RoadCem the safest piling mat technology, high tensile strength and breaking strain with excellent dynamic absorption

When RoadCem is added to cement, it rapidly increases the reactivity of the cement creating a high energetic value, which during hydration results in extensive Crystallisation, filling all voids and forming a dense, flexural mass.

RoadCem a mixture of noble-metals (e.g. Aluminium), non-noble metals (e.g. Magnesium) and synthetic Zeolites which combine to give a synergetic reaction to the formation of stable crystalline structures. These bond together and are homogeneously distributed throughout the stabilisation, with cement alone a weaker more open structure will occur.

The resulting mechanical properties of RoadCem soil concrete stabilisation are therefore far more predictable and measurable. This is especially true for mixed materials and made ground, where organics or sulphates can be present. Using multi-linear elastic modelling our design engineers Rodgers Leask can calculate final strength and loading capacity with confidence. Allowing the thickness of RoadCem stabilised piling mats to be safely reduced, saving cost and construction time.

RoadCem soil concrete stabilisation has a high bearing and impact strength providing a safe working platform for heavy plant, with low shear and wider distribution of forces towards the sub soils.

- Impervious to the elements; so no stone surface needed, which simplifies reinstatement.
- Full warrantee and certification available, allowing mat thickness and size reduction opportunities.
- A RoadCem mat can be created from any existing soil or site material, with nothing but binder imported to site.

Case Study of the prize winning Severn Trent site Clay Mills RoadCem piling mat.

Constructed to form the base for a £42 million upgrade to the sewer treatment works included an Activated Sludge Plant.

A total of 1381 pre cast driven piles to depths of 9m were required and a 6,000 m2 RoadCem stabilised soil platform was designed by Rodgers Leask Consulting Engineers of Derby

Plant	Track Length (m)	Track Width (m)	Max. Bearing Pressure (kPa)	Max. Operating Weight of Plant (tonnes)
Roger Bullivant 5000 series quiet hammer rig	2.83	0.7	113	38.50

The ground conditions comprised of made ground of soft slightly sandy silty clay to a depth of 2m, overlaying soft to firm clays.

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Roger Bullivant 5000 series quiet hammer rig	2.83	0.7	113	38.50

Using the proposed rig loadings the required platform thickness under BRE 470 would have been a minimum of 650mm. Requiring the removal of around 7,000 tonnes of material to landfill and replacement with stone.

This was deemed unsatisfactory with regards to the impact on site access, with so many lorry movements. This combined with anticipated costs provided the client with sufficient incentive to a more innovative methodology.

Soil samples were taken to the PowerCem laboratory in Holland and testing undertaken at 3, 7 and 28 days using cylindrical shape moulds. In addition flexural testing was undertaken on beam specimens.

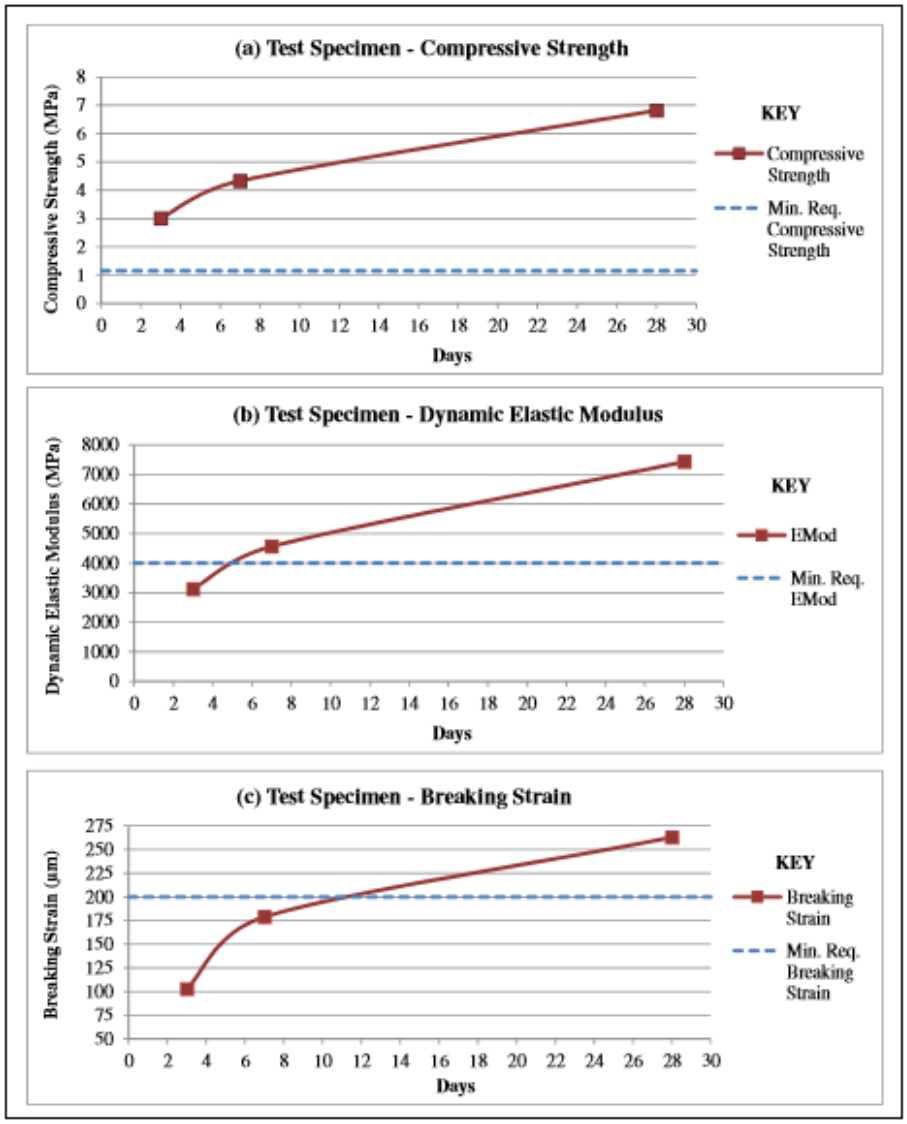


Figure 3.2 **RoadCem Insitu Soil Trials – 1.8/180m³ kg/m³ (RC_m/cement) (a) UCS, (b) EMod, (c) Breaking Strain**

As can be seen the UCS of samples were within the required 3-7 Mpa range indicating that the required strength was easily exceeded after only 3 days.

At fourteen it can be seen that the UCS will be in the region of 5Mpa and Emod in the region of 5500 Mpa and the maximum strain would not be exceeded with a platform depth of just 250mm.

This delivered a reduction of 400mm compared to the original design based on BRE 650mm of unbound granular material.

Providing the following benefits:

- Saving of £70,000
- Three weeks construction time
- 2,000 lorry movements
- Even after piling the mat was intact and without cracks, which allowed the piled structure to be used as the base blinding course for the concrete slab.

With safe access and easy set up, the piling operation was deflection free and predictable.

Allowing completion in less than half the scheduled time.

The unique visco elastic properties of the RoadCem soil mat, prevented cracking and reduced breakaway around the piles.
The increased dynamic absorption also reduced bounce, aiding pile alignment.

On a visit to the site during piling I was asked to take a photo of these piles stored on the edge of the mat, on just a 2 inch wooden strips.
The H&S officer from Bullivant's was amazed that despite the heavy weight of the stacked piles the mat was unmarked.

Conclusions:

Whilst the benefits of replacing the planned unbound granular piling mat at Clay Mills with a cement bound mat using the existing site weak materials are very clear.

It is the environmental and proven sustainability of stabilised soil working platforms that is the clear winner here and this application should be adopted more frequently within the UK construction industry.

Material testing has demonstrated that the addition of RoadCem to cement for soil stabilisation does improve the performance, by increasing compressive strength, stiffness and the breaking strain of bound materials.

By introduction of the stress-strain method, it has also been demonstrated that the key performance criteria for working platforms is the increased breaking strain of the stabilised material rather than the UCS used in many other applications.

A traditional cement soil stabilisation without RoadCem however will always behave as a rigid material.
Rigid materials will normally break at a strain of 50-125 micro meter, resulting in a steep decrease in Elastic modulus, when this breaking strain is reached.

The RoadCem mat showed surprisingly high visco-elasticity properties, simplifying and reducing the scheduled piling programme by half.

The Perfect Mat for Driven, Auger or Sheet Piling

Because we install in-situ, without the need to remove organic or weak top soils, RoadCem stabilised soil mats are installed at ground level with reduced risk of shear and abutted support by the existing ground, they are safe for heavy plant to mount dismount and/or run on.

Providing deflection free piling, with minimum bounce and high dynamic absorption.

One of the unique properties of RoadCem soil concrete working platforms, is workability. The Zeolite Nano structure allows easy piling, cutting and drilling without the monolith structure losing any integrity.

The worked platforms also retain all weather impermeability, against frost, flooding and heat. Allowing installation and working in all but the worst of weathers.

Perhaps working as close to edge of a RoadCem mat, as in the top left photo looks a little risky. But testing showed a safe margin.

Research set-up into the Visco-Elastic Behaviour of RoadCem

For the tests which were carried out at Delft University a single size sand (1780/m3) was used (fractions 0.5/1mm) in addition to 0.09% m/m of RoadCem material in relation to sand, as well as 9.14% m/m OPC (CEM 1 42.5 N).

The OMC (optimum moisture content) at MPD (maximum proctor density) was 11% m/m.

The reference mixture was composed with 9,14 m/m OPC (CEM 1 42.5N) under equal conditions prepared without any RoadCem added.

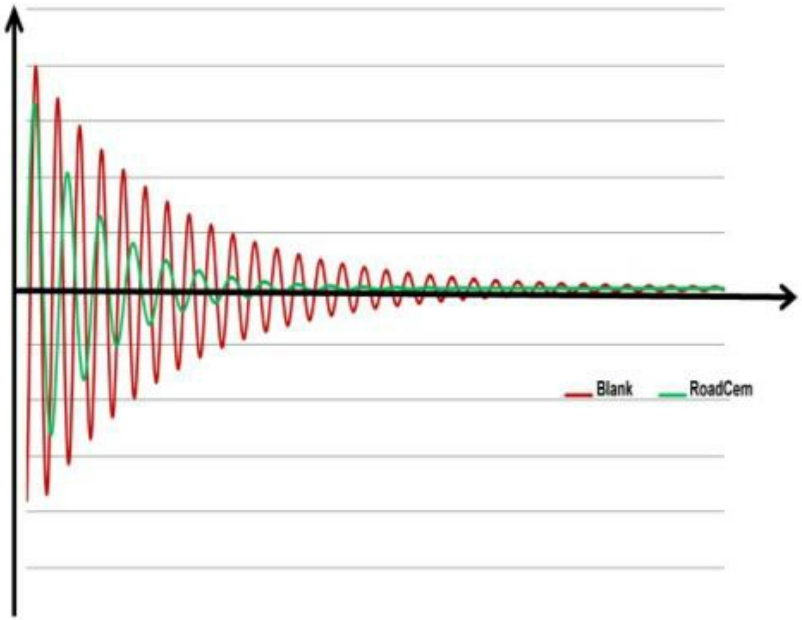
The visco-elastic and ductility properties of RoadCem were found by conducting dynamic tests.

Dynamic Testing

These dynamic tests are carried out using non-destructive ultra-waves in order to determine the dynamic- elastic modulus. By means of destructive four-point bending tests in which repetitive loads at a fixed frequency are applied, a superior fatigue performance is confirmed.

By observing the longitudinal displacement mode after excitation, the dynamic modulus is obtained, as well as the dampening characteristics, which relate to the visco-elastic properties of the material being tested.

It is very clear that the pattern for cement treated stabilisation with added RoadCem (shown green) is showing a restrained vibration compared to the cement alone stabilised material (shown as red).



The above figure shows that vibration absorption with RoadCem shows a higher restrain and will be more resistant to impacts and foundation loadings