Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- 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 blast furnace 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.
Red Gypsum

• A by-product of titanium dioxide production (white pigment).
• The red colour comes from iron oxide.
• Many other contaminants.
• Has been used in agriculture.
• Current output 125,000 Tonnes per year.
Red gypsum delivery at Roxby
Placed red gypsum at Roxby
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 landfiling
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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

<table>
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<th>Water/solids ratio</th>
<th>Red Gypsum</th>
<th>Plasterboard Gypsum</th>
<th>Limestone calciner dust</th>
<th>Cement Kiln Dust</th>
<th>Dry Run of Stantion Ash</th>
<th>Steel Slag Dust</th>
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<th>Steel Slag Dust weathered</th>
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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)
Gypsum/Slag mix trial pour
Thank You

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