

How to research your new  
ingredient for concrete and publish  
your findings.

An example of a typical type of  
paper

Peter Claisse

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- **The problem**
- Elements of a Research Programme
  - Research objectives
  - Materials characterisation
  - Pre-treatment
  - The basic tests
  - Environmental and health impact
  - Site trials
- The Publication
  - Introduction
  - Experimental Methods
  - Results and Discussion
  - Conclusions
- Conclusions

# The background that we all know

- Cement production gives off a lot of CO<sub>2</sub>. Approximately 5% - 9% of the total.
- The secondary materials that can be used in cement can present disposal problems if not used (in the US they may call them “toxic”)
- Mineral extraction to make cement is also a problem. Aggregate extraction is a big problem.
- Poor countries cannot afford to build the homes they need.



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# Research Objectives



Backfilling a mine?

- Define the Product that will be marketed and the application it will be marketed for.
  - A grey powder will be easier to sell than something that looks like a waste.
  - There is clearly a market for low strength cements for house foundations, road sub-bases, trench fill etc. CLSM or CLSM+
  - If the product will be blocks or paving slabs etc. this must be clearly defined at the outset.
- You must explain to your sponsors that they may get a negative result (note that these should be published)

# Materials Characterisation

- Must be enough analysis to make the work repeatable in other labs.
- An analysis of the variability of the materials is essential.



# Pre-Treatment of Materials



- Grinding, calcining etc. may help but the cost must be calculated.
- Can be useful for converting a “waste” into a “product” to keep the regulators happy.
- Remember to keep archive samples in sealed containers.

# The Basic Tests

- Always start with strength.
- Durability tests must be targeted at the chosen applications for the product.



# Environmental and Health Impact

- Is your work any use without these tests?
- Leaching tests are essential on all products.  
Even if they will be dry in use they will get wet after demolition.
- Will anybody cut or drill the product? Will the dust be toxic?
- Will the product be used in houses? Might there be trace gas emissions?

# Why site trials are needed (1).

- To validate lab results on a large scale
- To demonstrate production methods
- To provide exposure tests for samples which are then returned to the lab



# Why site trials are needed (2).

- To provide publicity
- To provide education



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# Publication



Normal good practice, such as adequate reporting of results from control samples and error bars on graphs, is assumed and not discussed here.

# The Introduction

- No need to say that replacing cement is a good idea.
- Discuss the availability of the chosen materials.
- Define the product and the applications.



# Experimental Methods

- Discuss problems with your methods (e.g. the “rapid chloride permeability test”). If you don’t, your reviewers will.

# Presentation of Results

- Do not try to present too much.
- Do your different tests rank your different mixes in the same order? Plotting one test against another will validate (or invalidate) your results.
- Make sure every graph communicates something useful.

# The Discussion

- Compare your product with existing alternatives. Focus on durability.
- If your strength is lower, don't say this isn't a problem.
- If one of your materials is sewage sludge ash, discuss the problems with marketing your product.

# Conclusions of the paper

- Is your chosen cement replacement ready for use in industry? Be honest.
- Conclusions are often best presented as brief bullet points.

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- **Conclusions**

# Conclusions – what a paper should have

- An informed discussion of the source of the material including the availability.
- A physical and chemical analysis of the material including estimates of the range of values which might occur in the supply.
- Test results for strength and leaching of the product.
- A report on a site trial.
- An unbiased discussion of the problems which may be expected before the product is brought to market.
- An analysis of the long term consequences of introducing the proposed technology.

# Thank you

[www.claisse.info](http://www.claisse.info)