- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial



Project Partners

• Coventry University

- Dr Peter Claisse
- Dr Esmaiel Ganjian
- Elevtherios Gross

Imperial College London

- Professor Alan Atkinson
- Dr Mark Tyrer
- Rosemary Greaves

• Birmingham University

• Dr Gurmel Ghataora



Project Sponsors

- The Mini-Waste Faraday Partnership
 - The Environmental and Physical Sciences Research Council
 - The Natural Environment Research Council
- Lafarge Plasterboard
- Huntsman Tioxide



The Mini-Waste Gypsum Project

- Sulphate activated pozzolans
 - Controlled Low Strength Materials
 - Products (blocks, floor screeds etc.)
 - Trench fill
 - Road bases
- Self-heated product forming
- Production of clean gypsum



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Sulphate Activated Pozzolans

- Super Sulphated Cement was made with blastfurnace slag and gypsum
- Widely used for foundations because of high sulphate resistance
- Discontinued due to poor shelf-life and the introduction of sulphate resisting cements.



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Controlled Low Strength Materials

- Low strength mixes for trench backfill etc.
- Not yet widely used in Europe.
- An alternative to foamed concrete for many applications.



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Current Uses of Gypsum

CLEAN MATERIAL

- cement
- plasterboard and plaster

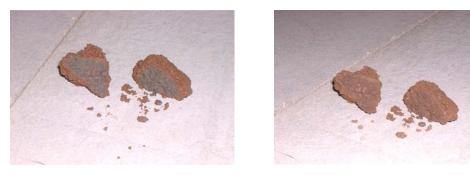
CONTAMINATED MATERIAL

• soil conditioner



Sources of by-product Gypsum

- Flue gas desulphurisation
- Titanium oxide pigment production



- Plasterboard off-cuts
- Spent casting cores etc.

ACI Convention New York



Red Gypsum

- A by-product of titanium dioxide production (white pigment).
- The red colour comes from iron oxide
- Many other contaminants

ACI Convention

New York

- Has been used in agriculture
- Current output 125,000 Tonnes per year



Red gypsum delivery at Roxby



ACI ConventionCOVENTRY UNIVERSITY CIVIL ENGINEERING GROUPNew YorkDr Peter Claisse



Placed red gypsum at Roxby



ACI Convention COV New York



Waste Plasterboard European Union Regulations

- Must be segregated on site
- Limited amounts can be recycled in the production process
- Cannot be landfilled with municipal waste (produces small amounts of hydrogen sulphide)
- No segregated cells available in the UK
- The organic content (paper) may prevent all landfilling





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Candidate materials (1)

- Sodium sulphate slag (Britannia Refined Metals Ltd.)
- Spent borax slag (Britannia Refined Metals Ltd.)
- Ferrosilicate slag (lumps from Britannia Refined Metals Ltd. sand size from Britannia Zinc Ltd.)
- Ferrosilicate copper slag (IMI Refiners Ltd.)
- Soda slag (Britannia Refined Metals Ltd.)
- Chrome Alumina slag (London & Scandinavian Metallurgical Co. Ltd.)
- Cement Kiln Dust ,CKD (Rugby Cement)
- Run of station ash (Ash Resources Ltd.)
- Lagoon ash (UK quality Ash Association)
- PFA (Ash Resources Ltd.)
- Steel slag (Tarmac Quarry Products Ltd.)
- Granulated Blast Furnace Slag, GBS (Tarmac Quarry Products Ltd.)



Candidate materials (2)

- Burnt Oil Shale (Tarmac Quarry Products Ltd.)
- By-product Gypsum (Biffa Waste Services Ltd.)
- Glass cullet (Mercury Recycling Ltd.)
- GGBS (Ground granulated blastfurnace slag)
- Limex70 (British Sugar Plc.)
- Shell foundry sand (Bruhl UK Ltd., Hepworth Minerals & Chemicals Ltd.)
- Green foundry sand (Castings Plc. And Bruhl UK Ltd.)
- Fire kettle setting (Britannia Refined Metals Ltd.)
- Fine rotary fascia bricks (Britannia Refined Metals Ltd.)
- Sodium sulphate solution (Britannia Refined Metals Ltd.)



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Initial Strength Results

4												
	Percentag											
					Dry Run		Steel					
Water/			Limestone	Cement				Steel Slag	'	/		
solids	Red	Plasterboard	calciner	Kiln	Stantion	Slag	Dust,	Dust	3 day	7 day	28 day	
ratio	Gypsum	Gypsum	dust	Dust	Ash	Dust	ground	weathered	strength	strength	strength	
0.16	15	0	0	5	0	80	0		0.5	0.7	2.3	
0.19	0	15	0	5	0	80	0		0.2	0.5	1.5	
0.20	20	0	0	0	0		80		0.2	0.5	2.3	
0.36	20	0	20	20	20		20		0.1	0.2	2.1	
0.26	15	0	1	4	0	80	0		0.6			
0.20	15	0	0	5	0	80	0		1.8			
0.00	0	15	0	5	0		0	80	1.0			



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Site Trial Mix

- 1 Part Water
- 2 Parts Red Gypsum (40% water as supplied)
- 3 Parts Steel Slag (Basic Oxygen Slag)



Gypsum/Slag mix trial pour (mixing)



ACI Convention New York



Gypsum/Slag mix trial pour





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Thank You

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