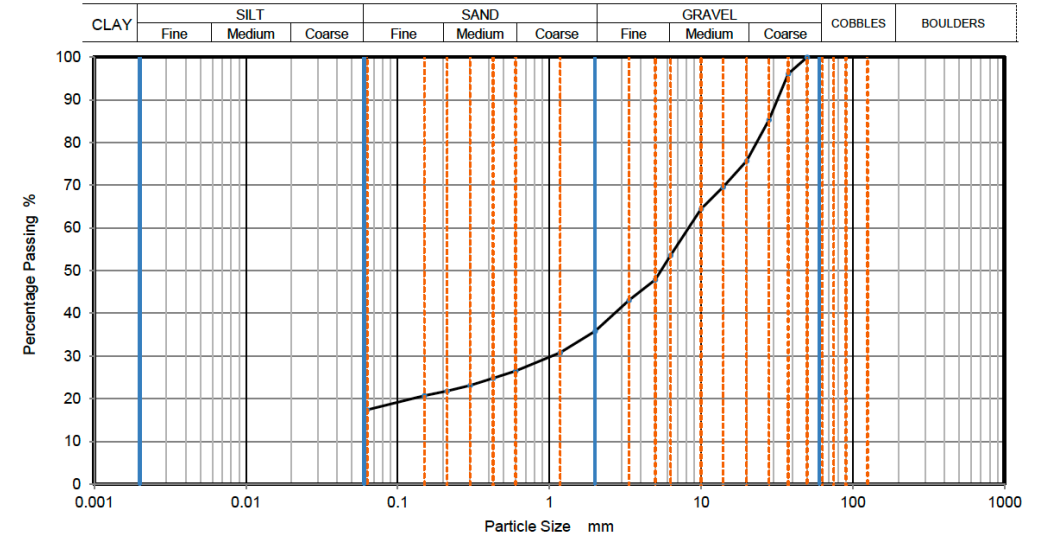
<sup>a</sup> School of Energy, Construction, Environment, Faculty of Engineering, Environment, Computing, Coventry University, Coventry, United Kingdom

<sup>b</sup> Faculty of Environment and Technology, Department of Geography and Environmental Management, Civil Engineering Cluster, University of the West of





# PowerCem Technology in action – Sulphate Resistance



## Project: A200802 Wilton International Port

Client: CE Geotech	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



# PowerCem Technology in action

## – Sulphate Resistance

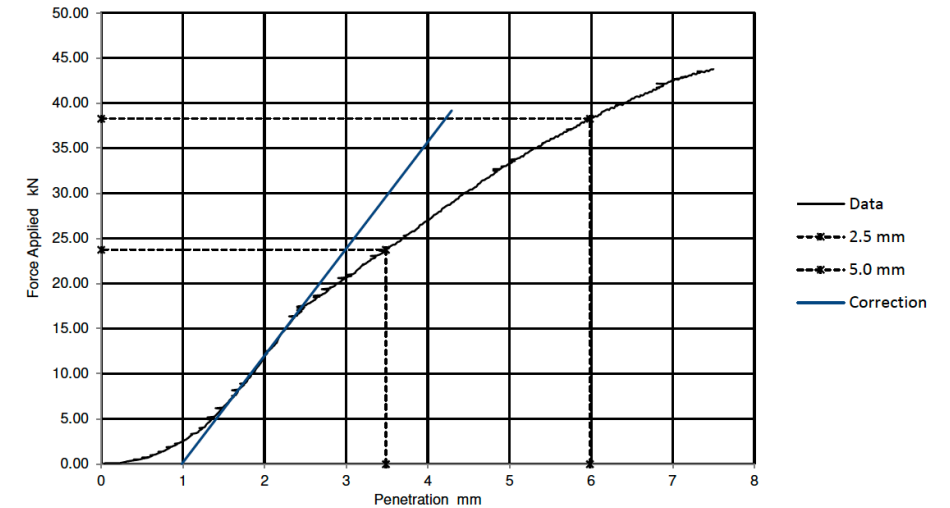


	California Bearing Ratio ( CBR )			Job Ref	A200802	
				Borehole/Pit No.	Composite	
Site Name	Wilton International Port			Sample No.	Roadcem/CEM1	
Soil Description	Grey mudstone			Depth m	0.00	
Specimen Curing Time	4 day	Target Moisture	OMC +4%	%	Sample Type	AMAL
Specimen Description	Specimen 5 (Swell) - 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/m <sup>3</sup>
Initial Specimen details	Bulk density	2.32 Mg/m <sup>3</sup>	Surcharge applied	0 kg
	Dry density	2.13 Mg/m <sup>3</sup>		0 kPa
	Moisture content	8.9 %		

### Force v Penetration Plots



Results	Curve correction applied	CBR Values, %			Moisture Content %
		2.5mm	5mm	Highest	
TOP	Yes	180	190	190.0	NA

CE Geotech Ltd  
CEG Laboratories  
Matlock Road, Kelstedge  
Derbyshire. S45 0DX

General remarks  
Final m/c not carried out at request of client  
Test specific remarks

Approved  
*Chris Salt*  
19/10/2020





# What type of stabilisation is best for your project?

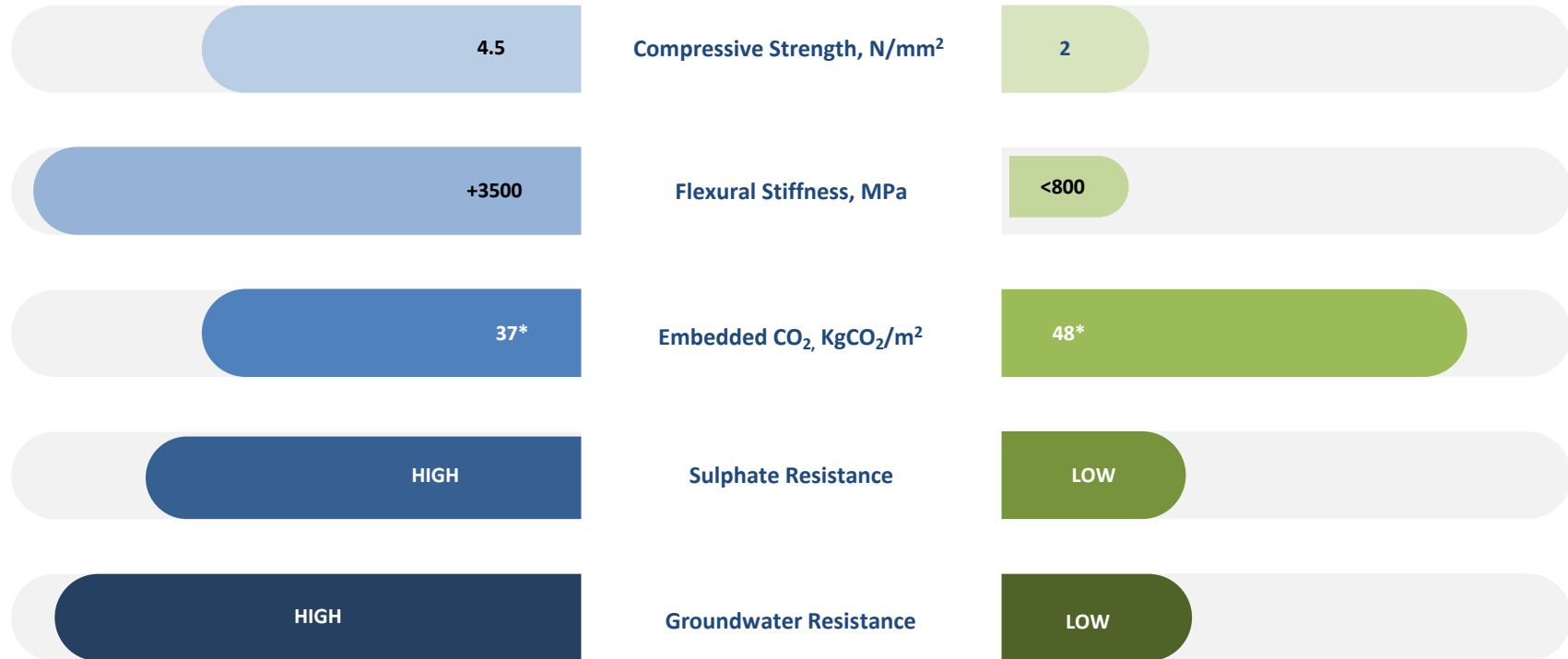
## RoadCem Soil Stabilisation

Values used from independent research data.

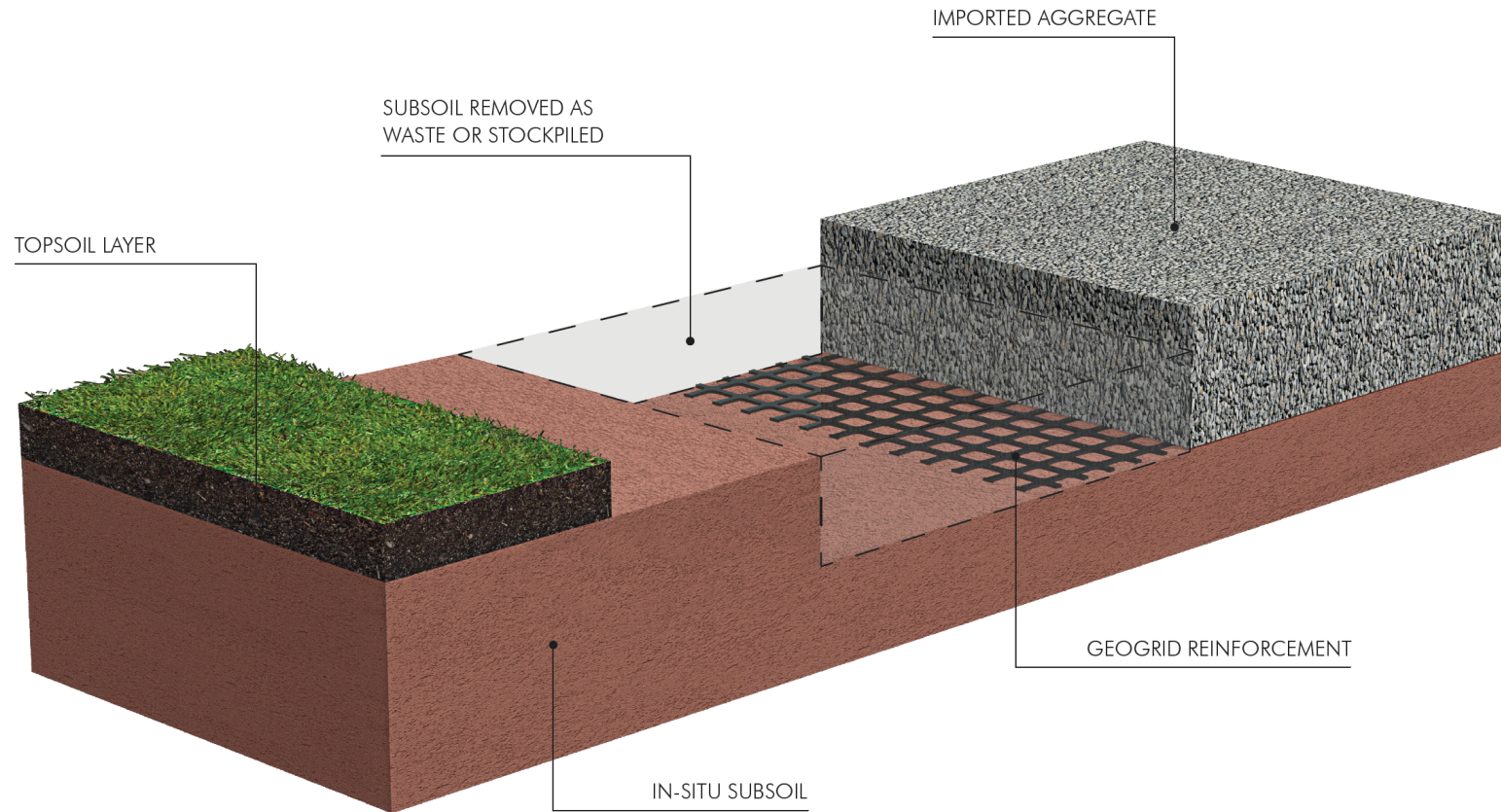
VS

## Soil Enhancement

\*Values used from published data, assuming an armoured type surfacing



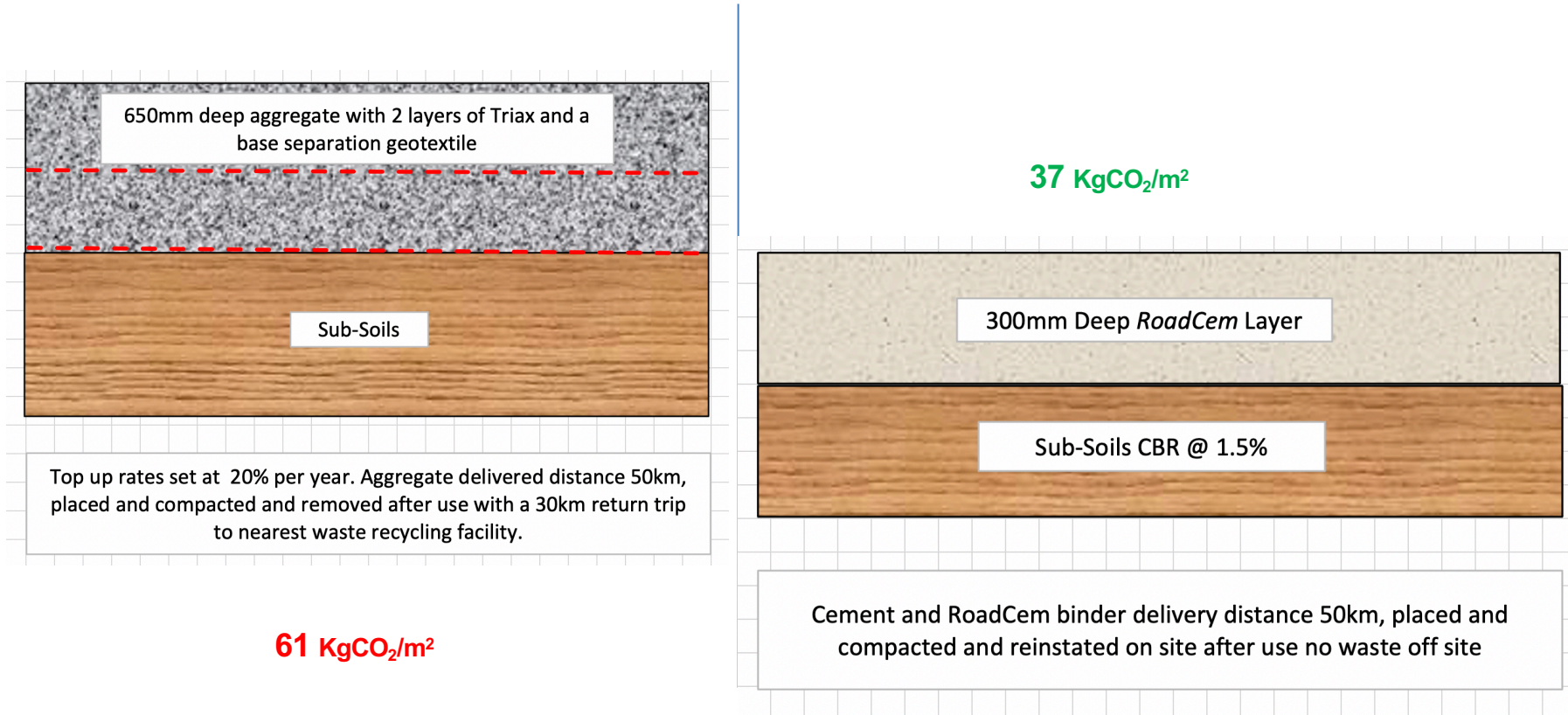
# Traditional aggregate and geogrid solution





# RoadCem – Sustainability Comparisons

## Traditional aggregate haul road compared to a RoadCem one





# PowerCem Sustainability Comparisons

## Example: road length 1000 m, width 7.5 m

Traditional construction



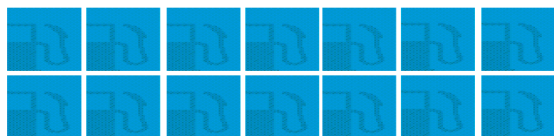
113 trucks



2 560 tons of new material



1 312 tons material to dispose of



7 125 liters of diesel fuel consumed

RoadCem construction



7,5 trucks



168 tons of new material

0 tons material to dispose of



1 180 liters of diesel fuel consumed



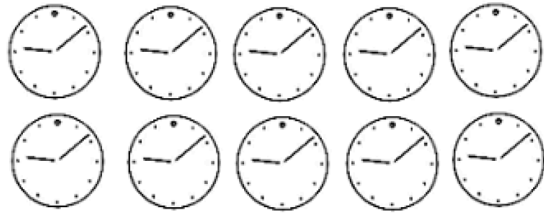




# PowerCem Sustainability Comparisons

**Example: road length 1000 m, width 7.5 m**

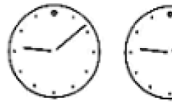
Traditional construction



20 days



RoadCem construction



3 days



40% cost reduction





# 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<sub>2</sub> – Use the most sustainable solution

LCA assessments show that by adopting a single layer solution embedded CO<sub>2</sub> can be kept to an absolute minimum



**>20% CO<sub>2</sub> reduction over soil enhancement**  
**>60% CO<sub>2</sub> reduction over aggregate solutions**

## SAVE TIME – Reduce Construction Programmes

A [RoadCem](#) solution can save weeks of programme time with +2000m<sup>2</sup> of single layer product installed each day



**Up to 90% reduction in programme time**



# RoadCem – Reversibility and Reinstatement



National Grid trial - Brinsworth  
AMEC and Environment Agency



# RoadCem – Reversibility and Reinstatement




 **RoadCem** soil stabilisation can be reinstated using the following steps:-

 Deep re-mixing of the stabilised layer to achieve the desired soil granularity

 The addition of water and pH adjustment as necessary

 Replacement of stripped topsoil materials

 Tillage of topsoil into a tilth

 No additional surface layers to be disposed of

 **RoadCem: The most sustainable soil stabilisation system available in the UK**







# RoadCem – Reversibility and Reinstatement

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● CARBON

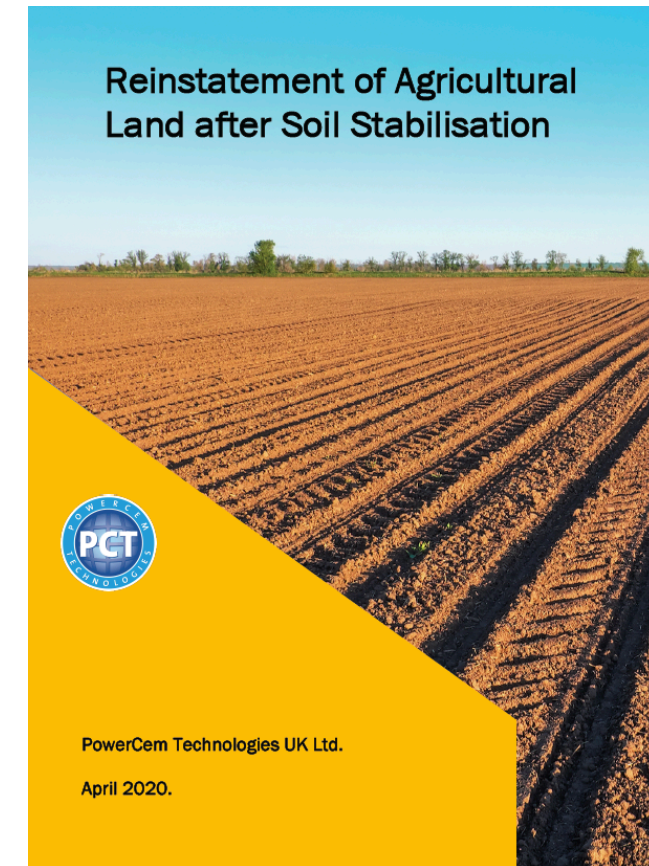


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● **RoadCem: The most sustainable soil stabilisation system available in the UK**





# RoadCem – Regulatory view

## What do the regulators say about Soil Stabilisation?

- The EA position is that any reversed or reinstated soil stabilisation process does not require permitting if the soils being stabilised are not originally considered a waste material.
- The CL:AIRE view echoes this sentiment saying that if the soils are not considered contaminated then there is no need for a Materials Management Plan (MMP) under the DoWCoP protocol.







# RoadCem – Permanent Roads & Parking

## Toyota Car Storage Facility Derby 2020



**UK Parliament**

Campaigns South Derbyshire In Parliament Surgeries Contact

### Heather Wheeler MP visits Construction Site of Toyota's New Derby Hub.

[Like](#) [Share](#) [Tweet](#)

Thursday, 30 July, 2020



# RoadCem – Permanent Roads & Parking

 **Toyota Car Storage Facility Derby 2020**







# RoadCem – Permanent Roads & Parking





# RoadCem – Working Platforms

 Designed using the new TWF Design Method

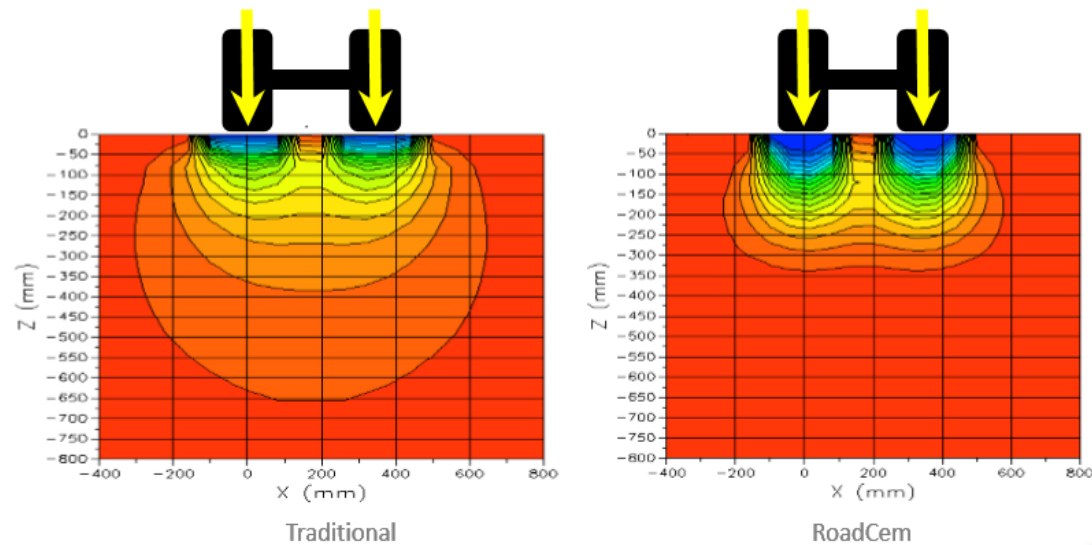




# RoadCem – Working Platforms

- Designed using the new TWF Design Method in conjunction with limiting the soil strain developing under the stabilised layer – BiSAR Analysis

Effect of higher dynamic elastic modulus with RoadCem





## RoadCem – Working Platforms

 All types of piling rigs and cranes can be used on a RoadCem working platform





# RoadCem – Working Platforms



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



- 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 Platforms

## STF refurbishment

The STF refurbishment was required to take place while maintaining the treatment capacity of the existing process. This required a phased construction and commissioning approach to ensure that sludge treatment and biogas production were not affected. The new process is being commissioned in parallel to the existing process, using dedicated feed pumps, gas holder, flare and boilers. The CHP transfer has been programmed to take place following the summer peak and prior to the high winter energy demand, minimising the disruption and expenditure to operations.



## Scheme constraints

**Ground conditions:** Geotechnical investigations revealed the site is located on soft alluvial deposits located at an approximate depth of 3m. These deposits posed to be problematic for the design and build of the new structures due to predicted large settlements with the proposed loads. Suitable founding conditions was not present until depths of around 20m, with a band of sand around 15m depth initially giving misleading pile sets until driven through to the desired level. Extensive piling was carried out over both areas of construction on the site, with over 220 (No.) precast driven piles used over the inlet works alone.

During construction the same ground conditions were to prove problematic for construction cranes and piling rigs. Temporary works to improve the ground conditions would have required between 650mm and 800mm of topsoil removal and replacement with graded fill and MOT type 1 aggregates. The areas required would have resulted in large amounts of waste material and extended programme from stripping and replacement of the material, that an alternative was sought. Using PowerCem RoadCem, the construction team were able create a suitable temporary works surface, using the existing ground material, with the addition of RoadCem which bound between 350mm and 450mm of topsoil together to provide a surface which had a higher bearing capacity and was able to distribute plant loads over a wider area. This not only saved critical programme time, but also reduced the amount of waste material removed from site. With consideration of the finished surface levels, the same temporary works platform was also utilised in the final road levels and pile cap design and levels.



# RoadCem – Working Platforms



What are you looking for?

Water Companies

Case Studies

Supply Chain

Job Search

Exhibitions

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# RoadCem – Working Platforms



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 rotated 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





## RoadCem – Temporary to permanent roads





**Questions**

**RoadCem Soil Stabilisation for  
Haul Roads, Site Compounds & Working Platforms**

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**07711 521 321**



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# PowerCem Technologies

Innovations for better solutions!