

Construction

Feb 2022

# Improving the Environment

Using advanced materials

## A Global Company





**Construction**

Welcome to  
Versarien

Mission ▶

To solve some of the world's biggest problems using the widest portfolio of 2d materials inc graphene

Improved  
Recyclability

Longer Life

Reduction of  
Fossil-Based  
Plastics

Reduced  
Maintenance

Lightweighting

Reduced Raw  
Materials  
(cement, metals...)

Enable  
Bio-Based  
Products



# Construction

## Welcome to Longhope

Graphene

Longhope  
Production

3D Printing

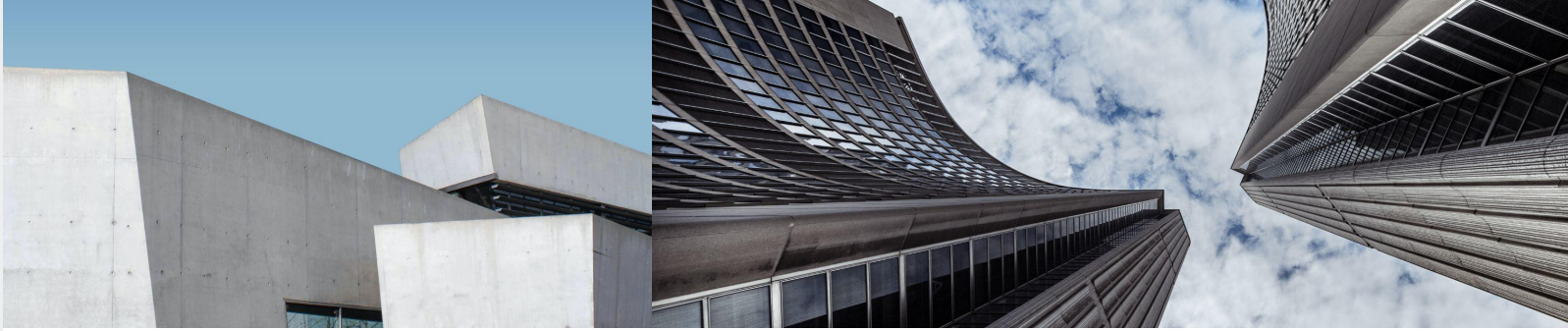
Graphene  
Enhanced  
Concrete

Brought forward plans for 10,000 sqft Innovation Centre that features a demonstrator floor using graphene enhanced concrete with graphene enhanced polypropylene fibres eliminating the need for steel rebar.

Plus presenting our 3DP Capability for this novel technology and novel material

**Low Carbon, Low Cost,  
High Performance**





Mission ▶ **To reduce CO2 used in construction.**

### Size of market

**24.7m tons**  
of Ready Mixed Concrete  
used in the UK\*

**250,000**  
miles of roads\*\*

\*<https://www.statista.com/statistics/476772/ready-mixed-concrete-product-on-in-the-united-kingdom-uk/>

\*\*<https://www.gov.uk/government/statistics/road-lengths-in-great-britain-2020/road-lengths-in-great-britain-2020>

### Problem being solved

Significant reduction in the amount of CO2 as a result of reducing the amount of cement used in Ready Mix whilst maintaining the strength, reduction in drying and curing time, reduction or elimination of Steel.

### Solution being proposed

Graphene reinforced concrete, graphene enhanced polymer fibres, and recycled materials.



Construction

GSCALE

Innovate UK

**G SCALE**

**G**

GRAPHENE

Scale up of 2  
patented  
graphene  
processes

**S**

SEAT

Aerospace  
Lightweighting  
Carbon Fibre

**C**

CONCRETE

Construction  
Reduce CO2

**A**

ARCH

Reinforced  
Thermoplastic  
polymers  
3D printing

**L**

LEISURE

Sport wear  
Thermal  
performance  
Moisture  
wicking

**E**

ELASTOMER

Reinforced  
elastomers  
Increased  
performance

**GSCALE - 18 months  
completed**

**Successes in the  
research & development  
continue**

**Developing real life  
products and  
technologies**

**Product development  
has led to commercial  
opportunities**



# Construction

Example Sectors

Rail, Road, Water

Tunnel Lining

3DP Permanent Formwork

Enhancing AACM

Water Industries

Slipform Road/Runways

Wind Turbine Bases

Modern Construction

Building House Raft

Very Light Rail (VLR) Structures



**Construction**

Progress

## Achievements



Completed Residential,  
Industrial and Retail  
applications

Graphene conventional  
slab and suspended slab

Casting 1000t of  
concrete using HP  
Nano- platelets

Recruited 3DP design /  
technical support

## Next Steps



Commissioning and  
installation of 3D  
Printer

Pouring the Innovation  
Centre fibre reinforced  
concrete slab

Demonstration  
living lab

Negotiations with supply  
chain partners

Opportunities with other concrete providers





Construction

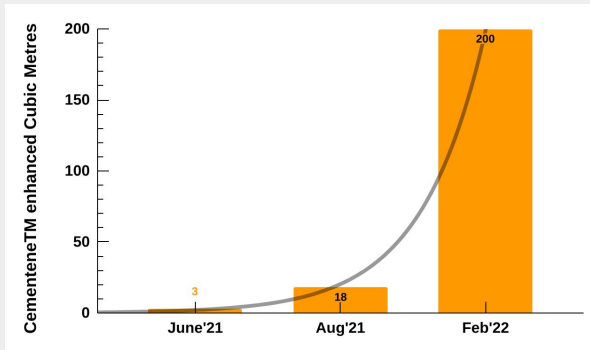
Cementene™  
&  
Polygrene™

## What is Cementene™?

Cementene™ is a range of products that are and will be developed.

This includes  
Admixtures for:

- 3D Mortar
- OPC based floor slabs
- AACM enhancers
- Concrete Foams
- Flooring Screeds etc



## What is Polygrene™?

Polygrene™ is a range of products that are and will be developed.

This includes:

- Masterbatches to enhance polymer performance and augment recycled polymer properties





**Construction**

**Cementene™**

**Why? To reduce the amount of cement, concrete & carbon in construction**

**Problem being solved**

Reduce reliance on high CO2 cements

**Problem being solved**

Slow strength gain and poor porosity in alkali activated cementitious materials

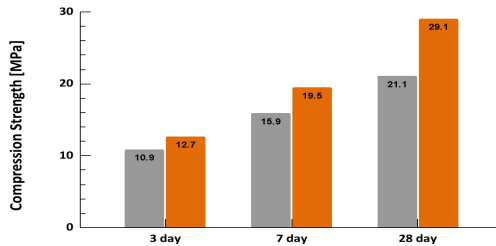
**Solution being proposed**

Graphene enhanced concrete and construction composites

# CEM I Results Cementene

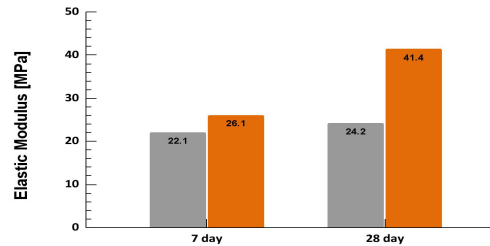
## COMPRESSION STRENGTH

+38% improvement at 28 days



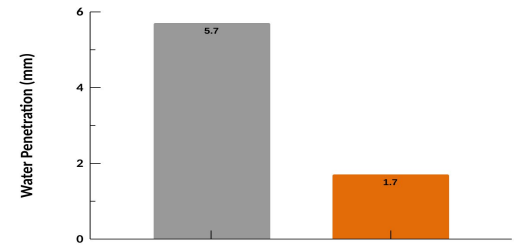
## ELASTIC MODULUS

+71% improvement at 28 days



## WATER PERMEABILITY

70% reduction in water penetration depth





**Construction**

Polygrene™

## **Why? To reduce the amount of fossil fuel based plastics used**

### **Problem being solved**

Graphene can lead the way towards polymer recycling and a circular economy.

### **Problem being solved**

Reduction in the use and improvement in the recyclability of plastics (including in the construction industry)

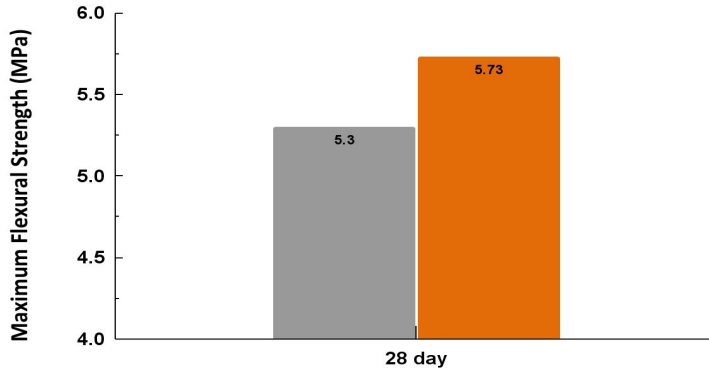
### **Solution being proposed**

Graphene enhanced plastics and graphene reinforced bio based plastics

### Reinforced CEM I Results

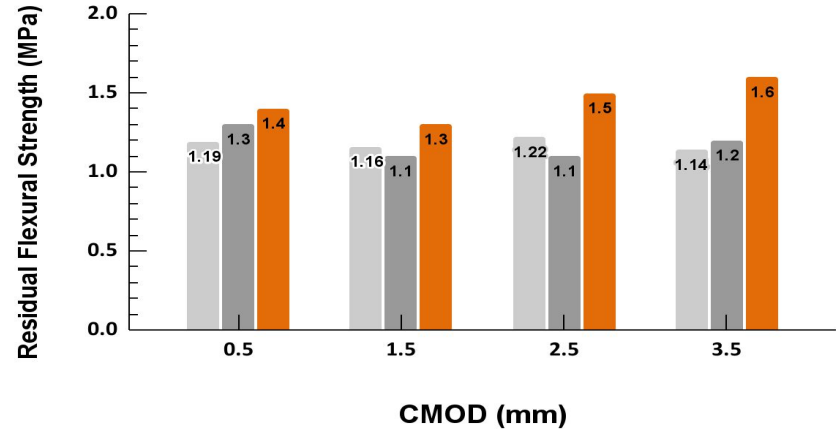


#### Limit Of Proportionality (LOP) (with crack induced test piece)



#### Crack Mouth Opening Displacement (CMOD)

Polygrene™ PP macrofibres outperforms by +30% industry standard PP macrofibre reinforced concretes at the same dosage





Construction

Cementene™

&

Polygrene™



Cementene



Polygrene

## Benefits of Cementene™

Greater Performance

Reduced CO<sub>2</sub>

Reduced Cost (thinner slab, less cover etc)

Reduced Site Costs (less time to build, additional early strength)

Longer Asset Life (low permeability/porosity leading to longer predicted life)

Highly workable concrete

## Benefits of Polygrene™ PP macrofibres

Greater Performance

Reduced CO<sub>2</sub>

Reduced Cost (remove steel reinforcement)

Reduced Site Costs (less time to build prepare)

Increased flexural strengths (lighter structures)



Construction

Longhope  
Case Study

## The 'REAL' Benefits of Cementene™ & Polygrene™ PP fibres

### Cementene™ Admixture offers;

>10% concrete saving

>10% 'cart away' saving

>10% less reinforcement

?? Quicker delivery / site setup saving

??? kg CO2 saved

### Polygrene™ PP chopped macrofibres offers;

??? kg steel reinforcement saved

?? hrs less steel preparation time saved (Quicker delivery)

??? kg CO2 saved

When complete the Case Study will quantify  
real and justifiable savings in areas such as...



**Construction**

Low Carbon  
Performance

## Construction Industry Challenges

The construction looks to maximise....

Low Carbon

Low Cost

High  
Performance

This can be achieved with Versarien's....



**Cementene**

Cementene™ Admixture



**Polygrene**

Polygrene™ PP macrofibres





**Thank you**

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