Investigating the Surface Qualities of Concrete Through Creative Practice

Rebecca M. Fairley

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Thank you

Jack Doyle at On Concrete

Martin Kay and Stuart Hedley at Bespoke Concrete

The Northern Region of the Concrete Society

The Tarmac Ltd Materials Laboratory,
Coxhoe Quarry

Dr. John Orr, The University of Bath
Prof. Mark Everton, The University of Bath

Barbara Robinson at Sunbury Embroidery Gallery

Matthew Fairley

Abstract

The research documented in this thesis is the written part of a practice based exploration into the surface qualities of concrete. The issue researched has been to uncover the possibilities of using concrete as a design material. By exploiting its ability to change from fluid state into a solid after curing. Therefore assuming the shape and textures of mould materials and to incorporate other materials into it's surface.

This was done in a workshop environment using 6 developing methods of putting materials and concrete together.

These were;
* Casting concrete onto a material
* Adding the material to a wet concrete surface
* Mixing the material into the wet concrete
* Sections of concrete joined with a material
* Brushing the wet concrete onto a material
* Shaping the concrete with a material

The samples created acted as the data and analysed through a set of criteria;

- Variety and boldness of texture
- The interaction of material and concrete
- Design potential
- My feelings for the surfaces
- Judgements about the process

Results were collected and organised in a project journal which contained photographs of the samples, the materials and procedures used to make them. Also a discursive annotation using the criteria for analysis as the framework. This written work came in the form of notes, mind maps and drawings. The journal also contained recipes and methods used to make the samples.

The research has grown out of an interest in material manipulation and a current trend in using concrete in more exciting ways.

This work contributes to knowledge
* by showing that concrete is an adaptable material that can be used to create surfaces with texture and character.
* that concrete is relevant to current ways of viewing what surface design can achieve
* and by demonstrating concrete can be used to create surfaces that engage and excite people.

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Chapter 1
Introduction

This research project explores ways of using concrete as a surface design material. The work focuses on employing the way concrete starts as a liquid. This liquidity enables the designer to trap structures within it's surface and to shape the surface by casting onto textured materials. The aim of this research has been to test the effect of a number of materials on the surface qualities of the concrete.

My introduction to making concrete was during the final year of BA (hons) Surface Design for Fashion and Interiors at The University of Huddersfield in 2010/11. Coming to it with no technical knowledge I had the freedom to really explore it's potential. Even before I had seen the first outcomes the process of making concrete felt familiar and comfortable because it is like baking. The similarities are in the measuring of ingredients, adding liquid 'by eye' to achieve the right fluidity, mixing and combining the constituents. Then pouring into moulds and waiting, a little anxious and excitedly for the end results. As with cakes these creations also brought delight to other people too.

The concrete became the main material for the Final Degree Show project which was well received. Traveling to New Designers, The Surface Design Show, Eco Build, Sunbury Embroidery Gallery and finally along with work from this project to The International Conference on Flexible Formwork 2012 at The University of Bath (icff2012).

The undergraduate work was experimental and free in it's approach to making surfaces with concrete, either by mixing in materials like marbles and plastic dominos or moulding the surface with textiles and plastics. Using the BA work as a pilot study, this Masters by Research builds on that knowledge whilst firming up methods and methodology to investigate the surface qualities of concrete.

This research has been approached through Creative Practice. Sample making, recording and reflection in the studio setting. Concrete in this project is the main constituent in a series of experiments, using a range of materials across 6 methods of applying material and concrete. With the intention of finding new surfaces with the possibility of fresh design outcomes. Full details of methods and methodology used follow in Chapter 3.

In order to make judgements and take meanings from the samples made, a set of criteria for analysis were established.

- Variety and boldness of texture
- The interaction of material and concrete
- Design potential
- My feelings for the surfaces
- Judgements about the process

The primary form of acquiring knowledge during this project has been through the practice. Support and development has been obtained from publications and articles found on the internet. Reviewed for this document in Chapter 2. Further forms of gathering understanding took place by visiting experts, attending training and being present at conferences.

A day was spent with the artist Jack Doyle from On Concrete at his studio in Manchester. On Concrete is a collaboration between Creative Impressions, a concrete materials supplier and manufacturer and a group of designers, including Jack. Together we mixed concrete, filled moulds, prepared the fluid surface for imprinting and sprayed cement onto stenciled surfaces. This practical information along with discussion benefited my work by learning new techniques, reinforcing current knowledge and sharing experience.

Bespoke Concrete based in Prudhoe, Northumberland, specialize in custom made pre cast concrete products. For example street furniture, sea defenses and public art pieces. They welcomed me for a day where I was shown their work spaces, looking at items in production, mould manufacture and polishing. I learnt how when casting at a large scale the water added to the mix is measured 'by eye.' This is because the sand can have an unknown water content. I found fascinating as it implies there is a knowledge here that can only be learnt by taking part in the mixing process. It relates to this project as the knowledge developed will come from my taking part in it. Another thought that occurred is the value of becoming skillful at a technique. When it becomes second nature Lawson (1997) in the book How Designers Think believes designers work best when we think least about a technique used. This valuing of skills and encouragement of intuitiveness is present in this piece of research.

In March 2012 I attended a Concrete Technology Training Day, at the Tarmac Ltd Materials Laboratory near Durham and held by The Concrete Society, Northern Region. The aim of the day was to provide information about specification, production, testing and supervision of concrete work. The information was divided between theory sessions and practical demos. I learnt some basic concrete technology and it's impact on forming a good quality material. I also acquired some of the language and terms used when discussing concrete; the methods and it's components.

Whilst my concrete work was displayed at the Surface Design Show 2012, I was approached by John Orr, a PhD student in Civil Engineering at The University of Bath, to exhibit at the Second International Conference of Flexible Formwork (icff2012). A three day event covering aspects of using textiles as the mould work for concrete. His interest in my work was because the flexible formwork community lacked the input of designers work. The papers given came from a mixture of disciplines including Architecture, Civil Engineering and Design. I had the opportunity to discuss my work with current researchers and examine my research in relation to them. I formed valuable contacts with potential for collaboration projects in the future and I was offered space to work in the University's Civil Engineering Department.

These events and others like them helped to shape where this piece of research fits within a wider context of both the research and concrete manufacturing. And confirms there is a current interest in taking a fresh look at concrete as a design material.

Chapter 2
Literature and Contextual Review

This chapter provides a summary of the current design uses of concrete in three main areas; architecture and interior design, civil engineering and furniture design. It also presents definitions and information relevant to this design project. First a brief outline of the history of concrete will be given to provide some historical context.

The first artificial cement was produced in 1824 by Joseph Aspdin and named Portland Cement due to its colour. According to Eric de Mare's book New Ways Of Building (1948) it became the basis for all modern cements. Becoming popular during the late 19th and early 20th century as a construction material due to it's versatility and strength (Collins 1959). It's use as a design material was also popular but fell out of favour as it became over used in the mass production of cheap items including balustrades.

Concrete had a brief period of glory during the Modernist era of the mid 20th century with the striking works of Le Corbusier and Paul Rudolph (Cohen and Moeller 2006). This very controllable and relatively cheap material could achieve the clean lines that became emblematic of the modernist movement, assisting in expanding the boundaries of what design in architecture could achieve. With the arrival of the brutalist period and the mass urbanization that followed the Second World War, concrete fell out of favour as a design material (Bennet 2005). An example of this is Tavy Bridge and Binsey Walk, part of the Thamesmead Southmere housing estate, London. Built during the 1960's it contained 25,000 homes, with a strong sense of community and famous for being used as the set for Stanley Kubrick's film A Clockwork Orange (dubstar74, 2013).

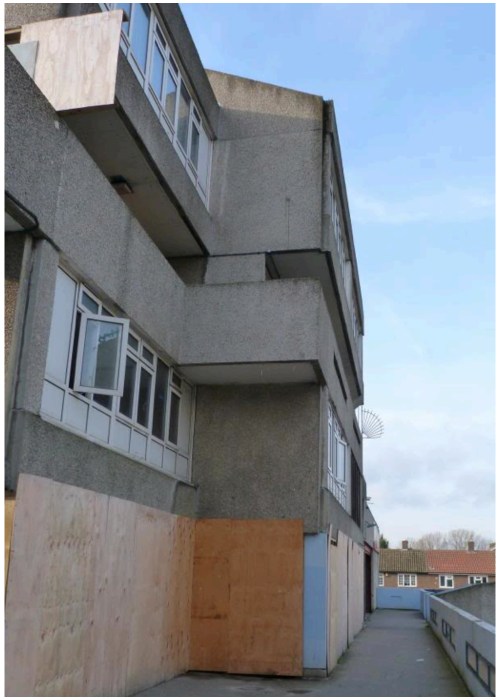


Image 1. 'All boarded up walking to bus stop and library'. Dubstar74, 2013

During the 1980s and 90s the estate was allowed to fall into disrepair finally resulting in its demolition. This is just one example of a nationwide trend of neglect leading to the negative feelings we culturally hold towards concrete. The trend has been continually reinforced by the press in their description of concrete structures.

"Concrete Jungle", The Guardian (Anon. 1973)
"Pug Ugly", Mail on Sunday (Anon. 1993)
"Grey and drab", The Times (Cohan, J. 1993)
"Concrete Prison", The Times (Sage, A. 2010

These statements all add weight to the dismissal of concrete as a design material. There has been in recent years a growing attempt to fight back with the effort to save iconic concrete structures from demolition (Hatherley, O. 2011). For example Birmingham Central Library and Preston Bus Station (Flatman, B. 2010).

There are some concrete buildings that are viewed far more positively. For example Kisho Kurokawa's Maggie Centre in Swansea (image 2. It creates a calm and therapeutic atmosphere for the patients and relatives of this cancer hospital (Whitehead, T. 2012). This serene ambience is also present in two churches with both exterior

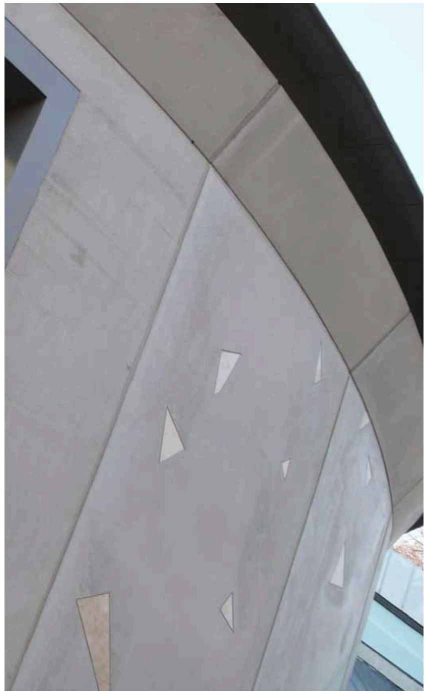


Image 2. Maggie Centre, Swansea.
Garbers, T & Haarmaan, L. 2012

and interior concrete surfaces. The Hong Kong firm O Studio Architects have created a church on the side of Mount Luofu based on the curving shape of a seed (image 3). Both the internal and external walls have been cast onto a vertical bamboo formwork producing a fine ridged organic surface (Frearson, A. 2012). In contrast La Laguna by Menis Arquitectos in Tenerife have a rough concrete surface on the forms that appear to rest together to make up the church's walls. Where the forms don't quite meet a cross shape is produced by the light from outside (Frearson, A. 2012). Both these grey concrete buildings hold an atmosphere of spiritual quiet. Closer to home the concrete exterior of the Hepworth Gallery, (David Chipperfield Architects) Wakefield, with its large plain surfaces fulfills it purpose as a functional public building embedded in the cultural and physical landscape. Combining the structural needs of the building with aesthetic qualities (Anon, 2011) it has provoked interest and discussion about concrete's suitability as a design material.

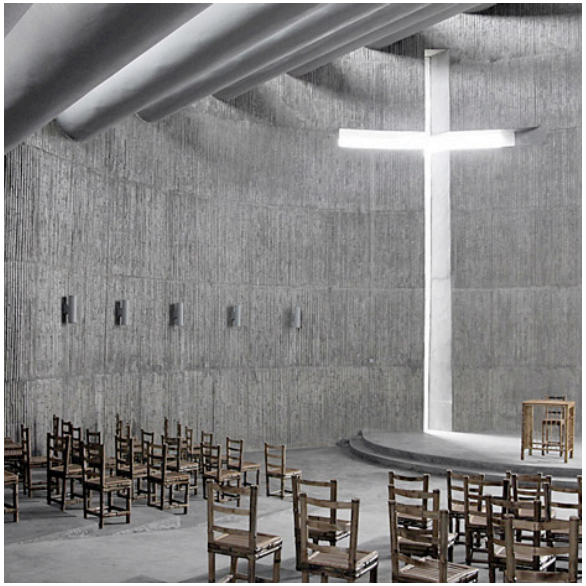


Image 3. Church of Seed. Wen, J. 2012

The company Graphic Relief is currently using innovative methods of forming large scale concrete surfaces with new design features. They use rubber moulds to reproduce the work of artists and illustrators. The final surfaces are finely textured producing an embossed effect (Anon, 2012). One example is the performance venue at The Old Vic Tunnels in London where the intricate designs of the graphic designer Yehrin Tong have been installed.

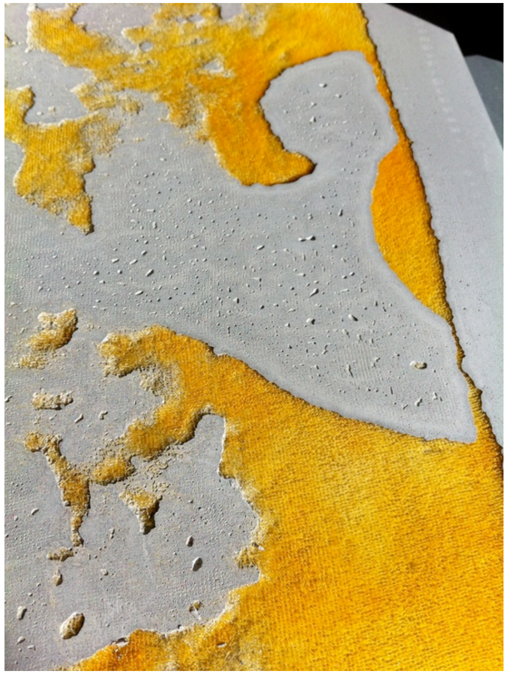


Image 4. Velvet Concrete: Crocus Flowering in April. Tactility Factory. 2012

Of special interest to this project is the work of Tactility Factory (image 4). A Northern Irish two woman design company with roots in academic practice. Their combination of disciplines, architecture and textile design aims to make the hard soft by combining textiles within the surface of the concrete, producing textures and patterns more reminiscent of wallpaper (Morrow. 2012). This, Tactility Factory believes creates a more humane and sensorily rich surface in the built environment. The admiration and excitement they drew at EcoBuild 2012 certainly backs their theory up. (Anon. 2012)

The idea of softening the built environment is reflected in the work of Mark West, an academic and architect based in Manitoba, Canada, with a special interest in using fabric as the formwork to shape concrete. At the icff2012 he out lined his work replacing the ridged containers that concrete is cast into with fabric. This allows, as he says the fabric to 'do its thing' and therefore make the surface's more approachable (BRE Centre for Innovative Construction Materials. 2012). He uses language like push, pull, buckle, wrinkle, elbow and groin to describe the finishes the concrete makes, bringing the material to a very human and understandable level.

This new way of constructing with concrete was described as a disruptive technology by Remo Pedreschi, in the paper he gave at icff2012. (BRE Centre for Innovative Construction Materials. 2012) In their book Fabric Formwork (2007), Remo Pedreschi and Alan Chandler describe the fabric formwork as a "fluid responsive formwork" (p. 1) which they then go onto say, "allows the behaviour of material to engage with and influence the building process itself." (Pedreschi & Chandler 2007. P 1) This they believe is bringing about a reevaluation of the construction of architecture but in relation to this project it highlights a new thinking about the value of surfaces in the built environment and our relationship with them.

Using the soft familiarity of the fabric formwork has been used in civil engineering by The Walter Jack Studio when forming a retaining wall at Heartlands, Redruth, Cornwall (Woods 2011). The wall stands at 3m and is 25m long leading from a local swimming pool to a site of regeneration providing services to the community. As a public space Walter Jack's aim was for the concrete to tell its own story, saying something about the process of using concrete.

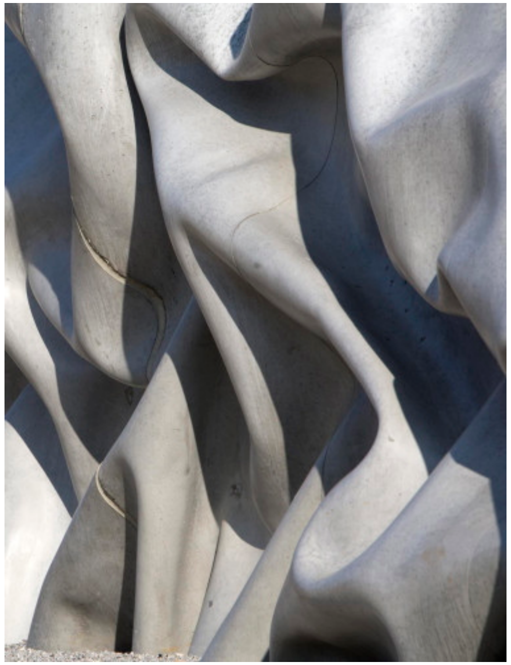


Image 5. Crushed Wall. Walter Jack Studio & Burt. S. 2012

The flip side of allowing the concrete's liquidness to decide the final form, Dr John Orr of The University of Bath has used maths and computer aided design to form the shape of load bearing beams. (The Concrete Centre. 2011) During giving his paper at the Specifying Visual Concrete Conference, he described how once the shape has been calculated a mould of fabric is cut and secured in a wooden frame. I had the opportunity to be part of a beam construction workshop at icff2012, in June 2012. The resulting beams not only cut down on materials used because the form follows function, but the process produces organic and pleasing shapes. It is my view that there is something more natural looking about them making the beams easier to live with.

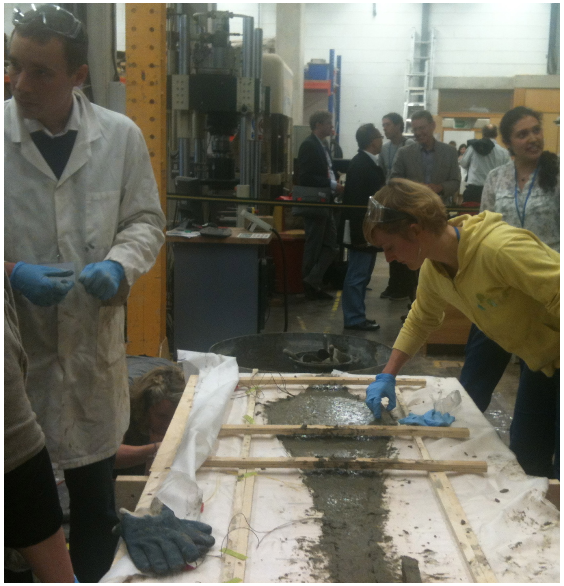


Image 6. Fabric Formwork Beam Workshop. icff2012

The ability of concrete to look soft is being exploited by designers looking at the possibilities for making furniture. The designers Remy and Veenhuizen of the Netherlands have been experimenting with moulding using PVC (BRE Centre for Innovative Construction Materials. 2012). Which has resulted in chairs that appear to be inflated and light weight when in fact they are durable and hard wearing, suitable for public out door spaces. The contradiction of appearing soft when actually being firm has been used and discussed by Anne-Metti Manelius (2010) for her PhD work exploring fabric formwork in architecture. In particular she created a chair which she set out to test the reactions of observers. Using a traditionally textured and patterned fabric to mould her concrete she subverted the meaning of concrete in the mind of the participants. The nature and meaning of the fabric had over ridden that of the of the concrete. This is possible because of the concretes ability to flow into spaces and take on the surfaces of other materials.

Image 7. The Ambiguous Chair. Manelius, A-M. 2011

Chapter 3
Methodology

The purpose of the methodology has been to allow an exploration of a variety of design methods with the freedom to follow new pathways if they arose. There was space to reflect on the processes, ideas and surfaces achieved with the continued eye on the long term goal of creating concrete surfaces with a value to wider society. The methodology had elements of Action Research (McIntosh, 2010) where there was an integration of making and analysis in the collaborative relationship between myself and the materials used. This encouraged the development of knowledge and understanding which is unique to me (the way I design, my choice of materials and how I see the outcomes) which influenced the direction of the research. This shifting and continued development enabled the research to reach it's full potential, giving rise to surprises and disappointments (Cross, 2011).

The methodology includes the analysis of myself, that is to say which materials I chose and my reaction to the outcomes. I am aware of and positioned myself within the broader historical and the current design contexts/cultures (McIntosh, 2010). This includes the recognition and evaluation of my 'other selves'. Using McIntosh's headings these are;

* The research based self - the maker, consumer of design books, papers and magazines, sharing my work and ideas with my peers and colleagues.
* The brought self - who I am already, female, mid forties, mother, my values, etc.
* The situational self - a post graduate student, member of the university, teacher, colleague, etc.

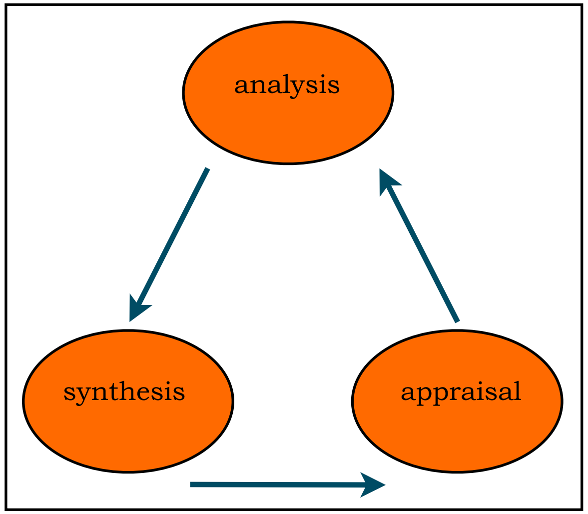
These elements influence my decision making and my awareness of them enhances the understandings achieved during the research.

I worked in a way which allowed time for thinking. In How Designers Think, B. Lawson (2006) considers thinking to be a skill which requires learning and practice to be used effectively. I therefore took my thinking time seriously, recording thoughts and ideas in a project journal. Through consideration and evaluation I developed the internal dialogue of a designer (Cross, 2007). The project journal contained photographs of my work in action, different stages of the techniques, sketches of ideas for new directions, accompanied by written details and thoughts. This was a way of thinking aloud, clarifying thought, enabling half formed ideas to be expressed and reflected upon. Forming a pathway to the development or rejection of ideas (Cross, 2007).

The framework of the methodology has similarities to the Markus/Maver Map of the design process where the cycle of Analysis, Synthesis and Appraisal leads to decision making in order to achieve the long term goal (Lawson, 2006). In this case the development of new surface designs in concrete.

- Analysis being the study of the current position - techniques in use, materials and samples to date, in relation to moving the research forward.
- Synthesis occurs next with the long term goal in mind questioning what are the possible ways to progress; new materials, adjusting techniques and making samples accordingly.
- Appraisal follows, where looking back and critically evaluating the suggested solutions in the synthesis step.

By judging the sample outcome, possibilities opened up and the cycle continues. The number of cycles needed to reach the final outcome is unknown and some cycles may be fruitless. This juggling and balancing of decision making continued until the allotted time for the Masters degree was complete. Inevitably further questions remained, to be explored during further research or picked up by other researchers.



Markus/Maver Map. B. Lawson. 2006.

Following this framework produced times of intense activity in the form of sample making, interspersed with times of thinking, usually done away from the workshop, often with supervisors regular meetings. (Cross, 2007)

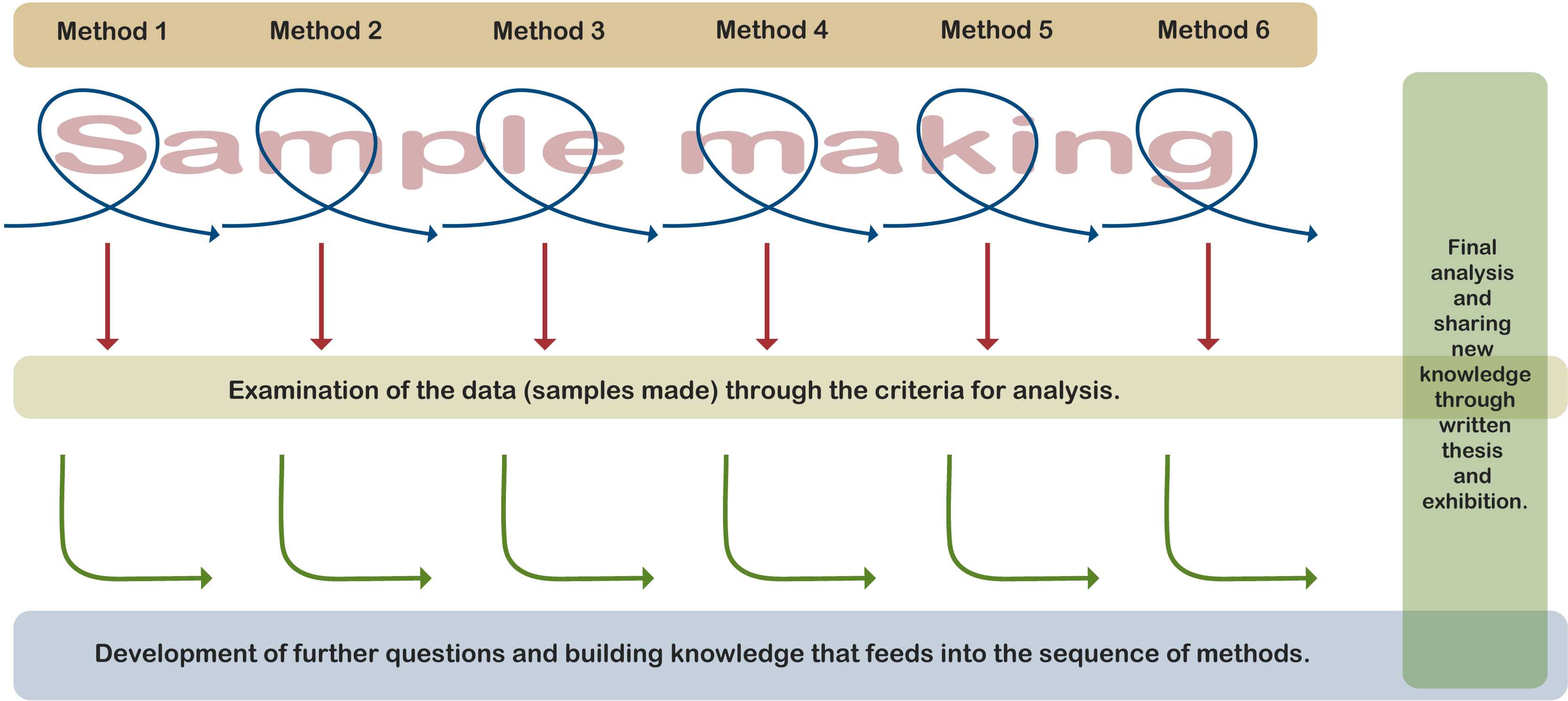
In practice batches of samples were made then analysed forming a Making and Analysis Cycle (page 22). This way of working nurtured the formation of new ideas to be used in the next round of sample making. I constantly critiqued my practice, allowing my learning to progress and design ideas to develop (Lawson, 2006). Encouraging the project to have a natural progress in the discovery of new design potentials in the materials used.

As a design methodology there was constant shifting and development with the emergence of new understandings (McIntosh, 2010). This enabled the research to be full of potential, surprises and unpredictability. Giving rise to risks and uncertainty with no absolute answers (Cross, 2011).

Investigating the surface qualities of concrete through creative practice.

The making analysis cycle

Rebecca M. Fairley.
Masters by Research



Methods for sample making

1. Casting concrete onto a material
2. Adding the material to a wet concrete surface
3. Mixing the material into the wet concrete
4. Sections of concrete joined with a material
5. Brushing wet concrete onto a material
6. Shaping the concrete with a material

Criteria for analysis

* Variety and boldness of texture
* Interaction of material and concrete
* Design potential
* My feelings for the surfaces
* Make judgements about the process

Collecting and controlling data

* Photography
* Annotation
* Project journal
* Reflection
* Exhibition
* Discussion
* Mind maps
* Sketching

Chapter 4
Research Practice and Results

Method 1. Casting concrete onto a material.

Casting concrete onto a material was the first step in the investigation into the surface qualities of concrete. I wanted to find out what happened if I poured a wet mix onto a material. Would they adhere, what would they look like and would this process add new qualities to the concrete? I used the materials that were to hand, either from my home or the workshop. This influenced the direction of the research as it involved my tastes and interests. With minimal consideration I tried many and varied materials. This gave freedom to the initial stages of the project, allowing the research to flow in an unpredictable direction. The belief was that this would increase the chances of finding something new.

An aim and a set of objectives were decided upon to assist in answering the research question and begin to build up data suitable for analysis.

Aim: This section of the project explores the effect of adding the wet concrete mix onto the chosen material.

Objectives:

- make a large number of samples, recording and annotating results
- use a wide variety of materials ensuring a broad examination of possibilities
- assess if the material adheres to the concrete's surface
- determine any design qualities of the sample
- judge the effectiveness of the methods used
- develop ideas for further investigation.

<u>The Concrete</u>

The concrete mix was made by hand in a large bucket, using a trowel as both measure and mixer. The ratio of mix was 2 parts 10mm shingle aggregate, 2 parts sharp sand and 1 part extra rapid cement. Water was added to produce a mix that moves easily but is not over wet, this was measured by eye. During commercial concrete production where the finished product requires standardization the quantity of water is half the weight of the cement used. (Crook, R. N. & Day, R. I. 2011) As the water content of the sand and aggregate can effect the mix's overall water content the measurement of the water added can not be relied upon. There are devices available to measure the aggregates moisture but in most cases the experienced batcher judges the amount of water by how "the concrete moves and sounds in the mixer." (Crook, R. N. & Day, R. I. 2011. p.

13) Throughout this research I added tap water a little at a time until the concrete was workable. Looking for a mix that was neither stuff or sloppy. An extra rapid cement was used allowing a quick curing time. Once I changed to the smaller silicon moulds the concrete mix with the 10mm aggregate became too bulky for the smaller sized moulds. Therefore the mix was changed to a 4 parts sharp sand and 1 part cement. The mix without the aggregate is not as strong but for the purposes of sample making it was acceptable.

Materials

A broad range of materials were introduced to this section of the project to develop an understanding of how different materials behave with the concrete. They were taken from my immediate environment, picked out for their texture, colour, shape, flexibility, etc. A full list can be seen in table 1, pages 26-27. I was aware that my personal preferences influenced what I chose, therefore a self selection activity, where I as a person started to shape the direction of the project. Each material selected was placed in a separate mould. Dependent on the material some resizing by cutting or folding was necessary to enable the item to fit and make good contact with the bottom of the mould.

Casting Method

The moulds used were wooden frames screwed together at the corners with ply wood bases, also screwed together to create a mould that made a $12cm^2$ sample. This gave a surface sample size large enough to begin to explore the qualities created. The samples were also of a manageable size and weight, and ensured a high number could be made with one mix. When each batch of samples was removed the dismantled frames are cleaned with a chisel and screwed back together for reuse. After the first two batches this aspect of using these moulds was found to be too time consuming. To improve the turn around a mould was required that needed minimal maintenance. Returning to the baking analogy and continuing to use my previous knowledge as a resource, I decided to try silicon muffin moulds. Despite making smaller samples they worked well as moulds, improving the turn around in sample making.

Image 8. Method 1. Preparation of moulds and materials

Fabric and Yarn	Hessian	Ribbon	Felt	Velvet	Gauze	Cotton (light weight)	Acrylic hand knit	Woven wool	Textured weave	Denim
Paper and Card	Corrugated card	Printer paper	Tracing paper	News paper	Squared paper	Waxed tissue paper	Cartridge paper	Light weight card	Page from old Atlas	Pulped news paper
Edible and Degradable	Orange peel	Sawdust	Onion	Onion skin	Apple	Sprout	Wheat flour	Savoy cabbage	Tea leaves	Carrot
Plastics	Packing foam	Carrier bags	Polystyrene	Faux leather	Cling film	Bubble wrap	Photo contact sheet	photo negatives	PVA with lentils	Glue gun
Metals	Kitchen foil	Milk bottle tops	Paper clips	drawing pins	Foiled packaging					
Miscellaneous	Shampoo	Soap bar	Black board chalk	Ice cube	Pipe cleaners	Toy car wheels				

Table 1. Materials used in Method 1.

To explore the results the materials have been split into five main types and a miscellaneous group. This is to enable discussion and comparison of the results and help in following the flow of ideas. The five groups are: Fabric and Yarns, Plastics, Edible and Degradable, Metals and Paper and Card. Those materials that did not fit into one of this groups formed a miscellaneous group. Each group's results are set out in a table with corresponding discussion of samples of particular interest, with a focus on their influence on the subsequent stages of the project. To conclude, comparisons will be made across the groups relating to samples and methods.

Wool yarn	Corduroy	Organza	String	Hessian webbing	Nylon webbing	Curtain fabric	Polyester chiffon	Plastic coated nylon	Fruit netting	Lycra	Stiff nylon
Salt	Coffee grounds	Avocado skin	Avocado nut	Beetroot	Tomato stalk	Hazel nut	Brazil nut	Almond	Walnut	Pine twig	Lentils
Clear plastic sheet											

<u>Method 1. Results for Fabric and Yarns</u>

A full list of fabrics and yarns with corresponding results it laid out in table 2 (pages 26-27). Followed by a more in depth discussion of some of the results where there has been some particularly interesting features or ideas for further work have arose from the samples. Table 3 (page 30) is a list of materials and corresponding results for a group of fabrics that underwent a manipulation technique before having the concrete cast onto them.

Material	Result
Hessian	Adhered firmly to the concrete, surface is flat, the wet mix has not seeped through the fabrics structure producing a true feeling of the hessian when touched. Looks like the mix was quite dry.
Ribbon	Adhered and partly buried in the concrete surface. Visible as lines.
Felt	Lifts from the surface with ease leaving fibres in the concrete. Colour of felt remains bright.
Velvet	Adhered to surface, wet mix has not come through the fabric and feels soft to touch.
Gauze	Fabric is barely visible, the concrete has almost entirely engulfed it.
Cotton (light weight)	Not well adhered to the surface, lifts with ease. Resisted the concrete, no seeping through the fabric.
Acrylic hand knit	Combination of materials is interesting, the texture of the knit is very obvious against the flat concrete. Concrete has seeped round the edges creating curves. The material has adhered and mainly resists the concrete.
Woven wool	Attached firmly to surface, resisting the wet mix. Creases have formed in the fabric. Wool remains soft.
Textured weave	Concrete has not penetrated this fabric, it lifts from the surface with ease. Good colour.
Denim	Well adhered to the surface with no concrete seeping through. The fabric has shaped the concrete with creases and curves.
Wool yarn	Partially engulfed by the concrete, visible elements have produced a scribbled effect, there are also ‘ghostly’ patterns from under the concretes surface.
Corduroy	Has not adhered, resisting the wet mix. Where the fabric has been pulled up the texture of the fabric is just visible in the concrete surface.
Organza	Lifts from the concrete easily leaving a very even surface. There are creases in the fabric that have made an impression in the concrete.
String	Where the string has not been engulfed by the mix it has produced an uneven scribbled surface.
Hessian webbing	Has not been entirely engulfed by the concrete producing a hatched effect on the surface. Shaped well to the mould edges.

Material	Result
Nylon webbing	Not flexible enough to curve to the moulds edges, engulfed in places and restricted the flow of the mix to produce a very textured surface.
Curtain fabric (heavy cotton)	Adhered to the concrete, resisting the penetration of the wet mix.
Velvet with a hole cut	Some adhesion, creased parts have shaped the concrete.
Polyester chiffon	Not adhered to the concrete or allowed the mix to seep through. Concrete visible through this light fabric, where a couple of bubbles are seen. Fabric surface smooth to the touch.
Wool hand knit	Adhered to the surface resisting the penetration of the wet mix. Surface warm and soft contrasting with the cool concrete.
Fruit netting	Almost entirely enveloped by the concrete. Where visible the netting cross hatches the surface, where just under the surface the material has created 'ghostly' lines.

Table 2. Method 1. Results for Fabric and Yarns

<u>Denim and Gauze</u>

The denim sample has been chosen for discussion as it demonstrates the ability of the fabric to resist the penetration of the concrete mix. In one corner the cement has made its way through the folds to create an almost suspended droplet of concrete. The resistant quality of the denim suggests it could be used to mould. In contrast the gauze fabric has no resistance to the wet mix. When placed in the base of the mould this fabric almost completely disappears.

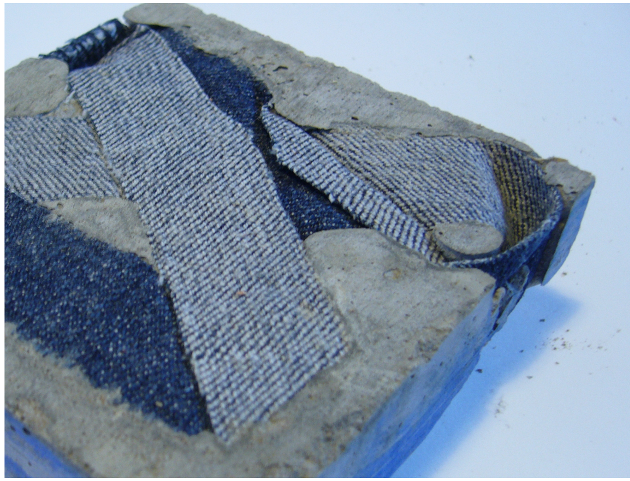


Image 9. Method 1. Denim sample.

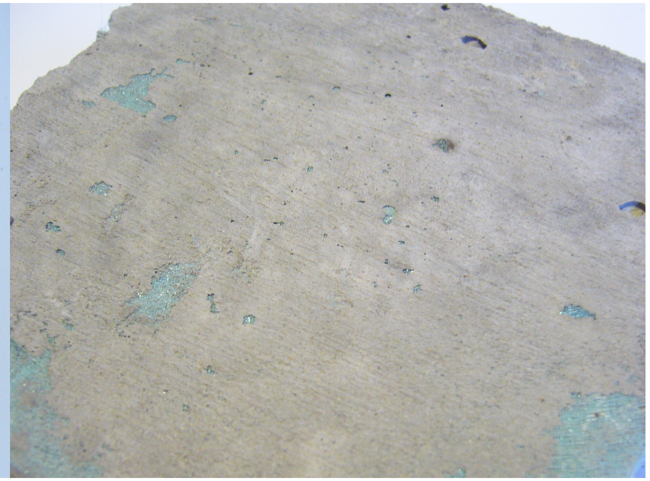


Image 10. Method 1. Gauze fabric sample.

Wool yarn and String

The lengths of yarn were roughly laid in the bases of the moulds. A dryish mix was used so that the material wasn't completely engulfed by the concrete. The string creates an interesting 'scribble on the concrete's surface, appearing and disappearing. The wool yarn produced a very similar result with the addition of ghostly patterns in the concrete's surface where the wool is just below it.

Image 11. Method 1. String sample.

Image 12. Method 1. Wool yarn sample.

Hessian and Webbing

The hessian bonded with the concrete to produce a not particularly interesting looking sample but it led to the idea of brushing the wet mix onto the surface of a material, which will be explored in method 5. With the webbing the concrete flows in and around the material creating a strong bond with the concrete. This led to consider using this material and the hessian as a way of joining groups or sections of concrete (see method 4).

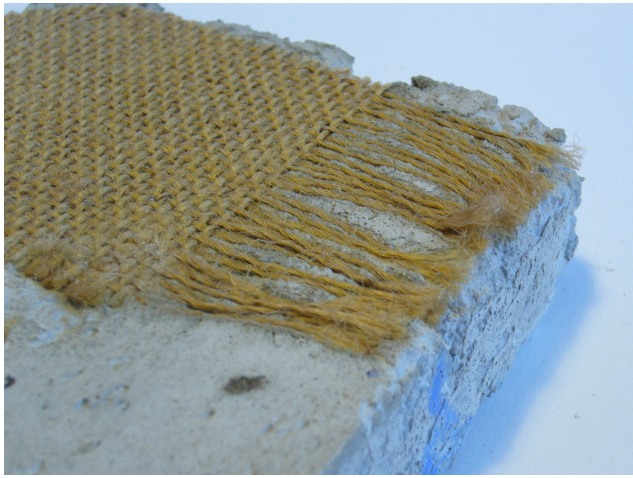


Image 13. Method 1. Hessian sample.

Image 14. Method 1. Webbing sample.

Nylon and Lycra

These fabrics did not adhere to the surface of the concrete. With gentle persuasion they came away from the concrete surface resulting in the texture of the textiles forming a surface pattern on the concrete. This led to several forms of manipulation, including hand embroidery, ruffles, Suffolk Puffs, and distressing the fabric with a heat gun before casting onto it. I considered the sample which had a ruffle stitched into the nylon the most interesting. The concrete accurately captured the folds of the fabric giving me the idea that other ways of manipulating a textile could be employed. For example smocking, trapunto, shirring and 'stitch and slash.' Other ways the fabrics had been enhanced were screen printing with foil and Expandex. The foil on the foil sample was barely visible. Expandex on the other hand left the delicate floral design on the concrete, as an impression and with small pieces trapped in the surface.

Image 15. Method 1. Nylon ruffle sample

Image 16. Method 1. Nylon Suffolk Puff sample

Image 17. Method 1. Expandex on nylon sample

Image 18. Method 1. Nylon distorted with heat gun sample

Table 3 contains a full list and results of fabrics and manipulation techniques used.

Material	Technique	Results
Plastic coated nylon	Suffolk puff, opening face down	Material has not adhered, a smooth cavity is produced.
Stiff nylon	Suffolk puff, opening face up.	Material has not adhered, a circular flower effect is seen in the concrete's surface.
Plastic coated nylon	Hand stitched ruffle	Material came away from the concrete surface revealing the creases and buckles of the ruffle.
Stiff nylon	Hand stitched ruffle	Material came away from the concrete surface revealing the creases and buckles of the ruffle, with some trapped threads.
Lycra	Screen printed Expandex (dyed blue)	The lycra lifted from the concrete leaving some small parts of the Expandex. The Expandex left a good definition in the surface.
Cotton	Hand embroidery (circle of blanket stitch)	Cotton fabric and embroidery thread lifted from the concrete, lines of the stitches well defined.
Nylon	Foiled	Fabric lifted from the concrete, a small amount of the foil remained on the sample surface.
Plastic coated nylon	Cut into discs and stitched into a pom pom	Most of the fabric could be removed, this had produced folds and well defined shapes in the concrete. Some fabric remained trapped in the sample surface.
Medium weight cotton	Hand embroidery	Fabric left on the samples surface, remained soft to touch. Interesting contrasting materials.
Heavy cotton	Hand embroidery	Fabric left on the samples surface, remained soft to touch. Interesting contrasting materials.
Nylon	Distorted with a heat gun	Could be lifted from most of the sample's surface to show a ripply and undulating sample.

Table 3. Method 1. Results for fabrics and manipulation techniques.

Method 1. Results for Paper and Card.

Table 4 contains a list of the paper and card types used along with a description of the results. Corrugated card and printer paper are discussed more fully with images as these two samples had significant interest.

Material	Results
Corrugated card	Adhered to concrete, interesting texture, not much contrast in colour.
Printer paper	Adhered to sample surface,
Tracing paper	Adhered to surface, patterns visible though the paper.
Newspaper	Adhered to surface.
Squared paper	Peels away from concrete. A ‘button’ of concrete has been created by the hole punched through the paper.
Waxed tissue paper	Adhered to the surface.
Cartridge paper	Adhered and shaped the concrete’s surface.
Light weight card	Adhered to sample surface.
Pages from an atlas	Peels away from concrete.
Brown paper	Adhered to concrete, interesting little pleat in surface.
Pulped newspaper	Shrank and lifted from concrete when dry.

Table 4. Method 1. Results for Paper and Card

Corrugated Card Sample

This sample was made right at the beginning of the project and led to using a group of papers and card in various ways. (See method 2.)

Corrugated card was torn into squarish shapes, small enough for several to be placed in overlapping layers in the mould. When released it was found that the material had stuck firmly to the concrete's surface. I tore some of the layers of card off, this created tones and textures in the card leaving a more pictorial surface.

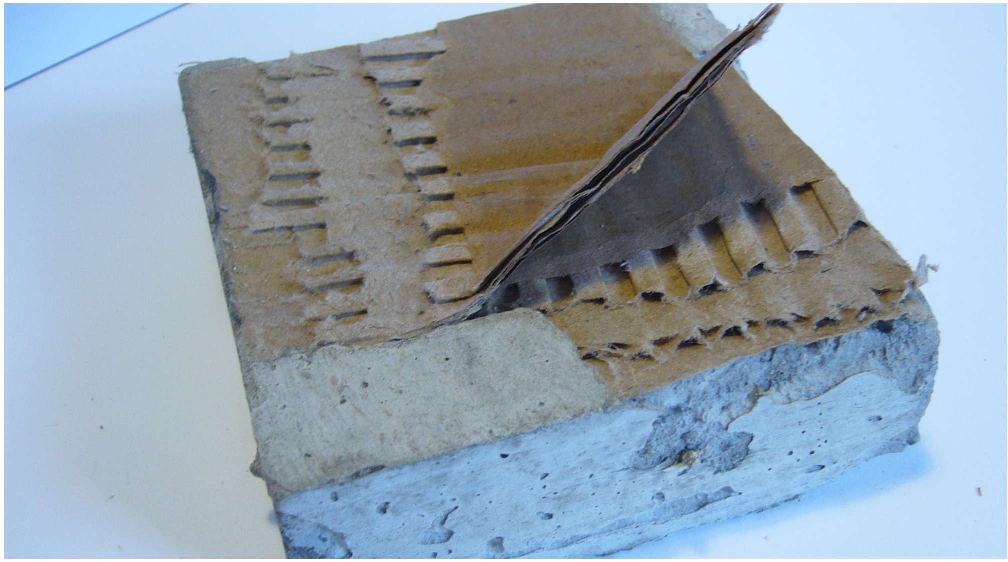


Image 19. Method 1. Corrugated card sample

Printer Paper

My expectation with this sample was that the paper would break up in the water content of the mix. The result was that the paper remained intact when the sample was removed from the mould. The surface was not particularly attractive, some of the mix had seeped under the paper creating a 'tide' mark. The material had firmly adhered to the concrete.

Further investigation into casting the concrete onto the paper and card did not produce anything of significance. Refer to table 3 for the full results.

Image 20. Method 1. Printer paper sample

Method 1. Results for Edible and Degradable.

The thoughts here were to continue to attempt a wide range of materials however unusual, to increase the chances of discovering a fresh way of working with concrete and ensuring a broad 'scatter approach' to these initial steps into the research project.

Table 5 contains the full list of materials in this section and the resulting sample observations. A number of samples are discussed more fully as they represented a change in research direction or were interesting in themselves.

Orange peel

The peelings were laid in the base of the mould. When the mix was added they floated to the surface and became trapped in the upper layer of the sample. It was noted that there was a darker patch surrounding the material which could be the oils seeping from the orange skin. In a few days the peel became moldy, dry and shrank in size, producing a cavity. This initial food stuff experiment led to a whole range of degradable materials being tested.

Image 21. Method 1. i. Orange peel sample

Image 22. Method 1. ii. Orange peel sample

Material	Results
Orange peel	Floated to concrete surface, darker around the peel. When dried out the peel shrank away from the concrete.
Sawdust	Those parts that came into contact with concrete adhered to create a brownish rough surface.
Onion	Some parts engulfed and fixed in the concrete. Over time the onion went moldy and shrank away.
Onion skin	Created a cavity in the sample surface.
Apple	Did not adhere, left neat sliced shapes. Those pieces left on the sample surface went moldy and shrank away creating cavities.
Sprout	Engulfed by the concrete, shrank with time creating a cavity.
Wheat flour	Not adhered to the surface but made a neat moulded shape. Interesting contrast in colour and texture. Became damp over time with brown spots.
Savoy cabbage	No adherence, when pulled away produce a lovely veiny surface.
Tea	Not adhered to the concrete but made a good moulded shape that became moldy.
Carrot	Some adherence, became moldy over time, great contrast in colour.
Salt	No adherence, but created a neat moulded shape. Over time the salt and the concrete surface became distorted.
Coffee	Not adhered to the concrete but made a good moulded shape that became moldy.
Avocado skin	No adherence, when pulled away produce a delicately ripply surface.
Avocado nut	Engulfed by the concrete, visible and stuck in the surface.
Beetroot	Adhered to the concrete, some colour change in the concrete's surface to a yellow hue.
Tomato plant stalk	The concrete has not entirely engulfed the material producing interesting spaces and curves.
Hazel nut	Engulfed by the concrete, visible and stuck in the surface.
Brazil nut	Engulfed by the concrete, visible and stuck in the surface.

Material	Results
Almond	Engulfed by the concrete, visible and stuck in the surface.
Walnut	Engulfed by the concrete, visible and stuck in the surface.
Pine twig	Protrudes from a cavity, firmly suck in the concrete.
Lentils	Some adherence, looks like a strange green pebble dash.

Table 5. Method 1. Results for Edible and Degradable

Savoy Cabbage Leaf, Avocado Skin and Sprout Samples

The fresh cabbage leaf was placed in the base of the mould with the wet mix poured on top. The concrete cured as normal, the leaf came away from the concrete with ease revealing a highly textures surface. The avocado skin also produced a textured surface when removed from the concrete. These vegetables appear to have a tough enough structure to with stand the concrete. As a final test a whole sprout was placed in the base of the mould. The concrete almost entirely engulfed the small vegetable which in itself was not particularly interesting but as time went by the sprout dried out and shrank away from the concrete leaving a textured cavern.

Image 23. Method 1. Cabbage leaf sample

Image 24. Method 1. Avocado skin sample

Image 25. Method 1. Sprout sample

Sawdust and Grated Carrot

Enough of the material was sprinkled into the mould to produce a layer approximately a centimetre thick before the concrete mix was added. When the samples were removed from the moulds it was noted that the concrete had not penetrated the material to any depth. Both the sawdust and the carrot adhered to the concrete in a small number of places, therefore not really effecting the surface qualities of the concrete.

Image 26. Method 1. Grated carrot sample

Image 27. Method 1. Sawdust sample

Tea and Coffee

The tea and coffee samples on the other hand did keep the shape of the mould. Not because the concrete had mixed with the materials but they had become moist and compacted, enabling the materials to have their own structure. This was not stable and with some pressure came apart. I did find the shape and the combination of these materials interesting and led to the use of PVA glue as a way of fixing materials.

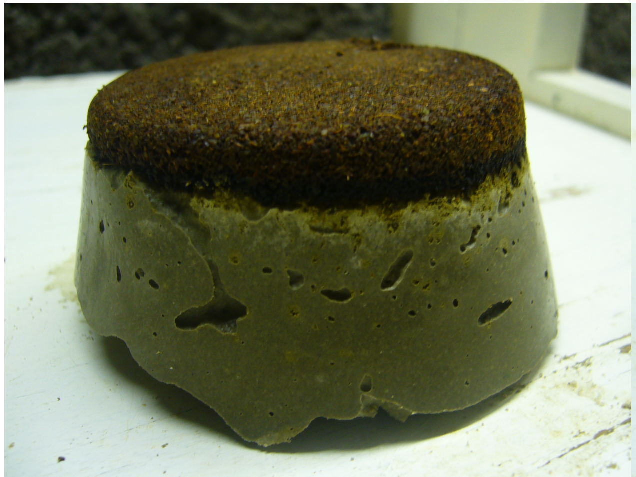


Image 28. Method 1. Tea leaves sample

Image 29. Method 2. Ground coffee sample

Image 30. Method 1. Lentil sample

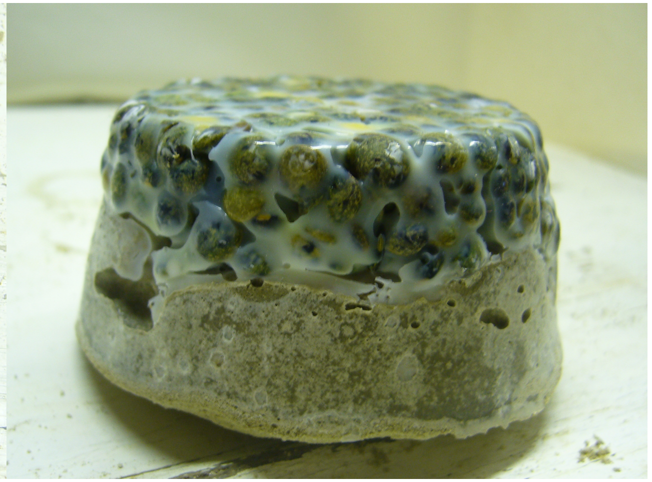


Image 31. Method 1. Lentil and PVA sample

Image 32. Method 1. Beetroot sample

Lentils

To follow on from the previous experiment lentils were used in the same way, once alone and for a second sample mixed with PVA glue. The sample without glue is very poor in appearance, a number of the lentils have stuck to the concrete but they have not added any value to the surface and are easily removed from it. The lentils in PVA are more interesting because they are suspended in a layer above the concrete continuing in the shape of the concrete's mould. It reveals more about the lentils suspended in the PVA than enhancing the surface quality of the concrete. This idea was therefore not pursued any further.

Beetroot

A number of slices fruit and vegetables were used, the most interesting being the sliced beetroot as this changed the colour of the concrete to a yellower tone where the material and the concrete have come into contact.

Salt

The salt was added in the same way as the other loose materials. When it was taken from it's mould the salt had formed into the shape of the mould, similarly to the tea and coffee. Over a few days the sample surface changed. The salt became rippled and depleted. Also the concrete's surface changed in structure becoming powdery and brittle. I assume that something chemical has occurred between the cement and the salt.

Image 33. Method 1. i. Salt sample

Image 34. Method 1. ii. Salt sample

Method 1. Results for Plastics

Table 6 contains the full list of plastic materials used in this part of the project together with the results. A number of interesting samples have been picked out for discussion along with images.

What was learnt here was that often the surface of the plastics are too smooth to adhere to the concrete. A way of exploiting this feature led to further experiments in shaping the concrete with the plastic which will be outlined later in the report. The plastics that did in some way become part of the concrete's surface will be considered here.

Material	Results
Packing foam	Engulfed by the concrete and deeply set in it. Where visible the contrast in surfaces is interesting.
Carrier bags	Where the material is deep within the surface of the concrete it has adhered. Can be lifted from the surface. Creases and curves in the plastic and the concrete look organic.
Polystyrene	Dryer mix was used to encourage the material not to float to the surface which was successful. The polystyrene has adhered.
Faux Leather	The fabric side has adhered to the concrete, the 'leather' surface lifts from the concrete.
Cling film	When on the concrete sample the cling film has a glassy appearance where it has been compressed by the wet mix. Lifts away from the concrete easily revealing an interesting surface of furrows and lines.
Bubble wrap	Has not adhered to the concrete, pulls away with ease leaving the circles of the bubbles. Some difference in the concrete's surface colour, sandy brown in places.
Photographic contact sheet	Has not adhered, interesting to see the photos in the concrete surface.
Photographic negatives	Enveloped in some places holding the material in place. Interesting to see the photo in the concrete surface.
PVA glue with lentils	The PVA and lentils are true to the shape of the mold and are continuous with the concrete. Good contrast in colour similar texture to the concrete.
Glue gun	Dependent on shape, adhered to the concrete but can be pulled off. Interesting shapes and textures.
Clear plastic distorted with a heat gun.	The concrete trapped the material, can see a hint of a rippled surface below it.

Table 6. Method 1. Results for Plastics

Packing Foam and Polystyrene

The foam was cut into shapes before it was placed into the mould. The concrete enveloped the material and held it firmly. The foamy lightness and grey concrete contrast interestingly in the space. A dryer mix was used for the polystyrene sample to discourage the material floating from the mould's base, but this produced a rough and unattractive finish.

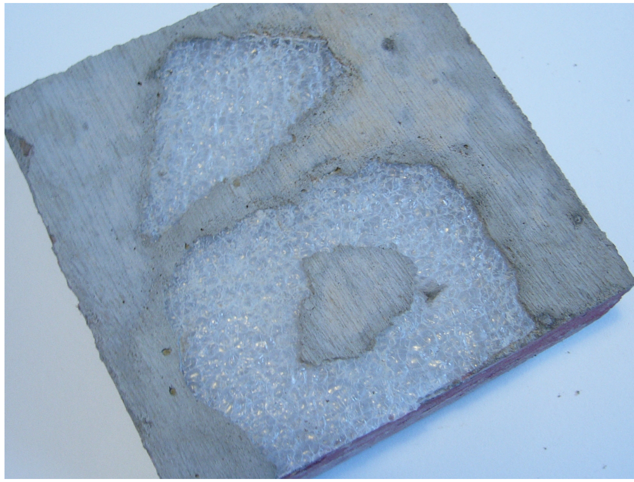


Image 35. Method 1. Packing foam sample

Image 36. Method 1. Polystyrene sample

Cling film

A strip of cling film was pleated and placed in the base of the mould. It required firm pressure to encourage the material into position. When the sample had cured the cling film provided a glassy effect whilst against the concrete's surface. With gentle encouragement the material was lifted to reveal a smooth surface with creases and ripples, much like the surface of water. This I found interesting, seeing the potential to use other smooth materials to create concrete surfaces that are solid yet give the impression of fluidity.

Image 37. Method 1. Cling film sample

Image 38. Method 1.
Opaque glue gun sample

Image 39. Method 1.
Clear glue gun sample

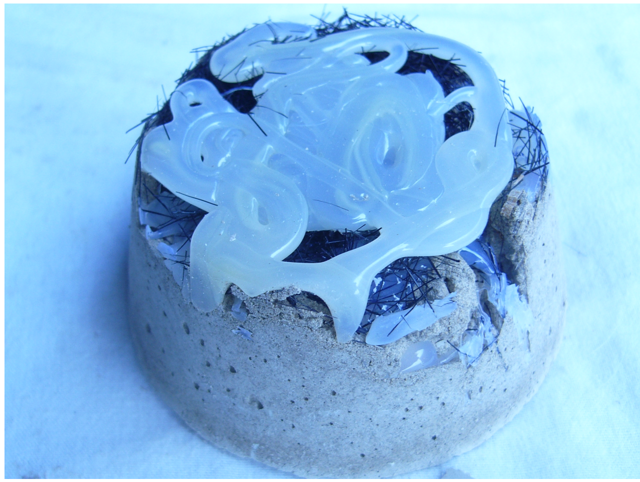


Image 40. Method 1. Glue gun and paint brush bristles sample

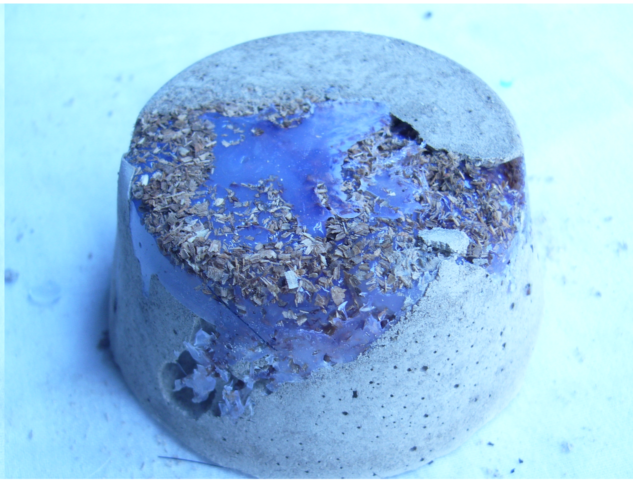


Image 41. Method 1. Glue gun and sawdust sample

<u>Glue Gun</u>

The idea of using the glue gun was that I would have control of the shapes produced and that the structure of the glue would become part of the sample rather than moulding the surface. This was inspired by the cling film sample which produced a glassy effect but the film had not adhered to the concrete's surface. The first samples were squiggles and blobs of glue that I had drawn onto the base of the silicon mould before adding the concrete mix. I questioned whether the glue would simply stick to the mould rather than the concrete, especially as the glue goes off quickly, before the mix could be added. Removal of the samples from the mould was not a problem. The glue remained in the concretes surface producing a glassy effect that suits sitting along side the grey concrete.

The next step was to combine the glue with another material. It wasn't as easy as I had hoped, as the glue sets very quickly. Nonetheless the results were interesting. One of these was the nylon bristles from a paint brush cut into the mould after the glue. The bristles are trapped between the glue and the concrete, visible through the glue and poking out in the spaces between the glue.

Bubble Wrap

As with the cling film, the bubble wrap was flattened and folded for one sample and with the bubbles remaining for a second sample. Both produced interesting surfaces once the material was removed. I was struck in particular at how the concrete picked up the bubble wraps surface even when the air had been removed from the packaging. These materials came away from the concrete too easily for there to be any further investigations in this direction.

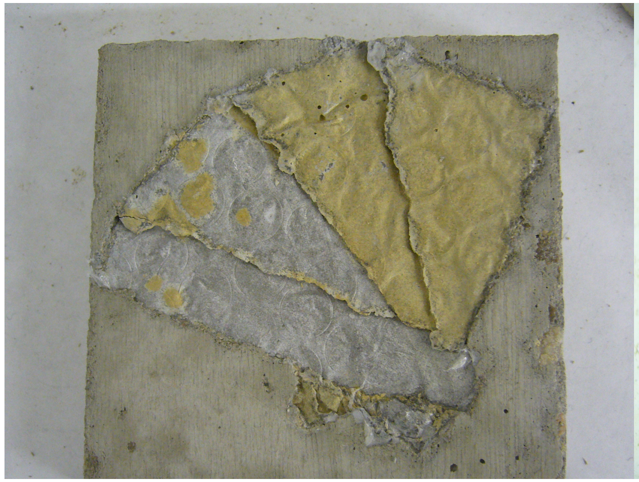


Image 42. Method 1. Flattened bubble wrap sample

Image 43. Method 1. Bubble wrap sample

Carrier Bags and Rubble Sacks

Alternatively if the plastic was scrunched up or distressed with a heat gun the concrete was then enabled to trap a section of the material and hold it in place.

Image 44. Method 1. Rubble sack distressed with a heat gun sample

Image 45. Method 1. Scrunched up carrier bag sample

Method 1. Results for Metals

The full list of this smaller group of materials can be found in table 7 along side the results.

Material	Results
Kitchen foil	Change in the materials state to a fragile condition. Black in places.
Milk bottle tops	Only where engulfed in the concrete the material is fixed to the concrete.
Paper clips	Nearly completely disappeared in the concrete, seen as golden lines in the surface.
Drawing pins	Cavities produced where the pins have held back the concrete. Good contrast between materials.
Foiled packaging	Most of the material removed leaving a smooth concrete surface. Some areas patchy with foil. Good contrasting materials.

Table 7. Method 1. Results for Metals

Kitchen Foil and Foiled Packaging

A section of kitchen foil was pleated and placed into the base of the mold. The pleating was done to add interest and texture. Once taken from the mould it was noted the foil had become brittle and fragile. Sections had adhered to the ply base and the concrete, separating pieces of the foil. There is also some change in colour, the foil is blackened with a tarnished appearance. Foil was used again in two other samples, one similar to this sample and the other where the foil is scrunched up into a ball. before it is placed in the mould. These did not add any further information to the initial sample. I did however use some foiled plastic packaging. The plastic part of the packaging came away from the concrete surface leaving either a smooth surface or pieces of shiny foil. I found this pleasing and looked at other metals that could be used.

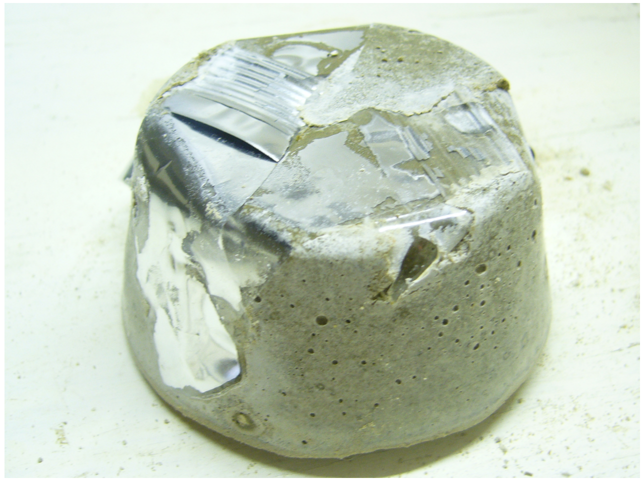


Image 46. Method 1. Foiled packaging sample

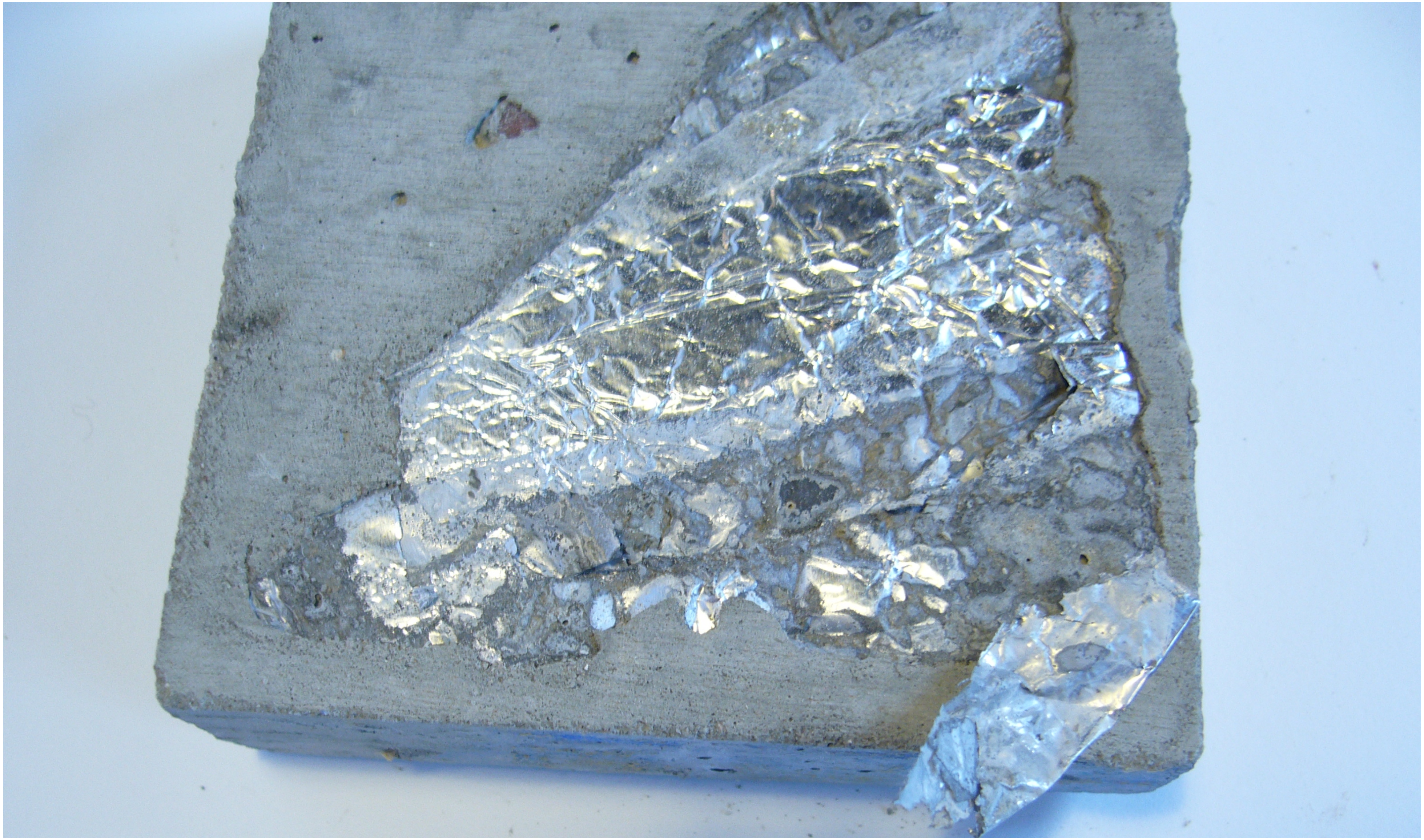


Image 47. Method 1. Kitchen foil sample

Paper Clips and Drawing Pins

These materials were dropped into the base of silicon moulds and the wet mix was added to them. The paper clips were almost entirely engulfed by the mix so they are barely visible. The drawing pins on the other hand are recognizable, appearing as small discs or creating hollow spaces with their grouped structure. I think there is something interesting in capturing and holding a familiar object in the concrete, particularly when the two materials are so different.

Image 48. Method 1. Paper clips sample

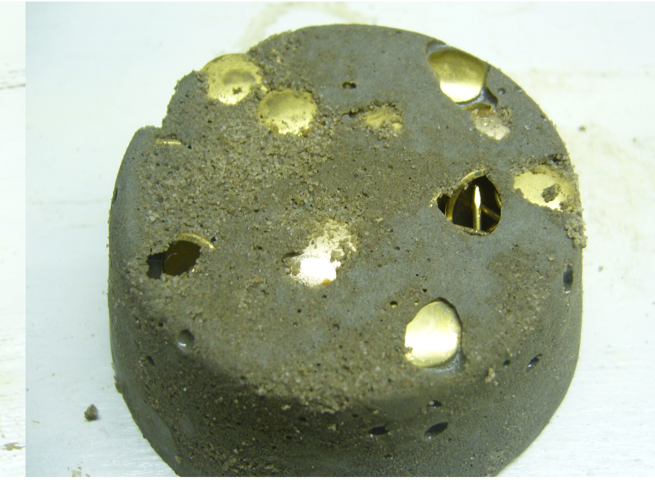


Image 49. Method 1. Drawing pins sample

Method 1. Results for Miscellaneous

This small group of materials do not fit into the groups above, they are therefore discussed here together. The group consists of shampoo, hand soap, black board chalk, ice cube, pipe cleaners and toy car wheels. Table 8 holds the full list of results. Some of the more interesting results are discussed more fully.

Material	Results
Shampoo	Has stopped the surface of the cement curing properly.
Soap bar	Adhered to the sample surface.
Black board chalk	Adhered to the concrete, fairly stable and well textured.
Ice cube	Cavity neatly produced by the ice before melting.
Pipe cleaners	Adhered to the concrete in lines and shapes. where the pipe cleaner is under the surface 'ghostly' shapes are in the concrete.
Toy car wheels	Some adherence.

Table 8. Method 1. Results for the Miscellaneous Group

Ice Cube

The ice cube was placed in the base of a silicone mould after which the concrete mix was added. When the sample was released from it's mould the ice cubes impression was visible with some water left in the base of the mould. This was interesting to me because the material used did not need to be removed.

Image 50. Method 1. Ice cube sample

Pipe Cleaners

Three pipe cleaners were gently twisted and bent to create a random shape and would fit into the base of the mould. The pipe cleaners created interesting patterns on the concrete's surface as they appear and disappear. I particularly like the smooth curved edges formed by the concrete as it has negotiated the pipe cleaner's surface. There are also ghostly shapes where the material is just below the concrete surface. Similar to that of the wool yarn sample.

There is interest in the combining of these two contrasting materials and the liquidity of the concrete as it has enveloped the pipe cleaners. The wet mix did not fully engulf the material, enabling the viewer to 'peep' under it's surface to the soft textures of the pipe cleaners.

Image 51. Method 1. Pipe cleaner sample

Conclusion to Method 1

This part of the project was characterized by adding concrete onto a material in the base of a mold. This enabled a number of judgments relating to concrete as a design material. Assessment of which materials would adhere to the concretes surface, how the concrete behaved and looked after this process. The fabrics generally adhered, cotton could be pulled from the surface, denim contained the concrete and the gauze became engulfed by the concrete disappearing almost entirely. The materials with smoother surfaces, in particular the plastics did not stick unless partially submerged in the concrete. Card and paper successfully adhered to the sample surface with little effect to their structure. What really stood out for me was how the concrete behaves, it didn’t matter what I poured the concrete onto it always accommodated it

What also came out of this first round of making samples was how long it took to clean and remake each wooden frame. This was improved by adopting the silicone trays which released the concrete samples without dismantling, they could be washed with water to remove any debris and produced samples of a useable size.

Method 2. Adding the material to a wet Concrete surface.

During this phase of the project the surface qualities of the concrete were tested by adding a variety of materials to the wet concretes surface. Inspired by the unexpected success of the paper in the Method 1 the project moved onto looking at how a range of different papers behaved when added to the concrete. This then developed into the testing of a whole range of materials. An aim with a set of objectives where used as the frame work to test this method.

Aim: This section of the project explores the effect of adding a chosen material to the surface of the wet concrete mix.

Objectives:

- to make a large number of samples, recording and annotating results in a project journal
- use a wide variety of materials ensuring a broad examination of possibilities
- assess if the chosen material adheres to the concrete
- determine the design qualities of the sample
- judge the effectiveness of the methods used
- develop ideas for further investigation

Casting Method

Silicone muffin trays were used as moulds for this batch of samples. A mix consisting of 4 parts sharp sand and 1 part extra rapid cement was mixed by hand in a bucket and added to the moulds with a trowel. Once the concrete was in the moulds the pre prepared materials (image 46) were gently pushed into the wet surface and left to cure. The stages of the method along with the results were photographed and recorded with notes in the project journal.

Materials

Materials were chosen from my immediate environment and as a development of the Method 1. The materials have been split into five groups for discussion of results, Paper and Card, Edible and Degradable, Plastics, Metals and a Miscellaneous group. A full list of materials can be found in Table 9. Each group of materials has a table of results along with description of any manipulation and analysis of any interesting results with accompanying images.

Image 52. Some of the materials prepared for Method 2.

paper and card	edible and degradable	plastics	metals	miscellaneous
tracing paper	orange peel	photographic negatives	paper clips	soap bar
newspaper	sawdust	photographic contact sheet	foil	shampoo
squared paper	onion		drawing pins	black board chalk
waxed tissue paper	apple			
cartridge paper	spout			
light weight card	savoy cabbage			
pages from an atlas	tea			
brown paper	carrot			
pulped paper	salt			
	coffee			
	avocado skin			
	beetroot			
	hazel nut			
	brazil nut			
	almond			
	walnut			

Table 9. Materials for Method 2

Method 2. Results for Card and Paper

A full list of the paper and card used with the results is outlined in Table 10.

For these samples six different papers were used, encompassing a range of qualities; texture, strength, flexibility and colour. Three different methods of manipulating the papers were applied to the material before being added to the concrete. The first was sections of paper gently scrunched up to create a ball that would fit onto the sample concretes surface. The other two were tubes made of the material, one tightly rolled and the second more loosely. The narrow tubes were several layers thick and the larger tubes had two layers at the most. With these different manipulations the reaction of the paper and the concrete could be more fully tested. The narrow tubes were added as a group of 4 or 5 and the wider tubes added in pairs. Further testing was carried out with some of the samples to discover the effects on the concretes surface if the paper was removed by burning it or allowing the paper to degrade out of doors.

All the papers tested were successfully added to the concrete and remained intact during the curing process. The tracing and tissue paper were tricky to push into the mix as they wanted to crease and buckle

Material	Results
Tracing paper	A delicate material with some transparency, nice to manipulate, rolls and scrunches well, tricky to push into wet cement as it wants to buckle. Stuck fast in the concrete.
Newspaper	Easy to manipulate, tricky to push into wet cement, water soaked up the paper, dried with out problems. Stuck fast to the concrete.
Squared paper	Good for manipulation, nice to push into the mix. Stuck fast in the concrete.
Waxed tissue paper	Fairly easy to roll and good to scrunch. Tricky to push into the wet mix, wanted to collapse and give way. Absorbed the water causing it to be very floppy. Dried up ok and all samples kept their shape.
Cartridge paper	Easy to roll, did not scrunch up well but once it did it made firm shapes. Pushed into the mix with ease. Stuck fast.
Light weight card	Easy to manipulate, holds shape well, pushes into the mix and stuck fast.
Pages from an atlas	Pleasure to use something old. Tricky to roll up, needed tape to secure the shape. Went into the mix with ease and stuck fast. Good colour combination and seeing the maps adjacent to the concrete.
Brown Paper	Easy to manipulate, difficult to push into the mix as it gave under the pressure. Once dry it remained firm and secure in the concrete.
Pulped newspaper	Placed on the concrete mix surface slow to dry with no adherence.

Table 10. Method 2. Results for Paper and Card

under pressure. The squared paper and atlas pages had the right amount of give and firmness, making them the most successful papers to be manipulated and added to the concrete. Water from the mix soaked up some of the sample papers (brown paper, news paper and tissue paper) without any effect on the results.

I felt the information on the paper was interesting and would be relevant when judging the samples design qualities. The newspaper says something about the date and era, it also signals political and cultural information. Particular stories, colours and shapes could be selected. The squared paper has my own hand written notes, a recipe for concrete, alluding to the makers interests and thoughts. The square motif possibly add a flavour of nostalgia, it's traditional, old school and pre computers. Pages from an atlas added colour to the samples surface suggesting a vintage feel.

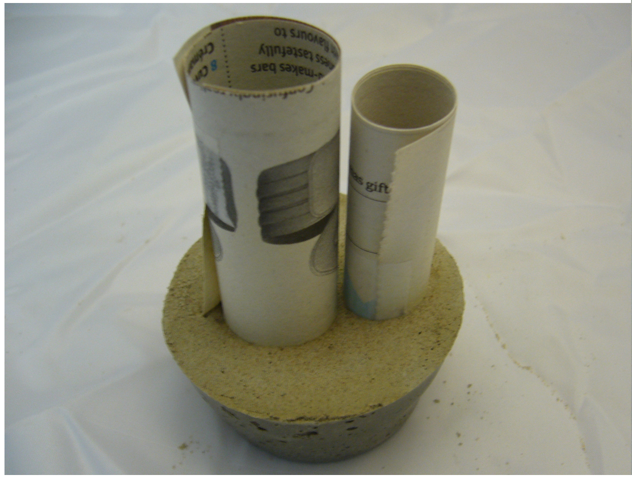


Image 53. Method 2. Wide newspaper tube sample

Image 54. Method 2. Scrunched up squared paper sample

Image 55. Method 2. Narrow atlas page tube sample

Image 56. Method 2. Narrow brown paper tube sample

Image 57. Method 2. Scrunched up paper removed using fire

Image 58. Method 2. Scrunched up paper sample weathered outside

The samples used to test removing the paper by burning created sharp neat shapes in the concretes surface. The flames scorched the concrete and it took a number of matches to completely burn the paper away.

Of the samples placed outside only one saw it through the winter without breaking up. This was due to the poor quality of concrete because the mix lacked aggregate. Surprisingly the paper was very hard wearing and is still present in the sample seen above after over 12 months outside.

Method 2. Results for Edible and Degradable

Seventeen edible or degradable materials were used during this method. They fall into three groups; those in a powdery form; sawdust, tea, salt, coffee. Materials that had been sliced, grated or torn; orange peel, onion, apple, cabbage, carrot, avocado skin, beetroot. Whole items; sprout and nuts in their shells, hazel, brazil, almond, walnut. The first and second groups were gently pressed onto the wet concrete mix with the palm of the hand and the third group pushed into the mix with a finger. A comprehensive list of the materials used in this part of the project is out lined in Table 11.

The powdery materials in the main brushed away from the concrete surface. The coffee grounds slightly discoloured the concrete surface and the salt behaved in the same way as when the concrete was added to it in Method 1.

Image 59. Method 2. Ground coffee sample

Image 60. Method 2. Salt sample

Image 61. Method 2. Sawdust sample

Image 62. Method 2. Wheat flour sample

The sliced onion, apple, beetroot and orange peel went moldy, dried, shrank and peeled away from the concrete's surface. Depending on the positioning of the sample material an impression was exhibited when the material shrank or was removed. This was particularly evident with the orange peel. When pushed into the surface on its narrow end and once it had dried and shrank, it left a cavity with the impression of the orange's dimply skin. There was a similar reaction from the sprout, avocado skin and cabbage leaf. The materials from this group that did remain in the concrete's surface were the nuts.

Image 63. Method 2. Apple slice sample

Image 64. Method 2. Almond sample

Image 65. Method 2. i.
Orange peel sample

Image 66. Method 2. ii.
Orange peel sample.

Material	Results
Orange peel	Some manipulation possible before adding to the wet mix. Pushed into the surface with ease. Over time the peel shrank back and could be removed leaving interesting shapes with dimpled surfaces.
Sawdust	Where good contact has been made with the mix the material is stuck but not firmly.
Onion	Where pushed into the surface the material stuck. Very moldy and smelly.
Apple	Slices are easy to remove, the concrete surface is unstable.
Sprout	Stuck firm in the concrete, looks ridiculous.
Wheat flour	Minimal adhesion.
Savoy cabbage	No adhesion, delicate veiny patterns in the concrete’s surface.
Tea	Not bonded well with the concrete, brushes away easily.
Carrot	Where buried in the surface the material has attached.
Salt	No adherence. Over time the salt and the concrete surface became distorted.
Coffee	No adherence, some discolouration of the concrete’s surface.
Avocado skin	Peels away from the concrete with ease revealing an impression of the fruit’s skin.
Beetroot	Adhered to the concrete, some colour change in the concrete’s surface to a yellow hue. Dried out over time leaving shapes.
Hazel nut	Stuck in the surface not very interesting to look at.
Brazil nut	Stuck in the surface not very interesting to look at.
Almond	Stuck in the surface not very interesting to look at.
Walnut	Stuck in the surface not very interesting to look at.

Table 11. Method 2. Results for Edible and Degradable

Method 2. Results for Plastics

There were two materials in this group; photographic negatives and a contact sheet. They were tested in the same batch as the paper and card above and therefore manipulated in the same ways. The strips of negatives were not easy to roll along the length, it tended to spring open even when taped. When rolled width ways it was easier but the material still wanted to spring out flat. For this reason it was also a problem to scrunch up into a ball and push into the wet concrete. Once dry the tubes fixed well into the concrete, the scrunched up piece less so. There were similar problems and success with the contact sheet. Table 12 contains the full results for these materials. The design interest with these materials lies mainly with the images on them.

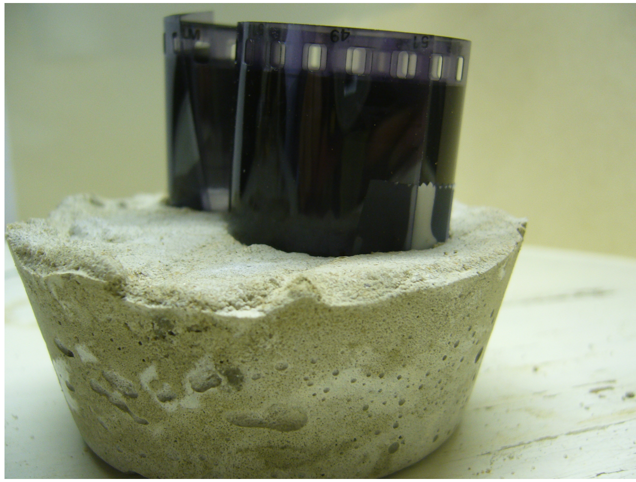


Image 67. Method 2. Photographic negative sample

Image 68. Method 2. Contact sheet sample

Material	Results
Photographic negative	Not easy to manipulate therefore tricky to push into the concrete. Trapped and held firm when cured.
Photographic contact sheet	Not easy to manipulate therefore tricky to push into the concrete. Trapped and held firm when cured.

Table 12. Method 2. Results for plastics

Method 2. Results for Metals

The three materials in this group were kitchen foil, paper clips and drawing pins. The foil was scrunched up then placed on the surface of the wet cement, pushing it in slightly. It bonded with the concrete, becoming darker and brittle. The drawing pins and paper clips were sprinkled liberally on the wet concrete surface and then pushed gently to break the surface. Those items that became partly submerged became part of the concrete's surface. Their reflective quality contrasts well with the concrete's matte grey surface.

Table 13 contains the results for the metals used in Method 2.

Image 69. Method 2. Drawing pin sample

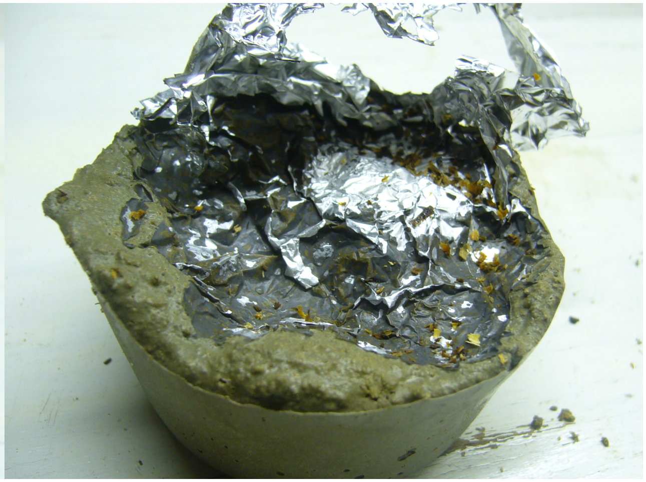


Image 70. Method 2. Kitchen foil sample

Material	Results
Paper clips	Where good contact has been made the bond with the concrete is strong.
Kitchen foil	Adhered to the concrete with blackened areas and the foil seems more fragile, tearing easily.
Drawing pins	Where pressed into the surface the pins are firmly trapped in the concrete. Good contrast between smooth and shiny and the grey concrete.

Table 13. Method 2. Results for Metals

Image 71. Method 2. Paper clip sample

Method 2. Results for Miscellaneous

The materials tested in this part of the project are listed along with the results in Table 14.

A soap bar, shampoo, blackboard chalk and an ice cube were in this final group. Placed on the surface of the wet cement the soap bonded surprisingly firmly with the concrete. The shampoo left an oily surface on the concrete once the curing had occurred. Blackboard chalk adhered well to the concrete this added some interest to the concrete's surface. As with when an ice cube was used in Method 1, here again the ice made a significant impact on the concrete creating a cavity the size and shape of the ice cube.

Image 72. Method 2. Soap bar sample

Image 73. Method 2. Ice cube sample

Material	Results
Soap bar	Placed on the wet cement this material has adhered to the concrete's surface.
Shampoo	Has stopped the surface of the cement curing properly.
Blackboard chalk	Good adhesion with a stable surface.
Ice cube	Cavity neatly produced by the ice before melting

Table 14. Method 2. Results for Miscellaneous

Image 74. Method 2. Blackboard chalk sample

Conclusion to Method 2

When submerged enough for the concrete to grip the material many in this group adhered to the surface. The design effects at this small scale was difficult to judge. The potential with the paper and the degradable objects was that as they changed over time and due to environmental conditions the surface of the sample would change, eventually revealing cavities and negative spaces. Placing a material into the wet surface gives the designer more control of placement. The disadvantage is that the concrete surface itself lacks the smoothness created by the moulds surfaces.

Method 3. Mixing the Material into the Wet Concrete.

Whilst adding materials to the surface of the wet concrete it occurred to me that there were other ways to put concrete and material together. One of these ways was to mix the material into the wet concrete mix.

Aim: This part of the project explores the effect of mixing a material into the concrete during the mixing stage to evaluate any outcomes on the surface qualities of the concrete.

Objectives:
- make a collection of samples, recording and annotating the results
- use a number of interesting materials
- assess the design potential of each concrete and material combination
- examine any visual or tactile effects the material has on the concrete
- judge the effectiveness of the methods used
- develop ideas for further investigation

Casting Method

During this stage of the project each sample needed to be mixed separately. The measurements were worked out by placing the dry materials in the mould to give an idea of the quantities required. A 4 parts sharp sand and 1 part cement ratio was used, measured with a desert spoon and mixed in a plastic mixing bowl by hand. The mix contained buff coloured sharp sand and extra rapid cement, silicone muffin trays were used as moulds. The quantity of materials added was done by eye, adding enough to appear to have an impact on the result.

Image 75. Method 3. Mixing of concrete and nylon fibres

Materials

The materials used continue to be from the domestic environment, either having uses in the home or DIY. For the purposes of discussion they have been placed in 3 groups; metals, plastics and miscellaneous. A full list can be found in Table 15, followed by each group being examined accompanied with images of the samples.

metals	plastics	miscellaneous
fine wire wool	nylon brush fibres	lint from the tumble dryer
medium wire wool	nylon pan scrubber	fibres from paper mop
thick wire wool	tile spacers	cotton wool
staples	plastic hoops	erasers
stainless steel pan scrubber		

Table 15. Materials for Method 3

Image 76. Method 3. Fine wire wool sample

Material	Results
Fine wire wool	Mixed with some difficulty. Visible on the upper surface and sides appearing here as red squiggles and lines where the material has rusted.
Medium wire wool	Mixed with some difficulty. Visible on the upper surface and sides appearing here as red squiggles and lines where the material has rusted.
Thick wire wool	Mixed with some difficulty. Visible on the upper surface and sides appearing here as red squiggles and lines where the material has rusted.
Staples	Easy to mix. Not visible on the upper surface, one small area to the side.
Stainless steel pan scrubber	Chopped then mixed. difficult to get an even mixture. Very interesting sample. The concrete has been restricted and shaped by the metal producing texture and form.

Table 16. Method 3. Results for Metals

Image 77. Method 3. Wire wool medium thickness sample

Image 78. Method 3. Thick wire wool sample

Image 79. Method 3. Staples sample

Image 80. Method 3. Stainless steel pan scrubber sample

Method 3. Results for Metals

Three of the samples were different width wire wool; fine, medium and thick, similar results were seen with all three. The wool was pulled apart and cut into smaller sections before adding to the mix, stirring in with a spoon until the material and the concrete appeared to be evenly distributed. This proved difficult as the wire fibres locked together. Once the samples had cured where the wire wool is visible on the concretes surface it is seen to have rusted producing reddish lines and marks.

There is no visible change in the sample with the staples added. On the other hand the stainless steal pan scrubber has a prominent effect on the samples surface quality. The material was difficult to mix in even when cut into small pieces as the spirals tangled and clumped together. The resulting surface is shaped in an interesting way, appearing to have restricted the concretes flow and trapping it in the coils. (See Table 16 for full results)

Method 3. Results for Plastics

Four materials were used in this group, Nylon brush fibres, nylon pan scrubber, tile spacers and plastic hoops. The materials and the results can be seen in Table 17. The interesting aspects of mixing these materials and the resulting samples are discussed below.

Material	Results
Nylon brush fibres	Very difficult to mix, upper surface is hairy, not visible at the mold edges.
Nylon pan scrubber	Impossible to mix in properly. Remained in knot of fibres and burst from the mold when released from it.
Tile spacers	Mixed easily and evenly. Some protrude from the surface, not visible at the mold edges..
Plastic hoops	Mixed easily, probably too big for this mold, lots visible on the upper surface, some visible at the base.

Table 17. Method 3. Results for Plastics

There were similar difficulties in mixing in the nylon pan scrubber to the stainless version. It was impossible to produce an even blend, clumping together in one area of the mix and springing out of the side of the sample when it was released from the mold. Visually this is effective. The tile spacers and the nylon brush bristles had little effect on the samples except where they protruded from the upper surface. The brush bristles were particularly difficult to mix into the concrete then appeared to float to the surface. Mixing in the plastic hoop was not a problem but the mix seemed to work its way to the base of the mould forcing the hoops above the surface.

Image 81. Method 3. Nylon pan scrubber sample

Image 82. Method 3. Nylon brush fibres sample

Image 83. Method 3. Plastic hoop sample

Image 84. Method 3. Tile spacers sample

Method 3. Results for Miscellaneous

As with the previous methods a number of materials used did not fit into a category, therefore they will be discussed as group. A full list of the materials included and the results are in Table 18.

This group comprised of lint from the tumble dryer, fibres from a paper and cotton mop, cotton wool and pieces of an eraser. The lint was not pleasant to mix in, it also tended to clump together in the mix. The sample took longer to dry out and there is minimal visible effect on the sample's surface. The duster material was cut into smaller more manageable pieces before being added to the concrete. It was difficult to mix into the concrete, again tending to clump together. The material is only slightly visible on the finished sample.

The first mix with the cotton wool was disposed of as it was impossible to mix with the concrete. A second sample was made by soaking the cotton wool in water first before adding it to the mix. This enabled the two materials to combine but it took much longer to cure, with droplets of water still visible on the sample's surface several weeks later.

Material	Results
Lint from the tumble dryer	Tricky to mix and not pleasant. Took longer to cure. Small amounts visible on the sample surface.
Fibres from paper mop	Mixed with some effort. Small amounts visible on the samples surface.
Cotton wool	Soaked the cotton wool to aid mixing. Took longer to cure. None visible on the samples surface.
Erasers	Mixed with ease. Visible on the upper sample surface.

Table 18. Method 3. Results for Miscellaneous

Image 85. Method 3. Lint sample

Image 86. Method 3. Fibres from a paper mop sample

Conclusion to Method 3.

One batch of samples was felt to be enough to draw some conclusions from. The method of mixing each sample separately was very time consuming. This was partly because the materials selected were not appropriate due to the difficulty in blending them with the wet concrete mix. The samples surface design potential was poor, this led to the decision of not continuing with this method.

Image 87. Method 3. Cotton wool sample

Method 4. Sections of Concrete Joined with a Material

Early on in the initial sample making stages the idea of joining concrete parts with a material came up. With the decision to use the muffin trays as moulds this seemed a natural step as the material could be simply draped between the muffin cases.

Aim: To explore the possibility of using a material to connect pieces of concrete.

Objectives:

- make a collection of samples, recording and annotating the results
- assess the design potential of each material and concrete combination
- examine any visual or tactile effects the material has on the concrete
- judge the effectiveness of the methods used
- develop ideas for further investigation

Casting Method

Muffin tray moulds were used and a 4 parts sharp sand to 1 part cement mix. A mix without large aggregate was used because of the small size of the concrete samples. It was realised that this makes a lower strength concrete but was suitable for the purposes of sample making. Measuring out the qualities of the mix was done with a trowel and mixed in a bucket. The method of putting together the concrete and material was done in one of three ways.

a; Half filling the moulds with wet mix, laying the material on the concretes surface then finally filling the moulds covering the material within.

b; Filling the moulds with the wet mix, adding the material by pushing it into the surface.

c; Laying the material across the bottom of the moulds, adding the mix to the moulds covering the material.

Materials

Materials chosen for this method were considered appropriate for connecting pieces of concrete because they come in lengths long enough to span the muffin mould tray and they have the flexibility to bend into the moulds. (Table 19)

hessian
hessian webbing
nylon webbing
cotton fabric
chicken wire
nylon fabric

Table 19. Materials for Method 4.

Method 4. Results

The full results for Method 4 are outlined in Table 20. This section also contains some details about adding the materials and observations of the finished samples.

Material	Results
Hessian	The concrete firmly grips the material, strong enough to hold up from one end.
Hessian webbing	The concrete firmly grips the material, strong enough to hold up from one end. Some shaping of the concrete through the spaces in the webbing. Good texture.
Nylon webbing	The concrete firmly grips the material, strong enough to hold up from one end. Some shaping of the concrete through the spaces in the webbing. Good texture.
Cotton fabric	The concrete firmly grips the material, strong enough to hold up from one end. The delicacy of the cotton looks interesting with the concrete particularly when it is supporting the concrete parts.
Chicken wire	Feels very secure in the concrete
Nylon fabric	Concrete was cast onto this fabric, a strong bond has not been made.

Table 20. Method 4. Results

Hessian, Cotton and Webbing

Hessian, cotton and both the types of webbing were combined with the concrete using method a; Half filling the moulds with wet mix, laying the material on the concretes surface then finally filling the moulds covering the material within. All four materials firmly adhered to the concrete so that the length could be held up by one end without any damage to the sample. The concrete did not appear to penetrate the structure of the hessian and the cotton fabric, producing internal edges to the sample. Conversely it appears that for the samples created using the webbing the mix has penetrated through the holes in the structure, creating a strong hold on the material. It is seen that at some of the edges the mix has not entirely enveloped the webbing producing interesting textures.

Image 88. (top) Method 4.
Hessian sample

Image 89. Method 4.
Nylon webbing sample

Image 90. (top) Method 4.
Hessian webbing sample

Image 91. Method 4.
Cotton fabric sample

Chicken wire and Nylon Fabric

Chicken wire was pushed into the wet mix once the moulds were full. This method was chosen as an alternative to the one above, the chicken wire was strong but also flexible making it suitable. This sample successfully joined the two materials but did not have any effect on the surface of the concrete. Because of its strength there is the possibility of using this method to create pieces on a much larger scale.

For the final sample in this group the mix was cast onto the nylon fabric used to connect the concrete. The fabric not adhere to the concrete, peeling away when lifted so it couldn't be considered as successful.

Image 92. (left) Method 4.
Chicken wire sample

Image 93. Method 4.
Nylon fabric sample

Conclusion to Method 4

What was really interesting in these samples was the webbing's ability to create texture with the concrete. It was appealing to see the samples stacked for the photography suggesting the possibility of making larger scale free standing pieces. with an element of repetition.

Image 94. Method 4. Hessian webbing sample stacked

Method 5. Brushing the Wet Concrete onto a Material

Another way of putting concrete and material together in order to investigate the surface qualities of concrete tested during this research was to brush a wet mix onto a material, in a similar way to using paint.

Aim: Assess the surface qualities of samples made by brushing a concrete mix onto a material.

Objectives:

- make a collection of samples recording and annotating results in a project journal
- assess the design potential of the material and the concrete
- examine any visual or tactile effects the material has on the concrete
- judge the effectiveness of the methods used
- develop ideas for further investigation.

Casting Method

I had a sense that using the ration 4:1 sand to cement may not work for this method. Therefore the ratio used was equal parts cement and sand, so it was more of a cement based slip. A normal setting cement was used with a soft sand to ease the application of the cement slip. The ingredients were measured out with a spoon and mixed in a bowl to the constancy of thick paint. This allowed for a medium sized paint brush to apply the mix.

Materials

The materials used (Table 21) were chosen for a number of reasons.

- A flat even structure facilitated the application of the mix.
- Success in bonding with the concrete had been shown in previous methods.
- The material was either a manageable size or could be cut.

It was important to have an appropriate under surface to the samples, one that would have little impact on the results. The sample materials were placed on a piece of plastic sheeting.

hessian webbing
nylon webbing
chicken wire
hessian
cotton fabric

Table 21. Materials for Method 5.

Results for Method 5

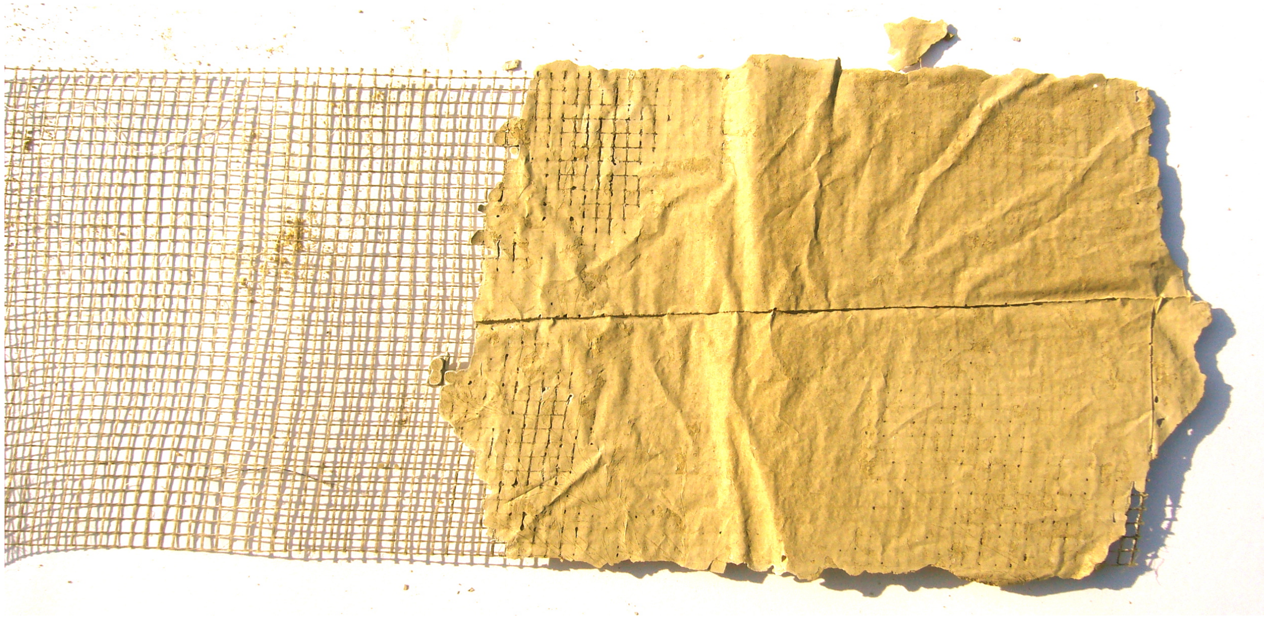
Once the concrete had cured the samples where removed from the plastic sheeting. It was found that all five materials had bonded with the concrete but the concrete was fragile. Care was taken not to bend the samples when examining the surfaces. All the samples exhibited sandy and uneven upper sides. In contrast where the concrete had penetrated the material to the underside the surface was smooth with signs of creases that had been in the plastic sheeting. This occurred with all the materials except the hessian where the wet mix did not pass through the fabric.

Image 95. (top) Method 5. Cotton fabric sample

Image 96. Method 5. Hessian sample

Material	Results
Hessian webbing	Absorbed through but sample is fragile.
Nylon webbing	The concrete has been absorbed through but sample is fragile.
Chicken wire	Absorbed through but sample is fragile.
Hessian	Adhered to surface, did not penetrated the material.
Cotton fabric	Absorbed through but sample is fragile.

Table 22. Results for Method 5



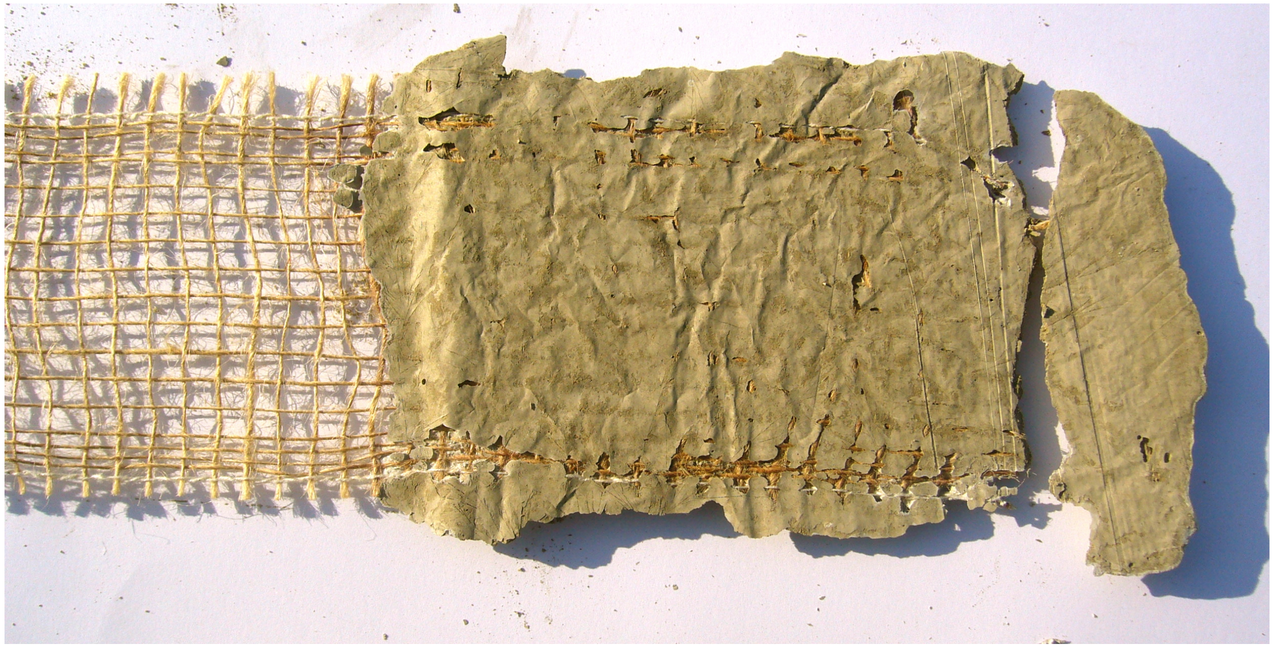


Image 97. (top) Method 5.
Nylon webbing sample

Image 98. Method 5.
Hessian webbing sample

Image 99. Method 5.
Chicken wire sample

Conclusion to Method 5.

When painted onto a surface in this way the concrete accommodated the material by soaking through if the material was porous enough or adhering to the surface. The painted side was rough and sandy, not particularly interesting. The underside of the samples, where the concrete had moved through the material and set against the plastic sheeting were more appealing. This was because the concrete had picked up the details in the plastic sheeting, it's smooth texture and fine crease marks. This outcome could be achieved by casting directly onto a material. This was explored during the next section of the project, Method 6.

Method 6. Shaping the Concrete Surface with a Material

This is the final method used during this research into the surface qualities of concrete. The aim was to explore the way the concrete would react to being cast onto a surface where that material would act as part of the mould. This method was initially developed during the BA (hons) Surface Design for Fashion and Interiors. During this project procedures were clarified and developed to improve the possibility of finding new outcomes. The belief being that the structure and characteristics of the material would transcribe to the surface qualities of the concrete.

During this method the materials used underwent manipulation and change to further explore the surface's effect on the concrete. These will be fully described in each results section.

For the purposes of this report Method 6 is divided in to four phases. This enables the description of the flow of ideas and creative thinking and view the evolving nature of the research.

Phase 1. Small multiple sampling
This has been divided into 5 groups, showing the ways in which the materials where treated prior to use.

- unembellished materials
- oil as a release agent
- combination of two mould materials
- manipulation of the mould material
- layering of mould materials

Phase 2. Large square samples
Phase 3. Large rectangular samples
Phase 4. Final sampling.

Aim: This section of the project explores the design potential of using a material's surface as part of the moulding process.

Objectives:
- make a variety of samples, recording and annotating the results
- use a range of materials to test the possibilities of this method
- assess the selected material's effect on the concrete
- study the surface qualities of each sample
- judge the effectiveness of the methods used and adapt if necessary
- develop ideas for further investigation

<u>Casting Method</u>

Wooden frames were used as moulds for this part of the project, they came in a number of sizes and because they come apart the shape could be changed from square to rectangle and finally an L shape. The initial samples where created using the small frames that made the earlier concrete squares measuring 12 cm^2. This progressed to frames measuring 25 cm^2 with the addition of 50 cm lengths to give the option of rectangles and L shaped samples. The frames screwed together at the corners to make the edges of the mould. The chosen material was secured to the base of the frame with masking tape and attached to another frame of the same size. The purpose of this was to hold the mould material and to raise the material off the work surface, allowing space for the material to stretch under the weight of the concrete mix. Releasing of the cured concrete was done by unscrewing the frame and pulling away the moulding material. The wood frame was then cleaned and screwed back together for the next use.

A concrete mix of 2 parts 10mm shingle aggregate, 2 parts sand and one part cement was used throughout this section. Snowcrete and silver sand was used when a pigment was added and for both the Plastic

Sheet and Glue Sample and Plastic sheet and Rolls of Tape Sample. Otherwise an extra rapid cement with sharp sand was used. This came about to enhance to colour of the pigments and vary the colour of the finished surfaces. Mixing of the concrete was done in a bucket, with a trowel which was also used for measuring. When the quantities of mix became much larger a hand held electric mixer was used.

Image 100. Method 6.
Samples waiting in moulds

Materials

The materials came from my environment and where topped up with items from the charity shop. Table 23 contains a full list of materials used in Method 6. They were chosen because they appear to have interesting possibilities, they fit and were fixable into the frames. The materials used to manipulate and adapt the surfaces used have also been listed here and will be discussed fully in the results section.

Fabric	plastic	miscellaneous
hand knit jumper	plastic sheeting	chicken wire
jersey t shirt	slip mat	pipe cleaners
jersey fabric	bubble wrap	cooking oil
crimped fabric ladies top	cling film	string
textured towel	nylon rope	cardboard packaging
cotton fabric	glue gun	rolls of tape
hessian	carrier bag	thread
webbed nylon jacket liner		
denim jeans		
corduroy trousers		
Gore tex jacket		
woven textured fabric		
toweling robe		
handed knitted nylon string		
hand knitted plastic		
woven black sack/string		

Table 23. Materials for Method 6

Method 6. Phase 1. Small Multiple Sampling

This part of Method 6 is characterized by making are large number of small samples with a number of unembellished materials and working through a number of ways to influence the concrete's surface. Tables 24 - 28 contain the full list of materials, techniques used and results. Samples that stood out or signified a turning point in the project will be discussed more fully with corresponding supporting images.

Material	Result
Crimped fabric from a ladies top.	Domed shaped sample with the lined texture of the fabric clearly visible. Removed from concrete with ease.
Jersey fabric from T shirt	Tall even dome shape with the delicate texture of the fabric visible. Removes from the sample surface with a small amount of damage.
Cardboard packaging	Corrugated card with many slits in it to form a flexible surface. Produced a low dome surface with strips of card adhered to the sample surface and the texture of the corrugated parts.
Plastic slip mat	Highly perforated material. Concrete cured in the perforations but when removing the material the concrete broke away leaving a less striking texture.
Textured towel	Shallow dome created with good visibility of the towel's texture. Removal of the material did result in some of the concrete coming with it in the form of powder.
Bubble wrap (large)	Formed a low dome with good texture, removed with ease from the concrete surface.

Table 24. Method 6. Phase 1.
Results for Unembellished materials

Method 6. Phase 1. Unembellished Materials

Crimped Fabric Sample

The texture of this sample is surprisingly accurate to the original fabric. The expectation was that the weight of the concrete would stretch out the ceases to the point of invisibility.

Image 101. Method 6.
Unembellished crimped fabric sample

Cardboard packaging Sample

The packaging used for this sample shaped the concrete and also became part of it's surface. It remains along the lines of Method 2 where materials were added to the concrete's surface. This then is a combination of two methods to create this interesting surface.

Image 102. Method 6.
Unembellished cardboard packaging sample

Method 6. Phase 1. Oil as a release agent.

Oils can be used to coat the inside of the mould to aid releasing the concrete. Some of the materials used have textures that adhere to the concrete's surface. This was a small trial to test whether using an oil would improve the materials ability to come away from the concrete. The overall result was that there was some improvement in removal of the sample with no noticeable difference to the surface texture, but to be sure more extensive testing would be needed.

Material	Result
Textured towel	Shallow dome with a good texture from the towel visible. Very alike to the previous textured towel sample with a darker surface. Material came away from the concrete a bit easier.
Cotton fabric	A low dome with some visibility of the fabrics texture. Removed from the concrete with ease.
Corduroy fabric	The texture of the fabric is visible on a low domed shape with a dark part to the side. Possibly due to the oil. The crease across the sample has probably been caused by the mix not being agitated enough when wet.

Table 25. Method 6. Phase 1. Results for Oil as a Release Agent

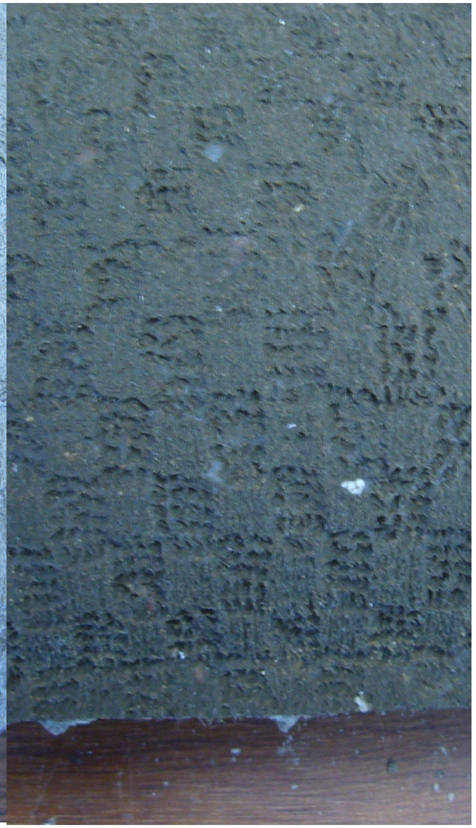


Image 103. (Left) Method 6. Unembellished textured towel sample.

Image 104. Method 6. Oil as a release agent textured towel sample

Method 6. Phase 1. Combination of two mould materials

<u>Crimped Fabric and Jersey Sample</u>

The surfaces of these two fabrics has been captured by the concrete. The possibilities for shapes, textures and design is many and varied with this method. The hand stitching which has produced the crease through the centre of this sample could be replaced with other forms of joining with possible different results.

Image 105. Method 6. Crimped fabric and jersey combination sample

Materials	Combination method	Result
Crimped fabric and jersey	Two triangles of fabric hand sewn together with cotton to create a square.	The stitched seam has less stretch than the fabrics resulting in an indented line across the surface. Both fabrics have bulged to a similar amount creating a tall dome. The jersey has a smooth surface and the crinkle fabric has produce a horizontal lined texture.
Hand knit and jersey	The piece of hand knit has a rectangle shape cut from it and a piece of jersey has been hand sewn into the space.	The knitted surface is powdery and unstable. It was difficult to pull away from the concrete, losing the quality of the surface pattern. The jersey section is proud with a smooth surface. Good contrasting surfaces and obvious difference in materials.
Hand knit and crimped fabric	The piece of hand knit has a rectangle shape cut from it and a piece of crimped fabric has been hand sewn into the space.	The knitted surface is powdery and unstable. It was difficult to pull away from the concrete losing the quality of the surface pattern. The crimped fabric is proud with a lined texture. Good contrasting surfaces and obvious difference in materials.
Jersey and hand knit.	The square of jersey has two rectangles cut from it, replaced with the knit which is held in position with hand stitch.	An even dome shape is produced with the two depressions where the knitted pieces moulded the concrete.

Table 26. Method 6. Phase 1. Results for Combination of two mould materials

Method 6. Phase 1. Manipulation of Mould Materials.

Jersey - gathered in the centre of the fabric with hand stitched cotton.

The jersey fabric with it's stretch and smooth texture adapted well to being used as a mould material. In this sample the central hand stitched gather has been clearly picked out by the concrete producing deep sharp creases.

Image 106. Method 6. Jersey, gathered in the centre with hand stitched cotton

Material	Technique	Result
Crinkle fabric	Pleating. Three pleats secured at the frame with masking tape.	Noticeably taller dome. Crinkled texture present throughout surface. Folds of the pleats visible as furrows across the sample.
Plastic sheet	Distorted with a heat gun	Generally smooth surface with a slight dome shape. Distortion visible as grooves and channels.
Jersey	Gathered at the frames edge secured with masking tape	Distorted dome, bulging to one side. Gather is visible as creases in the concrete. Fabric texture also visible.
Jersey	Gathered in the centre of the fabric with hand stitched cotton	Distorted dome with a pinched upper surface where the gather was made. Creases very noticeable and the strain in the jerseys structure.

Table 27. Method 6. Phase 1. Results for Manipulation of Mould Materials

Method 6. Phase 1. Layering of materials

Jersey and Chicken Wire Sample

Of the materials used in layers to shape the concrete this sample is the most impressive. Again it is the flexibility of the jersey that has accommodated the concrete and the chicken wire to produce this soft looking well defined surface.

Image 107. Method 6. Jersey and chicken wire sample

Materials	Method of layering	Result
Cotton fabric and chicken wire	Chicken wire is secured below the cotton fabric filling approximately half of the mould surface.	The chicken wire is visible through the cotton creating an impression on the surface. The wire has also restricted the shape of the dome so it there is more height on the cotton only area.
Hessian and pipe cleaners	Both materials secured to the frame with the hessian upper most. Two pipe cleaners have been used in one direction across.	The concrete surface replicates the texture of the the hessian, there is barely any sign of the pipe cleaners only a gentle undulation in the sample surface.
Plastic sheet and string	Both materials secured to the frame with the plastic upper most.	The surface is smooth from the plastic with a small depression where the string crosses.
Jersey and chicken wire	chicken wire is secured below the jersey reaching half way across the sample surface.	The jersey has bulged through the chicken wire under the weight of the concrete to create this soft doughy looking surface.
Slip mat and plastic sheet	The plastic layer is below the slip mat to control the flow of the concrete through the perforations in the slip mat.	A very textured surface has been produced with minimal breakage of the concrete nubs made by the slip mat.

Table 28. Method 6. Phase 1. Results for Layering of Materials

Method 6. Phase 2. Large Square Samples.

To improve the diversity of sampling this phase of Method 6 added in an increase of sample size. Scaling up of the samples meant there was more surface area to experiment with and it tested whether the materials used would behave in new ways with more concrete loaded onto them. Table 29 lists the materials used, any manipulation techniques and the visual results.

The concrete mix consisted of two parts silver sand, two parts 10ml aggregate and one part snow crete with 5% yellow pigment. The materials used were attached in between two frames and raised from the work surface with pieces of wood to ensure the mould material did not come into contact with a solid surface.

After the initial results with the smaller samples this was a surprisingly disappointing batch, with a number of unsuccessful samples. For example the webbed nylon could not be removed from the concrete's surface, ripping as it was pulled away.

Image 108. Method 6. Phase 2.
Webbed nylon sample

Material	Manipulation technique	Result
Crimped fabric	none	Comforting large dome shape. The fabrics texture is visible throughout the surface, less towards the upper area. There is a dint in one of the sides where the mould material has come to rest against the wood that lifts the frame away from the work surface.
Bubble wrap, jersey, crimped fabric.	A square of bubble wrap and a square jersey sewn together with a rectangle of crimped fabric.	Produced a rather lumpy dome shape. Looks like there are 4 pieces for material as there is some tension across the crimped rectangle. Bubble wrap surface has a strong texture. The crimped fabric has lost much of its definition.
Hand knit, cling film	Layered materials with the cling film upper most to capture the textures of the knitting and preserve the concretes surface.	A large uneven dome. The knitted surface is not visible, the concretes surface has only the creases from the cling film.
Webbed nylon	none	Material could not be removed from the concrete as the wet mix had engulfed the fabric setting it within the surface.
Denim	none	Formed a low dome. The fabric was difficult to pull away from the concrete leaving a powdery surface. It did produce some interest where the jeans had worn, thinning the fabric, and the seam is visible.
Gore tex	Smocking	The weight of the wet mix ripped the fabric were it was stitched losing much of the texture of the smocking. Those that remained created an uneven shape with deep creases.
Jersey	none	Produced a large dome. Uneven in places, where the fabric had come into contact with the wood raising the frame and where the fabric had come loose from the frame.

Table 29. Method 6. Phase 2. Results for Large Square Samples.

Jersey Sample and Gore Tex with Smocking Sample

The unembellished jersey fabric sample created this strong large dome. The uneven surface appears to be caused by the aggregate contained within it. What was of interest is the dint that travels along the sample's side. This was caused by the fabric under the weight of the concrete resting on the wooden planks used to lift the samples clear of the workshop floor. This accident led me to consider placing objects under the mould material which was briefly explored in the Final Sampling Phase.

The smocking stitching failed in the sample below but this first test of Gore Tex as a mould material proved successful.

Image 109. Method 6. Phase 2.
Jersey sample

Image 110. Method 6. Phase 2.
Gore tex with smocking sample

Method 6. Phase 3. Large Rectangular Samples

To further increase the surface area of the samples and to test the behaviours of the materials within a different shape, large wooden rectangular frames were used. This increased the amount of concrete for each sample by a large amount. It also made it too physically demanding to mix the concrete in a bucket. Therefore an electric hand held mixer was used for this part of the project. Pigments of red and green were used, further exploring the change in the surface quality of the concrete. To complete this group an L shaped frame was made up and a sample formed with the jersey fabric. A full list of materials, manipulation techniques and the results is outlined in Table 30.

Table 30. Method 6. Phase 3. Results for Large Rectangular Samples

Material	Manipulation technique	Result
Plastic sheet, textured weave	Machine stitched in uneven stripes.	The materials have domed under the weight of the concrete. Where the width of the strips is larger the bulge has increased. The two textures are distinct from each other, this difference in surface has also effected the depth of colour. The plastic surface has produced a deeper green colour.
Toweling, plastic sheeting, cotton thread	Layered with the plastic upper most and machine stitched across the mould materials surface.	A shallow dome has been created with a smooth surface with lines of dots from the stitching or the cotton is trapped in the concrete's surface.
Chicken wire, carrier bag plastic	Layered with the plastic upper most.	The chicken wire has only formed sporadic and shallow impressions on the smooth surface.
Textured woven fabric	none	Even textured dome shape. The colour appears blue questioning whether the fabrics colour has leached into the concrete.
Carrier bag plastic, gore tex, nylon rope, cotton thread	Gore tex and rope made piping that was then stitched to the plastic with the piping upper most.	The surface has an even curve with three surface textures. One, the smooth plastic, two, textured gore tex and three, the nylon rope, which has been picked up through the gore tex.
Plastic sheet	Distorted with a heat gun.	Smooth large dome with much of the distortions missing, possibly stretched out. The distorted areas visible at the samples edges show creases and furrows much like a deflated balloon.
Jersey	L shaped frame used.	This sample required nearly twice the amount of mix expected, despite this the mould material stayed intact creating an uneven and lumpy shape.

Carrier Bag Plastic, Gore Tex, Nylon Rope Sample

This sample has multiple surfaces created by the materials and techniques used. The largest area has been created by plastic giving this smooth slightly rippled surface. The lines were made by using Gore Tex and nylon rope to make a piping. The Gore Tex has textured the lines whilst the rope formed the deep river like channels.

Image 111. Method 6. Phase 3. Carrier bag plastic, Gore Tex and nylon rope sample

Plastic Sheet and Textured Weave Sample

A green pigment was used in the mix for this sample. The two contrasting materials have appear to effected the tonal quality of the pigment giving the impression of lighter and darker stripes. The width of the strips of material were varied to ascertain whether this would change the surface qualities of the concrete. Where the width was increased bulges in the surface have appeared.

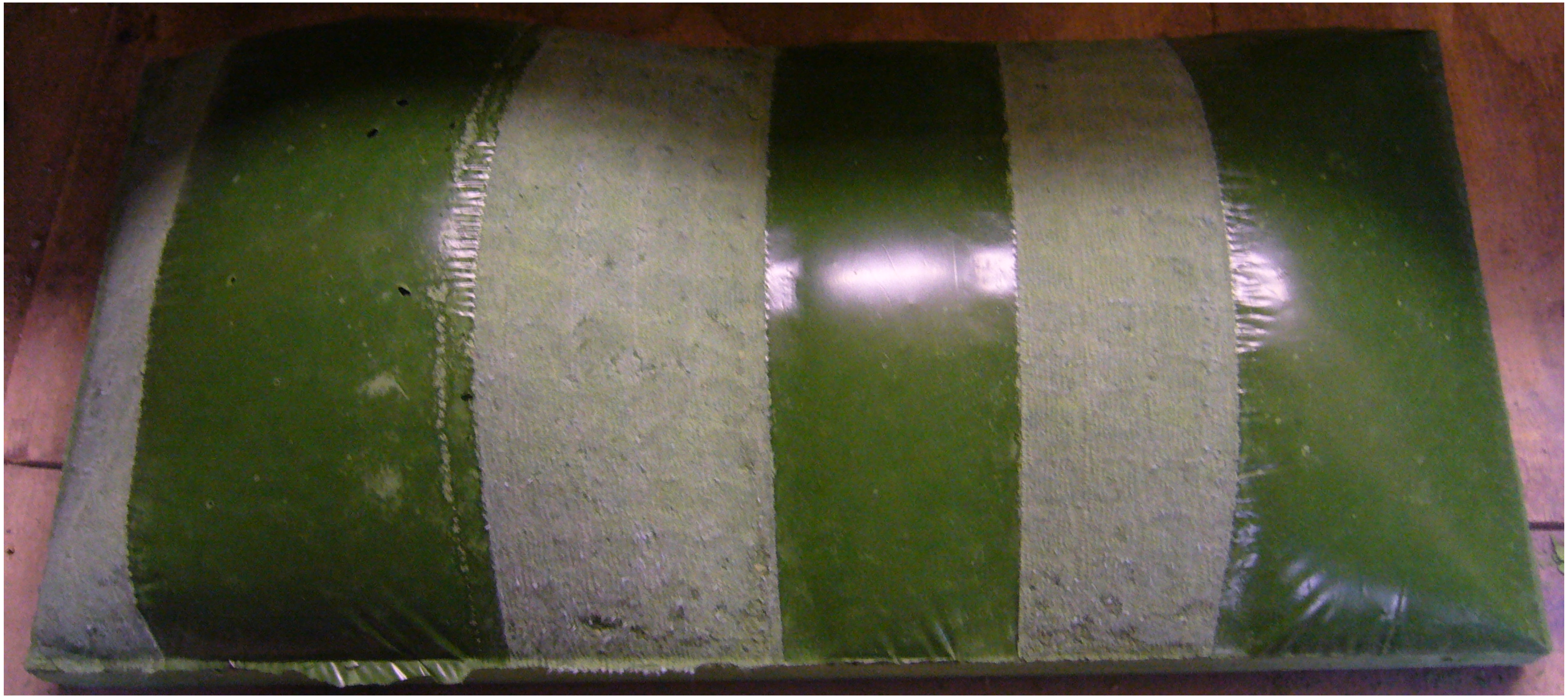


Image 112. Method 6. Phase 3. Plastic sheet and textured weave sample

Method 6. Phase 4. Final Sampling

During this final part of the research project a range of techniques, materials and frame sizes were used. Some new forms of manipulating the material were tested with good results, these include using the glue gun to draw onto plastic sheeting and knitting or weaving my own surfaces using nylon and plastic. For a full list of materials, techniques and their resulting surface qualities see Table 31.

Images of five samples follow with some discussion of the methods used and the resulting surface.

- Plastic sheet and glue
- Plastic sheet and rolls of tape
- Plastic carrier bag strips knitted
- Nylon garden twine knitted
- String and black sack strips woven

These have been chosen as the last pieces for discussion as they represent the final stage for this research question.

Material	Manipulation technique	Result
Plastic sheet, glue	Drawing with glue gun onto plastic sheet	Shallow dome with the glue plastic in the concrete surface.
Cotton, chicken wire	Layering with cotton upper most	Flattish sample, the texture of the chicken wire is visible but not significantly.
Plastic sheet, rolls of tape	The rolls of tape were placed under the plastic lifting the mould material slightly.	Smooth shallow dome with the two circles made by the rolls of tape clearly visible.
Cardboard packaging with areas of plastic tape	none	Very textured low dome with patches of the material still attached. A rough surface in most places with a smooth area which appears lighter where the plastic tape was attached to the card.
Jersey, chicken wire	Layering with the jersey upper most	Strangely disappointing sample as the jersey has not stretched through the wire to any great amount.
Plastic carrier bag	Cut into strips and hand knitted	A highly textured fragile surface that isn't powdery.
Nylon garden twine	Hand knit	A tall dome where the knit is clearly visible but the surface is powdery and much of it came with the material when it was removed.
String, black sack	Plastic cut into strips and woven with the string	Highly textured surface with plenty of smooth areas. The string is trapped in the concrete in places.

Table 31. Method 6. Phase 4. Results for Final Sampling

Plastic Sheet and Glue Sample

The simple technique of drawing with a glue gun onto the plastic sheeting created this sample. The glue remained adhered to the plastic whilst the concrete cured. When the sample was removed from the mould the glue has remained in the concrete's surface. This adds to the plastic smooth quality of the concrete.   It is probably possible to remove the glue creating a impression in the sample's surface. Casting concrete in this way could give the designer a lot of control over the finished surface design.

Image 113. Method 6. Phase 4. Plastic sheet and glue gun sample

Image 114. Method 6. Phase 4. Plastic sheet and rolls of tape sample

<u>Plastic sheet and Rolls of Tape Sample</u>

For this sample the mould material used was a sheet of plastic fixed into the wooden frame. To add the circles a pair of tape rolls were place under the mould material, lifting it slightly. The ripples in the plastic give the sample the illusion of being pliable.

Plastic Carrier Bag Strips Knitted Sample

A number of unsuccessful plastics were tried before the plastic knitted here. In order to knit the material required some stretch to negotiate the knitting needles whilst also being strong enough not to split. The plastic for this sample came from a bag used for collecting recycled materials by the council. It was both strong and stretchy. The aim was to create the texture of knitting with a smooth surface and ease when removing the concrete from the mould material. The resulting surface is delicate and some breakage occurred when the plastic was removed but enough of the texture remains to give an idea of what could be possible.

Image 115. Method 6. Phase 4. Plastic carrier bag strips knitted sample

Nylon Garden Twine Knitted Sample

As an alternative to making yarn from plastics this sample has been made by knitting with a nylon twine, which was comfortable and effective to knit with. When pulled away from the concrete some of the surface was lost but enough remained to create a finish with lots of texture and patterns from the knit. The dome has been formed by the weight of the concrete fashioning this soft pillowy shape.

Image 116. Method 6. Phase 4. Nylon twine knitted sample

String and Black Sack Strips Woven Sample

This final sample was cast onto a surface made by weaving string and strips of plastic from a black rubbish sack. This was as an alternative to knitting. The mould frame worked well as a frame to weave. The concrete a trapped pieces of the material in it's surface but the general appearance of the weave can be seen, forming this new texture in the concrete.

Image 117. Method 6. Phase 4. String and black sack strips woven sample

Conclusion to Method 6 and Chapter 4

The shaping and controlling the concrete's surface by casting it onto materials with texture was the most rewarding element of the project. My belief is that this method works with the concrete's ability to flow and move into spaces, mirroring the mould materials surface composition. The designers skill must be to choose materials and methods of manipulation to encourage the concrete into pleasing and interesting forms.

Chapter 5
Analysis of Data

For this section of the project I have chosen 10 samples for discussion that I feel represent the different characteristics of the research as a whole. Using the criteria for analysis outlined in the introduction, (Chapter 1) interpretation and judgements are made about the surfaces formed and the processes used. With these in mind suggestions for further research and possible design outcomes will be put forward.

Ice Cube Samples

The ice cubes were both cast onto and pushed into the surface of the wet concrete (Methods 1 & 2). This almost serendipitous sample came about through thinking really broadly in respect to materials. The workshop was very cold at this time so I was confident the ice would not melt within minutes. This made the process of making the sample unproblematic. The ice was easy to cast onto and push into the concrete. Once the concrete had set the water remained as a puddle in the mouth that the ice had created.

This sample is interesting because the material used so dramatically changed state leaving a neat indent. The strength in this sample is in how it is formed, the process rather than the final surface holds the beauty. There is something significant in the disappearance of the mould material. A range of samples investigating how materials that change and disappear during the moulding process would be the next approach.

Image 118. Method 2. Ice cube sample

Salt Samples

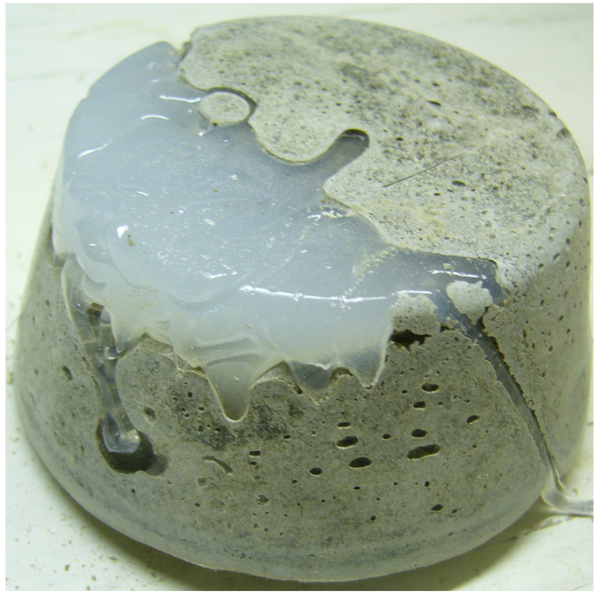
The salt was used both to cast onto and spread across the surface of the wet concrete (Methods 1 & 2). The resulting surfaces were rough and misshapen. They distorted over time forming a tortuous fragile surface that discoloured to a brown hue. Further research is needed to find out why this happened and if this corroding of the surface could be used creatively.

Image 119. Method 2. Salt sample

Glue Gun Samples

For these samples the wet glue was dribbled into the base of the moulds (Method 1). Some were clear glue and others had a yellow colour. Each one I tried to do differently; making dots, lines that ran up the sides and areas of heavy blobs. The glue was expressive and could be delicate, then solidifying very quickly. The wet concrete then filled the moulds.

All the samples had smooth neat surfaces were the concrete had encircled the glue creating a seamless surface. The glassy lines curl and ripple across the concrete implying both liquid and solid states. The spirit of the concrete to adapt and intwine is no more evident than in these samples. I can't see a reason why this method couldn't be tried on a large scale in possibly a very illustrative way. Testing would be needed but there may be suitable out door spaces as well as interiors. The scale could just as easily be taken right down to create distinctive jewelry pieces.



Images 120 and 121. Method 1.
Glue gun samples

Paper Tube Samples

I made a number of similar samples where tubes of paper were formed then pushed into the wet concrete surface. A range of papers were tested all with positive outcomes. The concrete held the paper firmly so it could be placed vertically without the paper slipping out. The implication being that interior walls could be decorated with these paper projections. On mass across a large surface, rhythmical patterns formed by colour and placement would express a lively display. Suitable spaces might be libraries, schools and colleges, using paper and text that hold meaning to those institutions. This kind of surface also reduces noise levels in large spaces. If cited outside the paper would slowly degrade, changing in shape and texture over time, eventually disappearing leaving tiny apertures where the paper once was. This now textured surface would then be inhabited by moss, lichen and insects.

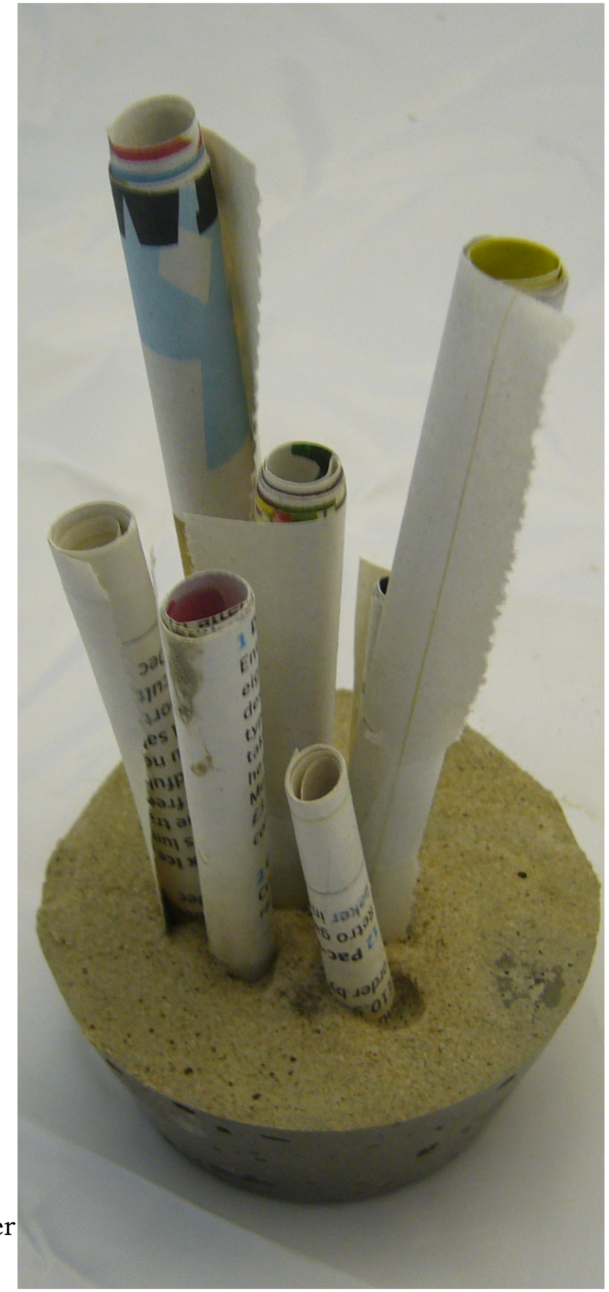


Image 122. Method 2. Newspaper narrow tube sample.

Edible and Degradable Samples

A whole variety of edible and degradable materials were tried with the concrete using Methods 1 and 2. There were mixed results as to whether the materials adhered to the concrete. My attitude towards the surfaces produced were confusing and uncomfortable. They appeared vulgar and neither the materials or the concrete were improved by their combination. With time and as some of the samples changed my feelings towards them altered. This was particularly so where the materials degraded and shrank away from the concretes surface. For example the orange peel samples turned moldy and diminished in size, which enabled me to remove them from the concrete. The remaining indents are delicately stippled with the dimpled surface of the peel. This tenderness of the concrete adds a poetic strength to the surface which surprised me.

Probably not attractive with the food stuffs stuck in the surface but there could be some practical reasons for having an edible surface to an exterior wall space. The blue tits in my garden frequently visit the exterior wall of my stone house to find food and materials they need. If the concrete was “pebble dashed” with seeds and bits of wool the birds would be attracted to it and supported by it. As the objects were removed, over time the concrete with its textured surface would facilitate small plants and insects to prosper. Encouraging the concrete surface to age and weather, blending into the environment.

Image 123. Method 2. Orange peel sample close up

Jersey and Chicken Wire Sample

This bold sample has been created by layering jersey fabric over chicken wire to produce a surface which runs counter to the commonly held belief that concrete is cold, urban and masculine. The forms of this piece communicate softness and warmth by the way the jersey has swelled through the wire structure. This and the other fabric formed surfaces stimulate an emotional connection with the viewer. There is a recognition and an identification with the concrete surface illustrated by this comment collected at Sunbury Embroidery Gallery in 2012.

“The textiles are wonderful, they seem to insist on being touched.”

This kind of sentiment has been repeated to me about the work, including an enquiry from Jon Wallsgrove, the Ministry of Justice, Department Architect. Who in conversation at the Surface Design Show 2012 expressed the view that the soft shapes in a robust material would be suitable for constructing environments in juvenile prison buildings.

The theme of “soft” durable surfaces would enhance a number of environments where heavy traffic and a high standard of cleanliness are needed. Centres of education; schools, colleges, museums and libraries and therapeutic centres for example hospitals, GP surgeries, psychiatric units and Maggie’s Cancer Care Centres.

Image 124. Method 6. Jersey and chicken wire sample close up

Woven and hand knitted samples

The final samples made during this research began to explore the possibilities of fashioning my own materials to cast onto. If the research were to continue this would be the direction to explore. The designer has ultimate control and freedom to create textures and reliefs that suit the nature of concrete and the designer. Searching out materials with different qualities and manipulating them to serve as moulds. This could allow the maker to generate more daring surfaces which crease, protrude and sweep. These surfaces could be really expressive, articulating a sense of place with intriguing tactile surfaces. They might be used in parks and places of adventure; writing retreats, story telling grottos and magical places with nooks and crannies.

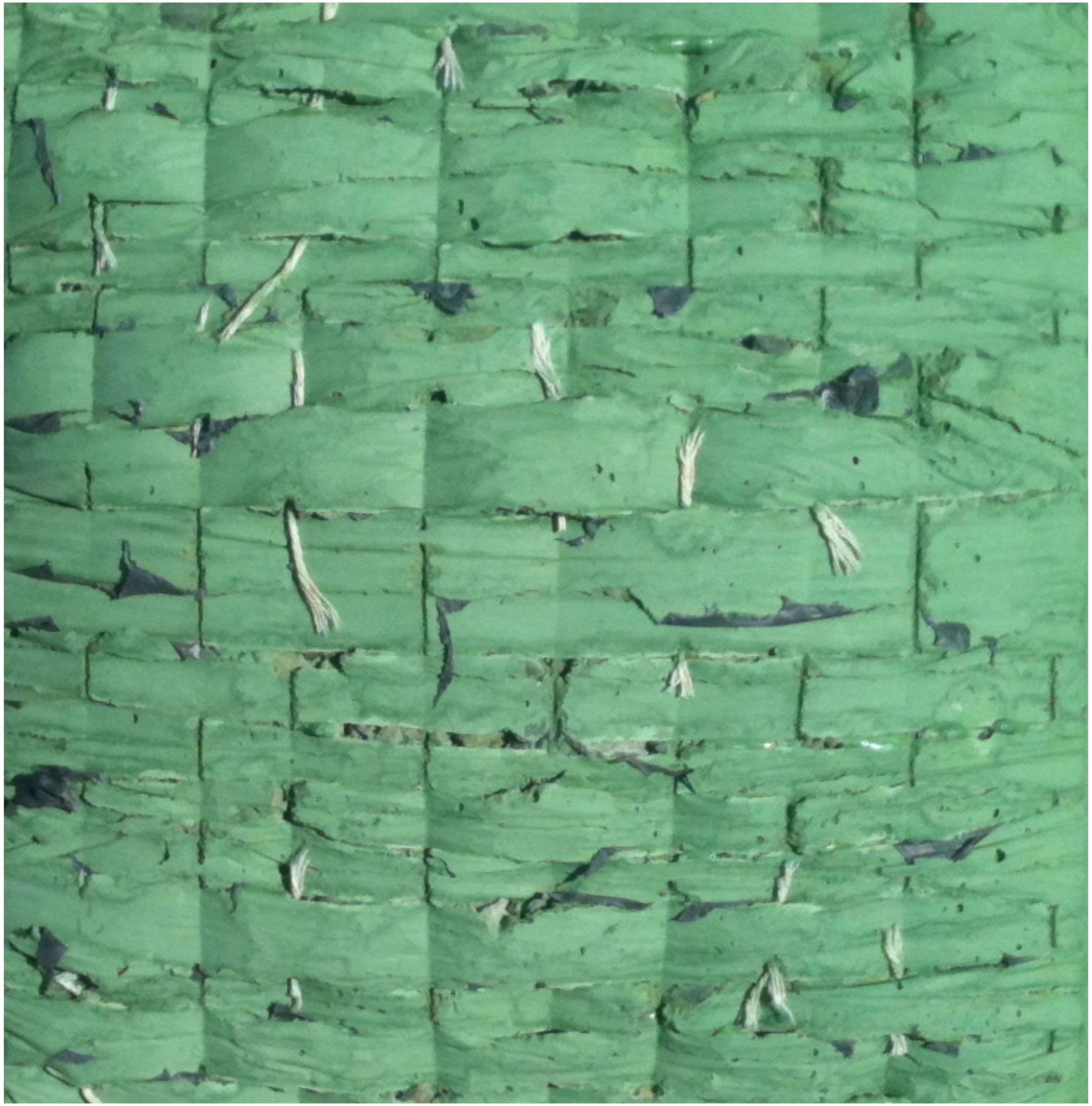


Image 125. Method 6. Phase 4. String and black sack strips woven sample close up

Chapter 6
Conclusion

In conclusion this Masters by Research has been about looking for new ways of using concrete as a surface design material. This has been achieved through Creative Practice where a series of experimental methods were used to explore the reaction of concrete when combined with a material. In the environment of a workshop space over 250 samples were made then analysed using a number of criteria from which value and meaning were extracted. Ways of working were spontaneous sometimes resulting in uncomfortable samples, but this also achieved many interesting results and an understanding of where the aesthetic boundaries are when using concrete as a design material.

One of the strengths of this project has been the development of a dialogue between myself and the materials used. This has enabled the surfaces to tell a story about the process and the materials used, that encourage viewers to engage with the concrete.

I was very lucky to meet and share my work with some of the experts who work with concrete in construction and design. To further develop this research it would be beneficial to collaborate in more meaningful ways. This would push and shape the experimental into functional surfaces.

On the design side I think the work would be stimulated by partnerships with knitting experts, textile designers and fabric manufactures (which are present locally in Huddersfield). With their knowledge of creating surface, combined with understanding yarn strength and the methods of their craft, development of bespoke fabrics could be created to use as mould surfaces.

The 6 methods of putting concrete and material together came about as the project unfurled and were experimental in themselves. They would benefit from being repeated and firming up. Including trying out different size and shape moulds made from a wider variety of materials. This might be interesting to do with undergraduate students as they would bring their own fresh ideas and understandings of the materials, expanding what has been found out during this project.

This research makes only a small contribution to what I believe is possible when using concrete as a design material. Potential research projects that could take this work into a PhD are

1. Research materials that shape the concrete's surface by starting off being

embedded within it then over time disappear. The questions would be, which materials would do this? What would be the effects of depth when the material is fed into the concrete? At what speed would the materials take to disappear and what would the resulting surface look like? Finally how would viewers perceive these changes?

2. Explore materials that distort the concrete's surface using the salt samples as a starting point. How does this effect life span, strength and durability? And are there places where a material that has a distorted changing surface would be suitable?
3. Take a deeper look at the materials that embed in the concrete's surface. Try a wider range of materials then test their permanence and soundness. This could be coupled with attempting large scale pieces where a lot of the surface is another material.
4. To work with textile manufactures and designers to create new materials to use as formwork. This could also include looking into casting concrete into shaped fabric sacks to form more sculptural pieces.
5. Research concrete mixes, testing the design potential of different cements, including self compacting cements and those that cure without dispersal under water. There is a whole range of admixtures with possible hidden design capability. Admixtures cover a wide range of substances that in small quantities change the characteristics of the concrete in it's fresh and/or hardened state. They have been developed to manipulate the concrete's properties to enable it's use in extremes of temperature, speeding up and slowing down of the setting period and the reduction of water use.

The next step with the work produced during this research is to encourage industry to examine the surfaces along with the techniques in order to develop a usable product. There are a number of ways this will be approached.

- Make finer more finished samples of uniform shape and size.
- These will then be used at trade shows (The Flooring Show, Harrogate. September 2013 and The Surface Design Show. February 2014) and visiting companies.
- Photograph samples and the work at trade shows to use in an online presence. For example through an online portfolio and Linkedin networking site.
- The images will also be developed into a series of photoshop visualizations to demonstrate the potential of the surfaces.
- Seek coverage in places that industry sources development ideas. Starting with current contacts, Elaine Toogood at the Concrete Centre and Victoria Redshaw at the trend forecasting company Scarlet Opus.
- Included with the images of samples and visualizations of the concrete surfaces provide supporting written work identifying what is unique about me as a designer.
- Once links have been formed with industry suggest collaborative projects where sharing of expertise and ideas will expand the unrealized parts of the research and create a product which is usable.

The work carried out during this research shows that the way I work as a designer with the concrete has created surfaces that are full of texture, colour and intrigue. This is the first step in it's development, with further exposure and collaboration with industry exquisite and engaging surfaces will be in production.

Bibliography

Alesina, I. & Lupton, E. (2010) *Exploring Materials. Creative design for everyday objects.* New York: Princeton Architectural Press

Anon, (1993) 'Concrete Bungle' *The Mail on Sunday* p.93 [online] Available at: <http://search.proquest.com.libaccess.hud.ac.uk/docview/734524327> [Accessed 11th September 2013]

Anon, (1973) 'Concrete Jungle to be garden estate' *The Guardian* p.8 [online] Available at: <http://search.proquest.com.libaccess.hud.ac.uk/docview/185724300> [Accessed 11th September 2013]

Anon, (2012) 'Concrete Reliefs Chosen For New Arts Venue' *Concrete Quarterly, 240* (Summer 2012) *p. 3* [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2011) 'Floating Fortress' *Concrete Quarterly, 237* (Autumn 2011) pp. 10-11 [online] Available from: <http://www.concretecentre.com/> [Accessed 22nd November 2011]

Anon, (2011) 'Hidden Depths. A new public square in Bristol takes its inspiration from the layered effects found in the site's geological history' *Concrete Quarterly, 235* (Spring 2011) p. 8 [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2012) 'Loughborough Prints Concrete' *Concrete Quarterly,* 240 (Summer 2012) p. 3 [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2011) 'Maurizio Anzeri's About Face' *Embroidery,* 62 (Sept/Oct 2011) p. 13

Anon, (2012) 'Pole to Pole' *Concrete Quarterly,* 240 (Summer 2012) p. 11 [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2011) 'Products' *International Design, Architecture and Culture*, 099, (September) pp. 98-107

Anon, (2011) 'Ripple Effect' *Architecture Today.* 223. (November) p. 109

Anon, (2012) 'Street Smart' *Concrete Quarterly, 240 (Summer 2012) p. 10* [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2012) 'The Rough With The Smooth' *Concrete Quarterly, 240* (Summer 2012) *p. 8* [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2012) 'Velvet-concrete tower wows EcoBuild exhibition' *Concrete Quarterly, 240 (Summer 2012) p. 2* [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Anon, (2011) 'Walter Jack Studio' *Architecture Today*. 223. (November) p. 113

Anon, (2011) 'Where there's muck there's class. Pudding Lane pumping mill' *Concrete Quarterly, 237* (Autumn 2011) pp.4-7 [online] Available from: <http://www.concretecentre.com/> [Accessed 22nd November 2011]

Anon, (2012) '4-Story Plant Pot' *Concrete Quarterly, 240 (Summer 2012) p. 9* [online] Available from: <http://www.concretecentre.com/> [Accessed 29th May 2012]

Banks, M. (2007) *Using Visual Data in Qualitative Research.* The Sage Qualitative Research Kit, London: Sage

BBC News: entertainment and arts. (2011) *£35m Hepworth Wakefield gallery opens doors.* [online] Available at:<http://www.bbc.co.uk/news/entertainment-arts-1344718> [Accessed 7th September 2011]

Bennet, D (2005) *The Art of Precast Concrete. Colour, Texture Expression.* Basel: Birkhäuser

Bizley, G. (2011) 'Classical Good Looks' *Concrete Quarterly, 237* (Autumn 2011) pp. 4-7 [online] Available from: <http://www.concretecentre.com/> [Accessed 22nd November 2011]

Braungart, M & McDonough, W. (2008) *Cradle to Cradle*. London: Vintage.

BRE Centre for Innovative Construction Materials (2012) *Second International Conference on Flexible Formwork*, University of Bath, 27 - 29th June 2012. Bath: BRE CICM, University of Bath.

Chandler, A. & Pedreschi, R. eds. (2007) *Fabric Formwork.* London: RIBA Publishing.

Cohen, J. (1993) 'Council to put cameras in estates; Scotland' *The Times* [online] Available at: <http://search.proquest.com.libaccess.hud.ac.uk/docview/318055769 > [Accessed 11th September 2013]

Cohen, J. L. & Moeller, G. M. (2006) *Liquid Stone. New Architecture in Concrete.* Basel: Birkhäuser

Collins, J. (2007) *Sculpture Today*. London: Phaidon

Collins, P. (1959) *Concrete. The Vision of a New Architecture.* London: Faber and Faber

Chudley, R. & Greeno, R. (2005) *Construction Technology*. 4th ed. Harlow: Pearson

Cragg, T. (2006) *In and Out of Material.* Manchester: Cornerhouse Publications

Crook, R. N. & Day, R. I. (2011) *Concrete Practice. Guidance on the practical aspects of concreting.* Camberley: The Concrete Society

Cross, N. (2011) *Design Thinking.* London: Bloomsbury

Cross, N. (2007) *Designerly Ways of Knowing.* Basel: Birkhauser. [online] Available at: <https://www-dawsonera-com.libaccess.hud.ac.uk> [Accessed 3rd September 2013]

Cross. N. ed (1984) *Developments in Design Methodology.* Chichester: John Wiley & Sons

De Maré, E. (1948) *New Ways of Building.* London: The Architectural Press

Dubstar74 (2013) ‘All boarded up walking to bus stop and library’ [photograph] *In: Thamesmead Southmere Housing Estate demolition, Clockwork Orange film location. 28DaysLater.co.uk - The UK Urban Exploitation Forums.* [online image] Available at : <http://www.28dayslater.co.uk/forums/other-sites/77426-thamesmead-southmere-housing-estate-demolitiom-clockwork-orange-film-location.html> [Accessed 11th September 2013]

Dubstar74 (2013) *Thamesmead Southmere Housing Estate demolition, Clockwork Orange film location* 10/01/2013 28DaysLater.co.uk - The UK Urban Exploitation Forums. Available at: <http://www.28dayslater.co.uk/forums/other-sites/77426-thamesmead-southmere-housing-estate-demolitiom-clockwork-orange-film-location.html> [Accessed 11th September 2013]

Emmison, M. & Smith, P. (2000) *Researching the Visual: Introducing Qualitative Methods.* London: Sage

Etherington, R. (2011) *Dezeen Magazine: Stitching Concrete.* [online] Available at: <http://www.dezeen.com/2011/08/09/stitching-concrete-by-florian-schmid/> [Accessed 23rd August 2011]

Flatman, B. (2010) *Shaping the City: Where books are incinerated, not kept'* [online] Available at: <http://www.benflatman.com/Stones%20of%20Menace/Stones%20of%20Menace.html> [Accessed 12th September 2013]

Foster, J. S. & Greeno, R. (2007) *Structure and Fabric.* Mitchell’s Building Series, Part 1, 7th ed. Harlow: Pearson.

Frearson, A. (2012) *Dezeen Magazine: Church of Seed by O Studio Architects* [online] Available at: <http://www.dezeen.com/2012/02/08/church-of-seed-by-o-studio-architects/> [Accessed 11th September 2013]

Frearson, A. (2012) *Dezeen Magazine: Church in La Laguna by Menis Arquitectos* [online] Available at <http://www.dezeen.com/2012/03/20/church-in-la-laguna-by-menis-arquitectos/> [Accessed 11th September 2013]

Freedman, C. ‘Soft Concrete’ *Elle Decoration.* 227. (July) pp. 104-113

Garbers, T. and Haarmaan, L (2012) ‘Kisho’s Gift’ [photograph] *In: Concrete Quarterly. Summer 2012* p.5

Ghaib, M. A. A. & Górski, J. (2001) *Mechanical properties of concrete cast in fabric formworks.* Academic Paper. Technical University of Gdansk

Gray, C. & Malins, J. (2004) *Visualizing Research. A guide to the research process in art and design.* Farnham: Ashgate Publishing.

Halbe, R. (2011) ‘A Natural Bond’ *Surface*, 89, (August) pp. 42-43

Harwood, E. (2003) *England: a guide to post war listed buildings* 2nd ed. London: Batsford

Hatherley, O. (2011) *BDP, Placebook: Preston Bus Station* [online] Available at: <http://placebook.bdp.com/1960s/preston-bus-station> [Accessed 11th September 2013]

Hauer, E. (2004) *Continua: architectural screens and walls.* New York: Princeton Architectural

Hayward Gallery (2010) *Ernesto Neto. The Edges of the World* [Exhibition Catalogue] London: Hayward Gallery.

Heinle, E. and Bächer, M. (1971) *Building in Visual Concrete.* London: Technical Press.

How They Work. Episode 3. (2012) *Ceramics, How They Work.* London: BBC4, April 16, [streaming media].

Igoe, E. (2010) *The tacit-turn: textile design in design research.* Academic Paper. Available at: <http://eprints.port.ac.uk> [Accessed 21st June 2012]

Jeska, S. (2008) *Transparent Plastics: design and technology* Basel, London: Birkhäuser

Jow, T. (2011) 'Ideas in design' *Surface*, 88, (June) p 24

Lawson, B. (1997) *How Designers Think* 3rd. ed. Oxford: Architectural

Manelius, A-M. (2010) *Concretely: My Blog on concrete love, concrete and architecture and specifically fabric forming, textiles used as formwork for casting concrete.* Available at: <http://concretely.blogspot.co.uk/2010/03/ambiguous-chairs.html> [Accessed 17th October 2011]

Manelius, A-M. (2011) 'The Ambiguous Chair' [photograph] *In: Fabric formed concrete chair in print. Concretely, Blogspot* [online image] Available at: <http://concretely.blogspot.co.uk/2011/07/fabric-formed-concrete-chair-in-print.html> [Accessed 12th September 2013]

Meyhöfer, D. (2008) *Concrete Creations, Contemporary Buildings and Interiors.* Berlin: Braun.

McIntosh, P. (2010) *Action Research and Reflective Practice.* Routledge: Oxon.

McKernan, J. (1996) *Curriculum Action Research.* 2nd ed. London: Kogan Page.

Newell, L. B. (2007) *Out of the Ordinary: Spectacular Craft.* London: V&A

Ojeda, O. R. & Pasnik, M. (2003) *Materials. Architecture in Detail.* Massachusetts: Rockport Publishers

Patel, R. (2011) 'Forma Fantasma' *International Design, Architecture and Culture*, 099, (September) pp. 36-38

Patel, R. (2011) 'Little Joys' *International Design, Architecture and Culture.* 098 (August) pp. 68-74

Richardson, J. G. (2002) *A Practical Look at Concrete.* Crowthorne: The Concrete Society

Sage, A. (2010) 'Estate families kept in concrete prison by historic status bid: France' *The Times* p.30 [online] Available at: <http://search.proquest.com.libaccess.hud.ac.uk/docview/320408077> [Accessed 11th September 2013]

Sauer, C. (2010) *Made of...* Berlin: Gestalen

Schmidt, P. & Stattman, N. (2009) *Unfolded: paper in design, art, architecture and industry.* Basel: Birkhäuser

Schön, D, A. (1991) T*he Reflective Practitioner: How Professionals Think in Action.* Aldershot: Ashgate

Stacey, M. (2011) *Concrete a studio design Guide*. London: RIBA Publishing

Studio Rolf. (no date) *Rolf. fr.* [online] Available at: <http://rolf.fr/> [Accessed 7th September 2011]

Tactility Factory (2012) 'Velvet Concrete: Crocus Flowering in April' [photograph] *In: Tactility Factory - Textiles and Concrete for Architecture. AAJ Press* [online image] Available at: <http://

aajpress.wordpress.com/2013/02/13/tactility-factory-textiles-and-concrete-for-architecture/> [Accessed 11th September 2013]

Tactility Factory. (no date) *Making Hard Surfaces Soft.* [online] Available at: <http://www.tactilityfactory.com/> [Accessed 7th September 2011]

Taraska, J. (2010) 'Material Goods' *Surface*, 83, (July/August) p 34

Tellier-Loumagne, F. & Black, S. (2005) *The art of knitting: inspirational stitches, textures and surfaces.* London: Thames & Hudson.

The Concrete Centre (2011) *Specifying Visual Concrete.* Southbank Centre, 19th October 2011. London: The Concrete Centre

Walter Jack Studio & Burt, S. (2012) 'Crushed Wall' [photograph] *In: Walter Jack: Crushed Wall. Concrete Installation, Heartlands, Cornwall. AAJ Press* [online image] Available at: <http://aajpress.wordpress.com/2012/03/28/walter-jack-crushed-wall-concrete-installation-heartlands-cornwall/> [Accessed 12th September 2013]

Wen, J. (2012) 'Church of Seed'[photograph] *In: Church of Seed by O Studio Architects. Dezeen Magazine.* [online image] Available at: <http://www.dezeen.com/2012/02/08/church-of-seed-by-o-studio-architects/> [Accessed 11th September 2013]

Weston, R. (2003) *Materials, Form and Architecture.* London: Laurance King Publishing.

Whitehead, T. (2012) 'Kisho's Gift' *Concrete Quarterly,* 240, (Summer 2012) pp. 4-7 [online] Available from: http://www.concretecentre.com/ [Accessed 29 May 2012]

Woods, B. (2011) 'Landquart' *Architecture Today,* 218, (May 2011) pp. 22 - 23