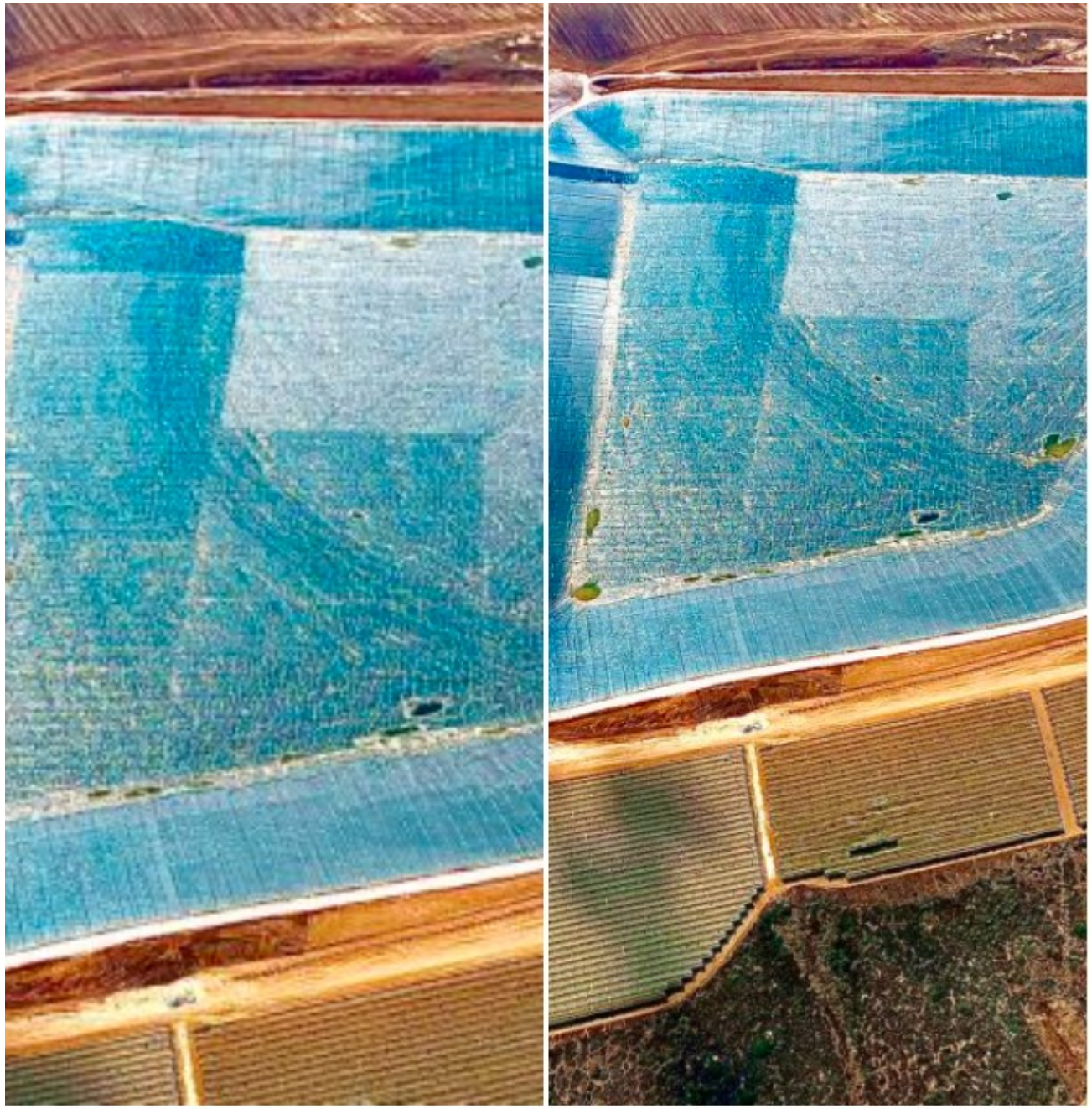


We Design and Supply *RoadCem* in-situ soil bunds/bases for Wetlands and Reservoir Projects

Proposal Overview

- PowerCem UK are happy to talk to Water Utility companies and contractors planning and constructing Wetland projects and Reservoirs. We offer a low carbon totally sustainable alternative to plastic membrane usage, allowing existing site soils of any type to be treated to form durable impermeable basins. Avoiding the need to truck clays and stone to site.

- RoadCem soil stabilisation is not sensitive to mixed soils, high organics, raised sulphates or over-wet fills being encountered. This allows a generic set of design proposals to be developed which will meet the wide range of ground conditions and loadings across the proposed projects.

- PowerCem in the UK work closely with consulting engineers Rodgers Leask of Derby who can supply fully engineered options with indemnity and design warrantees.

RoadCem in use for Suez Canal widening.

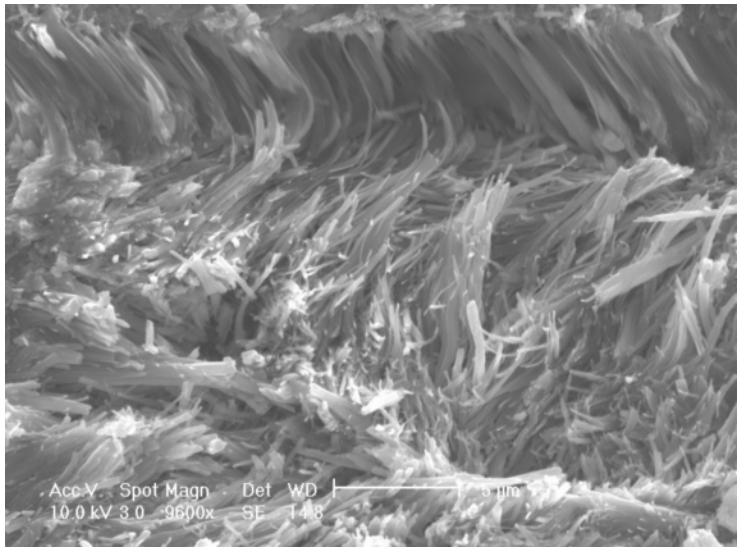
The Benefits of RoadCem Stabilisation

Reservoir and Wetland project benefits gained from the use of RoadCem

- Reduced earthworks and necessity to remove top soils from site for replacement with clays and stone.
- RoadCem offers rapid production of the impermeable stabilised bearing/bund layers from in-situ soils..
- Non-leaching stabilisation means no environmental contamination concerns from saturation of the RoadCem stabilised layer once the water is introduced. Also avoiding the environmentally sensitive need to use plastic membranes.
- RoadCem is not a ‘soft stabilisation’ technique it forms robust, crack free layers that will not soften over time when exposed to standing and/or running water.
- Programme and cost benefits achieved by all the above.

RoadCem Soil Stabilisation: Technical Information

RoadCem is a patented additive used to enhance cement based soil stabilisation. It is an inert blend of synthetic zeolites, and alkaline earth metals formed into a powdered product.



RoadCem enhances the behaviour of the cementitious reaction acting as a catalyst to produce a unique form of Nano-scale crystal growths within the cement bound material – promoting the formation of needle like crystals which create a binding lattice between and around the soil particles.

This crystalline structure differs from that within normal cement bonding where the contact point is gluing between adjacent soil particles typically occurs to develop strength-causing its inherently brittle nature and prone to cracking.

This binding lattice matrix produces much higher strengths and flexural stiffness of the end product, making it more robust and resistant to cracking able to withstanding high stresses without cracking, and repeated soaking and saturated conditions.

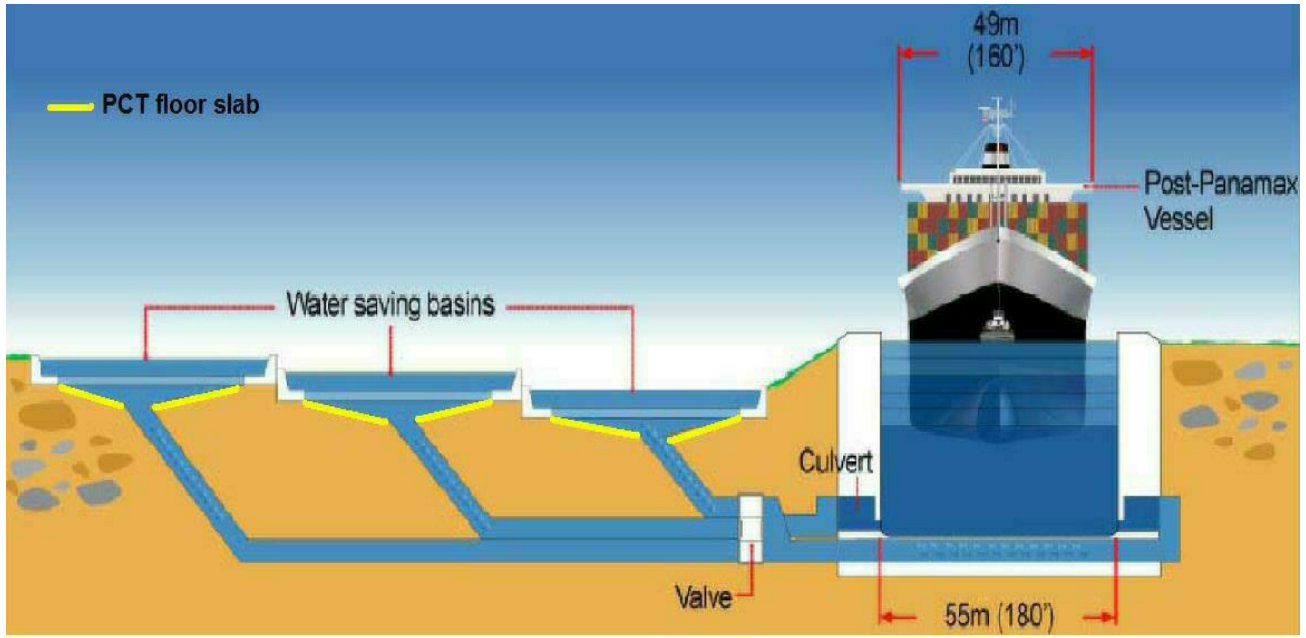
RoadCem Soil Stabilisation Details

RoadCem facilitates an extended, more efficient chemical reaction between the water and cement within any cementitious bound materials leading to:-

- A reduction of un-hydrated ‘free’ cement powder within the mix
- Can be used with soils having high sulphate levels and organics
- Greater cement hydration means strength with lower residual pH levels
- Increased strength characteristics without brittle or shrinkage behaviour
- Higher flexural stiffness – (increased Young's Modulus) – enhanced durability
- Highly waterproof product – no secondary sulphate reaction or leaching
- cement compounds into surrounding ecosystems during periods of saturation.

ROBUST, FLEXURAL STRENGTH, IMPERMEABLE, WATERPROOF, UN-REACTIVE

Mixed stabilised soils soaked for 28 days



RoadCem in-situ soil bases.

NUEVO CANAL DE PANAMÁ

2012-2013

NUEVO CANAL DE PANAMÁ

Fall Line
TESTING & INSPECTION
PANAMA, S. de R.L.

The Panama Canal
Third Set of Locks Project
Compressive / Tensile Strength Cylinders (LAB)

Project Name	ATLANTIC	Project Number	F100013	Date Sampled	7-Jun-12	Time Sampled**	02:30 p.m.
Time Batched**	N/A	Sample No.	5003	Mix Design ID**	N/A	Design Strength	N/A
Technician	AS-RS	Mixing Time**, s	N/A	Ticket #**	N/A	Truck #**:	70
Batching Plant I.D.**	N/A	Checked By	ER	Sample Location:	☐ Field ☑ Lab ☐ Plant	Placement Location**	POWER CEMENT F300 LAB TEST (35 CILINDROS 3 VIGAS)
w/cm**	N/A						

Slump (mm)	90	Air Temp. (°C)	28	Concrete Temp.* (°C)	32.8	Air (%)	1.2
Wet Sieve?	☐ Yes ☑ No	Mtl. & Pot Weight (kg)	21.37	Pot Weight (kg)	3.85	Pot Volume (m^3)	0.0071
Unit Weight (kg/m^3)	2468						

Scale ID	3375	☑ Scale Check	Air Meter ID	5000	Thermometer ID	3371	Slump Cone ID	3050

			Slump	Air	Concrete Temp	Air Temp
Mix Type	MARINO	**SPECIFICATIONS**	N/A	N/A	N/A	N/A

Age (day)	Date	Cyl No.	Height (mm)	Dia (mm)	Area (mm^2)	Fracture Type	Weight (kg)	Unit Weight (kg/m^3)	Test Method	Initials	Total Load (kN)	Strength (MPa)	Checked By
3	10-Jun-12	1	304.8	152.4	18241.47	3	14.047	2526	C	M.A	414.7	22.7	SB
7	14-Jun-12	2	304.8	152.4	18241.47	4	14.09	2534	C	M.A	484.8	26.6	SB
7	14-Jun-12	3	304.8	152.4	18241.47	3	14.03	2523	C	M.A	502.7	27.6	SB
28	5-Jul-12	4	304.8	152.4	18241.47	5	14.05	2527	C	M.A	634.8	34.8	JH
28	5-Jul-12	5	304.8	152.4	18241.47	4	14.06	2529	C	M.A	662.5	36.3	JH
90	5-Sep-12	6	304.8	152.4	18241.47	4	14.06	2529	C	DG	878	48.1	MM
90	5-Sep-12	7	304.8	152.4	18241.47	4	14.05	2527	C	DG	857.8	47.0	MM
120	5-Oct-12	8	304.8	152.4	18241.47	4	14.03	2523	C	HM	1025.2	56.2	MM
120	5-Oct-12	9	304.8	152.4	18241.47	4	14.02	2522	C	HM	1059.8	58.1	MM
		10											
		11											
		12											

Test Method: C = Compression E = Modulus of Elasticity T = Split Tensile

*The measured temperature represents the temperature of the test sample at the time of testing only.
** As reported in GUPC's batching ticket
Abbreviations Used: Dia = diameter, Mtl. = material, Temp = Temperature, Predet. = predetermined
Referenced ASTM Standards: C172, C143, C138, C231, C173, C31, C617, C1231, C39, C496, C1064

Erick Reveles

Firmado digitalmente por Erick Reveles
Nombre de reconocimiento (DN): cn=Erick Reveles, o=Fall Line Testing and Inspeciton Panama, ou, email=Erick.Reveles@falllinetsting.com, c=<n
Fecha: 2012.10.05 16:50:18 -05'00'

Fall Line Testing Inspection Panama, S. de R.L.
Piso 6 • Oficina 608
Panama, Panama

POWERCEM TECHNOLOGIES PCT

PERMEABILITY

Centro de Diagnosis y Evaluación de Materiales.
Sabino del Valle No.516 Col. Valle de León
Tel / Fax 52+(477) 636.54.18 / 43 Email: cone2@axtel.net
37140 León, Guanajuato, México.

CLIENTE	POWERCEM MEXICO	FECHA EMISION	14 DE AGOSTO DE 2012
LOCALIZACION	CANAL PANAMA	No. REPORTE	1
ATENCION	ING. OROZCO	No. CONTROL	1

CONCRETO ENDURECIDO, MASA ESPECIFICA, ABSORCION Y VACIOS NMX C 263 / ASTM C 642

MTRA No.	FECHA ELAB	MUESTRA UBICACIÓN	CLASIF TIPO	ALTURA (cm)	DIAM (cm)	PESOS (grs) A	B	C	D	ABS-I (%)	ABS-E (%)	g1 Mg/m³	g2 Mg/m³	VACIOS (%)
E24	11-07-12	ConcreCem	CIL	29.8	15.0	12,125	12,550.0	12,360.0	7,120.0	3.51	1.94	2.31	2.42	4.48
E25	11-07-12	ConcreCem	CIL	29.8	15.0	12,205	12,625.0	12,440.0	7,171.0	3.44	1.93	2.32	2.42	4.46
E26	11-07-12	ConcreCem	CIL	25.0	15.0	10,120	10,285.0	10,235.0	5,840.0	1.63	1.14	2.30	2.36	2.62
E27	11-07-12	ConcreCem	CIL	30.0	15.0	11,875	12,060.0	12,050.0	6,655.0	1.56	1.47	2.20	2.27	3.24
5														
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ESTADISTICOS		MEDIA		28.7	15.0	11,581.3	11,880.0	11,771.3	6,696.5	2.53	1.62	2.28	2.37	3.70
		DESV. EST.		2.4	0.0	1120.7	1221.0	1037.9	616.4	1.1	0.4	0.1	0.1	0.9

SIMBOLOGIA.

A	Masa Seca (grs)
B	Masa saturada por inmersión y superficialmente seca (grs)
C	Masa saturada por ebullición y superficialmente seca (grs)
D	Masa de la probeta sumergida (grs)
g1	Masa específica seca (grs)
g2	Masa específica aparente (grs)
ABS-I	Absorción por Inmersión
ABS-E	Absorción por Ebullición

GRAFICO DE COMPORTAMIENTO:

OBSERVACIONES:

Absorción después de Inmersión:	2.53	%
Absorción después de la Ebullición:	1.62	%
Masa específica seca:	2.28	Mg/m³
Masa aparente:	2.37	Mg/m³
% Volúmern de poros permebles:	3.70	%

Las muestras elaboradas con ConcreCem presentan menor absorción y % de volumen de poros permeables.

Ing. Alfonso Rafael Ayala Pérez.
Gerente Técnico
Ced. Prof. No.2076742

Registro No.6002 CNEC | Registro No.PCL/LB/001 OPM | Registro No. 2-314 DRO/DU | CEDEM-ABS-01C

CENTRO DE INVESTIGACIONES DE INGENIERIA
FACULTAD DE INGENIERIA
UNIVERSIDAD DE SAN CARLOS DE GUATEMALA

INFORME No.: 235 S.S. **O.T. No.:** 32.421

INTERESADO: Productora Acuario, S.A.
PROYECTO: Represa
ASUNTO: Ensayo de Permeabilidad Cabeza Variable
NORMA: ASTM D 5856-00
UBICACIÓN: Escuintla
MUESTRA No.: 1 **PROFUNDIDAD:** X metros
DESCRIPCIÓN DEL SUELO: Limo Arenoso Color Café
FECHA: Lunes, 28 de Abril de 2014

RESULTADO DEL ENSAYO:

Caudal de Entrada = 1,24 x 10^{-10} m³/s
Caudal de Salida = 0,00 m³/seg
Coeficiente de Permeabilidad= 0,00 x 10^{-9} cm/s

OBSERVACIONES:
Muestra proporcionada por el interesado.
Mezcla de Suelo, Cemento (180kg/m³) y POWERCEM (1,8 kg/m³).
Previo a ensayar se realizó curado de la muestra.

Atentamente,

UNIVERSIDAD DE SAN CARLOS DE GUATEMALA
FACULTAD DE INGENIERIA
CENTRO DE INVESTIGACIONES DE INGENIERIA
SECCIÓN DE MECÁNICA DE SUELOS

Ing. Omar Enrique Medrano Mendez
Jefe Sección Mecánica de Suelos

Vo. Bo.
Inga. Telma Maricela Cano Morales
DIRECTORA CII/USAC

FACULTAD DE INGENIERÍA —USAC—
Edificio T-5, Ciudad Universitaria zona 12
Teléfono directo: 2418-9115, Planta: 2418-8000 Exts. 86209 y 86221 Fax: 2418-9121
Página web: http/cii.usac.edu.gt

FLOOD RESISTANT – IMPERMEABLE
UNESCO RECOMMENDED

UNESCO-IHE
Institute for Water Education

Macro-economic Effects of Using the PowerCem Technology on Road Infrastructure in flood risk Areas

Ref nr: RC.INT.17.24052012

May 24th, 2012

Conventional deep stone road with concrete surface

Stabilised soil road treated in-situ with RoadCem

SCT

UNESCO

PowerCem Technologies
Innovations for better solutions!

SABANA YEGUA DAM

Dam runoff treated and sealed with RoadCem

PowerCem Technologies

WATER RESERVOIR ISRAEL

Large Reservoir constructed from in-situ soils using RoadCem

PowerCem Technologies
Innovations for better solutions!

WATER RESERVOIR ISRAEL

This is a very nice project to construct with RoadCem. If you have samples and the soil characterization we can start to prepare three different mix designs. Checking the impermeability / water absorption / shear strength / pressure and displacement.

Clay + Dutch material + 2% cement						E	
stretch vs tension	0,75	mm	400	kPa	7,07 kN	9425	kN/m^2
	0,38	mm	150	kPa	2,65 kN	6976	kN/m^2
	0,22	mm	60	kPa	1,06 kN	4819	kN/m^2
Clay + Dutch material + 4% cement						E	
stretch vs tension	0,72	mm	400	kPa	7,07 kN	9817	kN/m^2
	0,70	mm	150	kPa	2,65 kN	3787	kN/m^2
	0,21	mm	60	kPa	1,06 kN	5049	kN/m^2
Clay + Dutch material + 6% cement						E	
stretch vs tension	0,63	mm	400	kPa	7,07 kN	11220	kN/m^2
	0,48	mm	150	kPa	2,65 kN	5522	kN/m^2
	0,28	mm	60	kPa	1,06 kN	3787	kN/m^2

Design conclusion

The pressure strength of all three mixtures are perfectly acceptable.

Experience says that a critical shear strength of 100 á 150 kPa suffices.

The results would say that the 2% mix would be sufficient, but variations in material factors have to be taken into account.

A normal factor is 1,25, so the 4% mix gets a css of 152 kPa. This is perfect..

Large Reservoir constructed from in-situ soils using RoadCem

PowerCem Technologies
Innovations for better solutions!

CANALISATION CAIRO

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