



MPA Cement

Sustainable Development Report 2014

built-in sustainability with cement



Front cover: Burntwood School in south London won the coveted RIBA Sterling Prize 2015 for the UK's best new building. The school has been transformed with exposed in-situ concrete interiors and faceted precast concrete cladding panels to create a series of attractive learning spaces. Photo: Rob Parrish

Back cover: A typical family home requires four tonnes of cement, used all the way from its foundations to its floors and in the mortar that bonds its bricks. Photo: David Hatfull

Foreword

Last year, I was able to report that the UK cement industry stood ready to play an active role in the nation's economic recovery as it supplied its essential products to deliver on the Government's ambitious infrastructure and housing renewal programmes. I also commented on the significant, externally imposed barriers that prevented us from maximising our economic competitiveness potential. This year, I can report that the early signs of growth that we saw last year have been consolidated. The UK construction industry is on the road to recovery, and UK cement manufacturers are working alongside their clients to supply locally, responsibly-sourced, building materials for the many projects that are reviving local communities up and down the country and providing much needed jobs.

Unfortunately, I cannot report positive progress on all fronts. Our efforts to secure compensation against unfair carbon costs, imposed by our own Government and the EU, have been stuck in the quagmire of bureaucracy, both here in the UK and in Brussels. We are not calling for lesser carbon reduction targets or for special treatment – far from it. We were the first national cement sector in the world to produce its own 2050 carbon reduction roadmap in 2013, which was followed in 2014 with a collaborative industry/Government roadmap outlining

ambitious decarbonisation pathways. But we are up for that challenge and are already talking to the Department of Business, Innovation and Skills and the Department for Energy and Climate Change about how we can work together to turn our joint vision into a reality. All we ask in return is for a level playing field with our EU and global cement competitors and other competing building materials. We will not rest on this business-critical issue until fairness is delivered.

The May 2015 General Election is now behind us and a new Government in place with a fresh mandate to continue its infrastructure and housing development programmes. Locally produced cement is expected to be in high demand. But as I have said on previous occasions, cement must be produced as sustainably as possible. MPA Cement is now increasing its value to society by maximising the opportunities that will flow from a more circular economy. By using resources more efficiently in the production of cement, utilising wastes from other industries and extracting the best life cycle value from the finished product – concrete – we can break the link between economic growth and resource requirements. This is not new to the cement industry; we have been net consumers of waste for many years by using other industries' wastes and by-products. Minimising our call on virgin raw materials and fuels is now deeply ingrained in the UK cement



industry – but we can and will go further. I am pleased to announce that MPA Cement will publish its first Resource Efficiency Roadmap in 2016, setting out the industry's ambitions and our contribution to a circular economy.

The year 2015 has been another year of change for the UK cement industry. We welcome a new domestic cement producer to our membership: Aggregate Industries will operate the plants at Cauldon, Staffordshire and Cookstown, Northern Ireland under the ownership of Lafarge Holcim. At the same time, Lafarge Tarmac is now known simply as Tarmac and is part of the CRH Group. I wish both companies well as they establish their new brands. The two new companies will take their places alongside the other three domestic Portland cement manufacturers: CEMEX UK, Hanson Cement and Hope Construction Materials, as the industry moves forward to a more sustainable future.

Pal Chana
Executive Director

Cement in the circular economy

The European Commission plans to introduce a series of measures to promote a more circular European economy. It believes that, since the Industrial Revolution, waste has constantly grown. This is because developed economies have used a “take-make-consume and dispose” pattern of growth – a linear model which assumes that resources are abundant, available and cheap to dispose of.

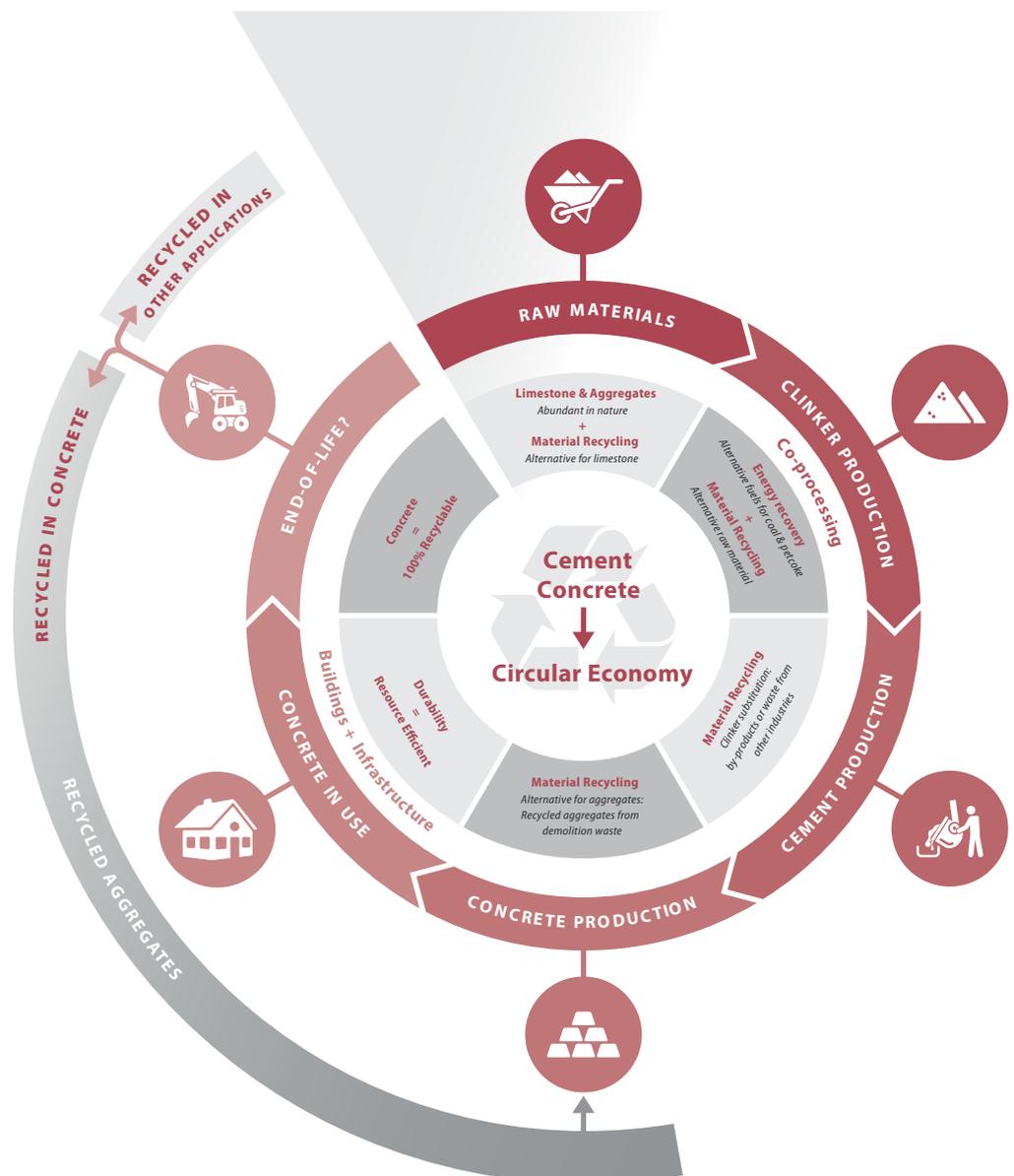
What they believe is now needed is a more circular economy. This means re-using, repairing, refurbishing and recycling existing materials and products. What used to be regarded as ‘waste’ can be turned into a

resource. The aim is to look beyond waste and to close the loop of the circular economy so that all resources are managed more efficiently throughout their life cycles.

As the literal foundation to our built environment, cement and concrete underpins our broader economy. Our homes, schools, shops, offices and much more all depend on cement and concrete. As our economy recovers from one of the longest and deepest recessions in recent history, cement and concrete will be in demand to rebuild and renew the country’s ageing infrastructure and provide the thousands of

new homes that are so desperately needed. But cement has to be made from raw materials and fuels which, in many cases, are not renewable. That does not mean that cement and concrete cannot be ‘sustainable’. By viewing these essential building materials from a circular economy point of view, it is easy to see how they can contribute to a more sustainable built environment and economy which has positive environmental and economic paybacks over its life cycle.

The diagram below shows how this works in practice.



Graphic courtesy CEMBUREAU

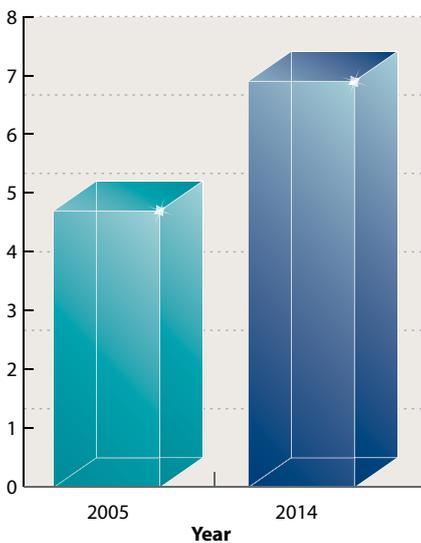
Cement in the circular economy

From the extraction of raw materials to make cement to the re-use or recycling of concrete at the end of its life, the cement industry has been living the circular economy for many years now.

Let's work our way around the virtual circle that is cement and concrete production, use and end of life.

RAW MATERIALS

To make cement, you need raw materials. In the UK, this is generally limestone or chalk and clay. These materials tend to be quarried close to production facilities to minimise transport, but the industry does not only use virgin raw materials. Over the past ten years, the amount of raw materials derived from waste and by-products from other industries has steadily increased. The chart below illustrates this.



In simple terms, this means we now make the same amount of cement for less virgin raw materials than we did ten years ago. In 2014, the industry left over 11.5 million tonnes of raw material in the ground through this replacement.

CEMENT CLINKER

Cement clinker is the principal intermediate ingredient of the grey powder we know as cement. Clinker manufacture is an energy-intensive process; so minimising the amount of energy that goes into making it is not only good for the environment but also makes business sense.

To make cement clinker we take the raw materials, crush them to a fine powder, heat them to volcanic temperatures at which a chemical change takes place. Cool the molten rock down again and, hey presto, you have cement clinker! Easy, isn't it? Not quite. The illustration below sets out the clinker making process.

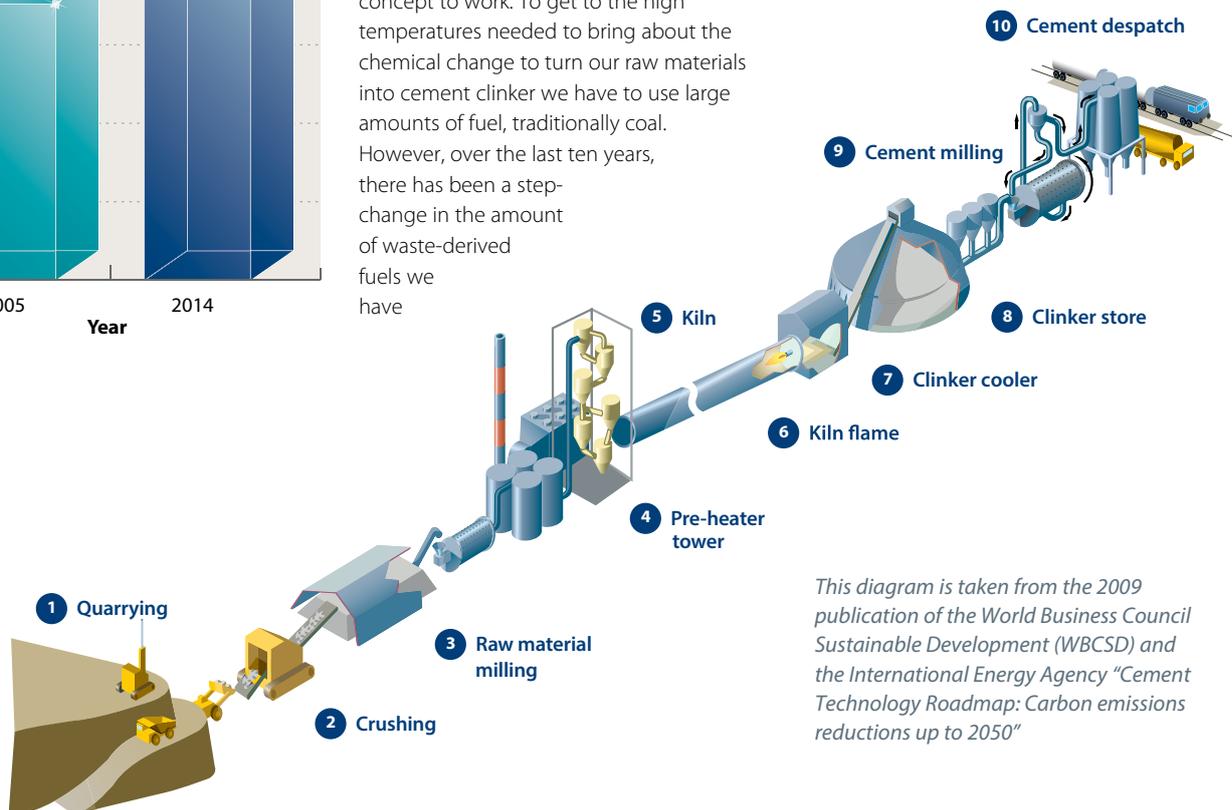
It is at this stage that the cement manufacturers can really step up the game in terms of putting the circular economy concept to work. To get to the high temperatures needed to bring about the chemical change to turn our raw materials into cement clinker we have to use large amounts of fuel, traditionally coal. However, over the last ten years, there has been a step-change in the amount of waste-derived fuels we have

been substituting for virgin fossil fuels to the extent that, on average, waste derived fuels now account for 44% of all kiln fuels.

Taken together, the amount of waste-derived fuels and raw materials used in the cement-making process now significantly outweighs the amount of waste the industry itself produces. In 2014, the industry used over 1.6 million tonnes of waste and by-products from other industries without producing any kiln dust process waste for disposal to landfill.

CONCRETE PRODUCTION

It is a common mistake to confuse cement and concrete. Cement is the grey powder that is mixed with water and aggregates to produce concrete. In other words, cement is the glue that bonds stones together. The concrete industry is looking to maximise the amount of waste-derived or recycled materials it can use in place of virgin aggregates. Demolition waste is an important source of recycled aggregates at this stage. Approximately one third of all aggregate used in the UK is recycled or secondary aggregate (three times the European average).



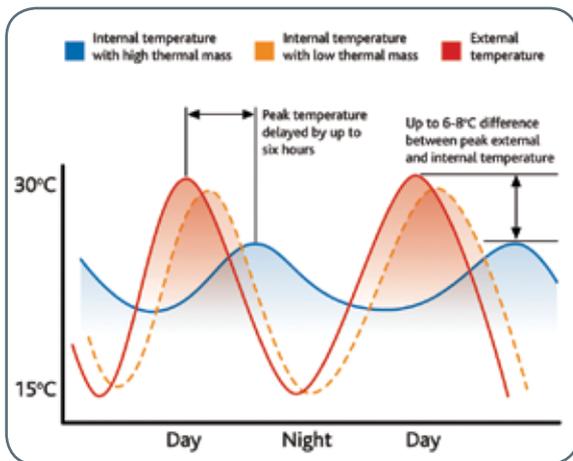
This diagram is taken from the 2009 publication of the World Business Council Sustainable Development (WBCSD) and the International Energy Agency "Cement Technology Roadmap: Carbon emissions reductions up to 2050"

Cement in the circular economy

CONCRETE IN USE

There's no getting away from it: cement production is energy-intensive. Does that make all construction bad? Definitely not! It all depends on how the buildings are used and perform over their life cycle. Think of it like buying a washing machine. You don't

examine in detail what it took to make each of its components; you are far more likely to want to know how the machine will perform over its life. Buildings are similar: they are made up of many components but we are more interested in how they will perform when we live or work in them. And that's where concrete has a big advantage – thermal mass.



We have all experienced erratic internal building temperatures. Sometimes it's too hot and sometimes too cold. Normal behaviour has us turn the heating or air conditioning up or down. But what if a building could be kept at a pretty constant temperature without the need for excessive artificial heating or cooling? That is what the thermal mass properties in concrete

can do. By absorbing excessive heat and releasing it back when temperatures drop, concrete naturally regulates internal room temperatures.

Not only does this make for a more comfortable living space, it also saves on energy bills and energy itself, which is good for the planet.

END OF LIFE

When buildings and other concrete structures come to the end of their useful life, there doesn't need to be any waste. Concrete can either be recycled into new concrete or recycled for use as other aggregates. And here's the little known part: when crushed, concrete reabsorbs 20% of the CO₂ it originally took to make it. Win, Win!

So now we have closed the loop in the life of cement and concrete. A vital material for our everyday lives but a great example of the circular economy in action.



CASE STUDY

Concrete storing energy



Photo: Black Architecture

The Catholic Overseas Development Agency's new HQ in Southwark, south London has been designed to "tread lightly on the earth". The brief to Black Architecture was to create a simple outward building that would face up to climate change. The building features internal concrete slab soffits which are exposed to provide thermal mass heating and cooling. The concrete's thermal mass stores energy from a ground source system at night to offset the heating or cooling loads the next day. The building has scored an "excellent" rating from BREEAM, the world's leading design and assessment method for sustainable buildings. Its carbon emissions are 72% below the Chartered Institution of Building Services Engineers office benchmark.

Industrial symbiosis in action

The cement industry's use of waste-derived fuels and raw materials has been standard practice for many years.

Industrial symbiosis has been defined as the sharing of services, utility, and by-product resources among industries in order to add value, reduce costs and improve the environment. Put simply: one business's waste is another business's resource.

The cement industry's use of waste-derived fuels and raw materials has been standard practice for many years. The following two illustrations show how the industry has

increased its use of waste derived fuels and raw materials since 1998.

The types of waste derived fuels commonly used in the UK include:

- Packaging and refuse-derived fuel
- Tyres
- Waste solvents
- MBM – meat and bone meal
- Sludges – paper and processed sewage pellets

Non-virgin raw materials can include:

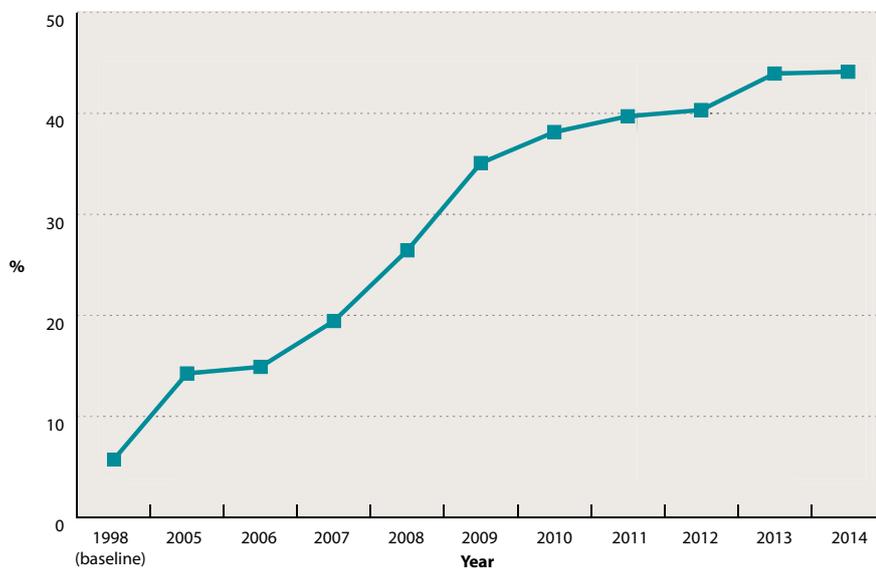
- Granulated ground blast furnace slag
- Pulverised fuel ash
- Quarry washings

While waste-derived fuels already make up 44% of all kiln fuels, we will go further and are aiming to increase this to 80% by 2050. Similarly, we will increase our use of alternative raw materials.

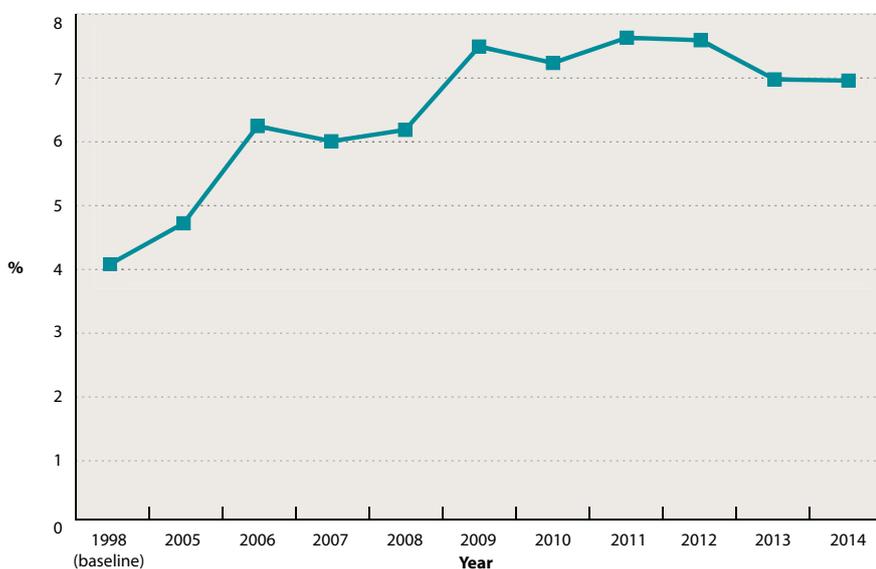
Biomass-based waste-derived fuels are an important aspect of our carbon reduction strategy where they are regarded as carbon neutral. Biomass currently accounts for 20% of all kiln fuels but it is our intention to increase this to 40% by 2050. This will not be easy with fierce competition for these fuels and unfair Government subsidies to some but not all potential users, from which the cement industry is excluded.

As an industry, we will continue to press the Government to level the playing field, not least because its own carbon reduction roadmap for the cement industry is underpinned by the extensive use of biomass as a replacement for fossil fuels. We are committed to doing everything we can to realise the carbon reduction ambition set out in the Government's roadmap and in our own Greenhouse Gas Reduction Strategy, but we need externally imposed barriers to be removed if we are to succeed.

UK CEMENT KILN SITES: PROPORTION OF FUEL COMPRISING WASTE MATERIAL



UK CEMENT KILN SITES: PROPORTION OF RAW MATERIALS COMPRISING WASTE MATERIAL



Innovation and quality

Cement companies are investing heavily in low-carbon cement formulations.

Innovation and quality optimisation remain key objectives for the UK cement industry. The acquisition of modern plant and processes allows our members to produce highly quality-assured cementitious products.

Cement has the highest level of attestation

in terms of compliance with specification. As manufacturing techniques become more and more advanced, it is crucial that the quality of the end product is correctly monitored and optimised. State-of-the-art online sampling combined with X-ray fluorescence (XRF) and quantitative X-ray diffraction (XRD) enable our members to remain at the forefront in terms of product quality and consistency.

Our companies are currently exploring the manufacture of next-generation, low-carbon cements. Of these cements, calcium sulfoaluminate cement (CSAC) has been identified as a potential alternative to Portland cement (PC). CSAC clinker requires less limestone than Portland cement and is also manufactured at a lower burning temperature (around 200°C less) than PC. To assist standardisation, the European Commission has funded the 'Ecobinder' project (www.ecobinder-project.eu), which is focused on generating long-term durability data from concretes manufactured using CSAC. In addition, the UK cement companies are investing heavily in low-carbon cement formulations, though much of this development is commercially confidential.

High standards in UK concrete practice ensure that basic cement (CEM I) from our producers is utilised in the most sustainable fashion. Additions such as granulated ground blast furnace slag and pulverised fuel ash now account for around 30% of the total cementitious materials in concrete production. In addition to reducing the clinker content in concrete, our members continue to develop sustainable solutions for formulating and producing concrete. Research of novel materials and processes has enabled our members to innovate while incorporating modern tools such as life cycle analysis (LCA) and building information modelling (BIM) to align with the EU's upcoming proposals for a circular economy. Our members have introduced low-carbon admixtures (eg self-compacting concrete) in conjunction with modern manufacturing processes (eg roller-compacted concrete) to design and produce a range of innovative concrete products.

Concurrent with various improvements in sustainability, it is crucial that both precast



Innovation and quality

and ready-mixed concrete products meet the performance required for their various applications. Our members provide specialist advice at an early stage of the design process to ensure that solutions are optimised, drawing on their extensive catalogue of products and formulations which now include:

- High-performance concrete (high strength and durability)
- Rapid-setting/hardening concrete (high early strength for rapid placement)
- Self-compacting concrete
- Fibre reinforced concrete
- Fire-resistant concrete
- Roller-compacted concrete (high-performance pavements)

CASE STUDY

Concrete protecting the environment

Concrete has a major role to play in the Lee tunnel which is part of the new London super sewer. The tunnel is one of two capturing an average of 39 million tonnes of London's sewage and by itself preventing more than 16 million tonnes of sewage mixed with rainwater

overflowing into the River Lee each year. The project used specialised concrete mixes from BRMCA members including ground granulated blastfurnace slag (GGBS), a highly sustainable by-product of iron making which replaces up to 70% of Portland cement. Special admixture blends were also used to control setting times in concrete which contained steel fibre as reinforcement.



Our people

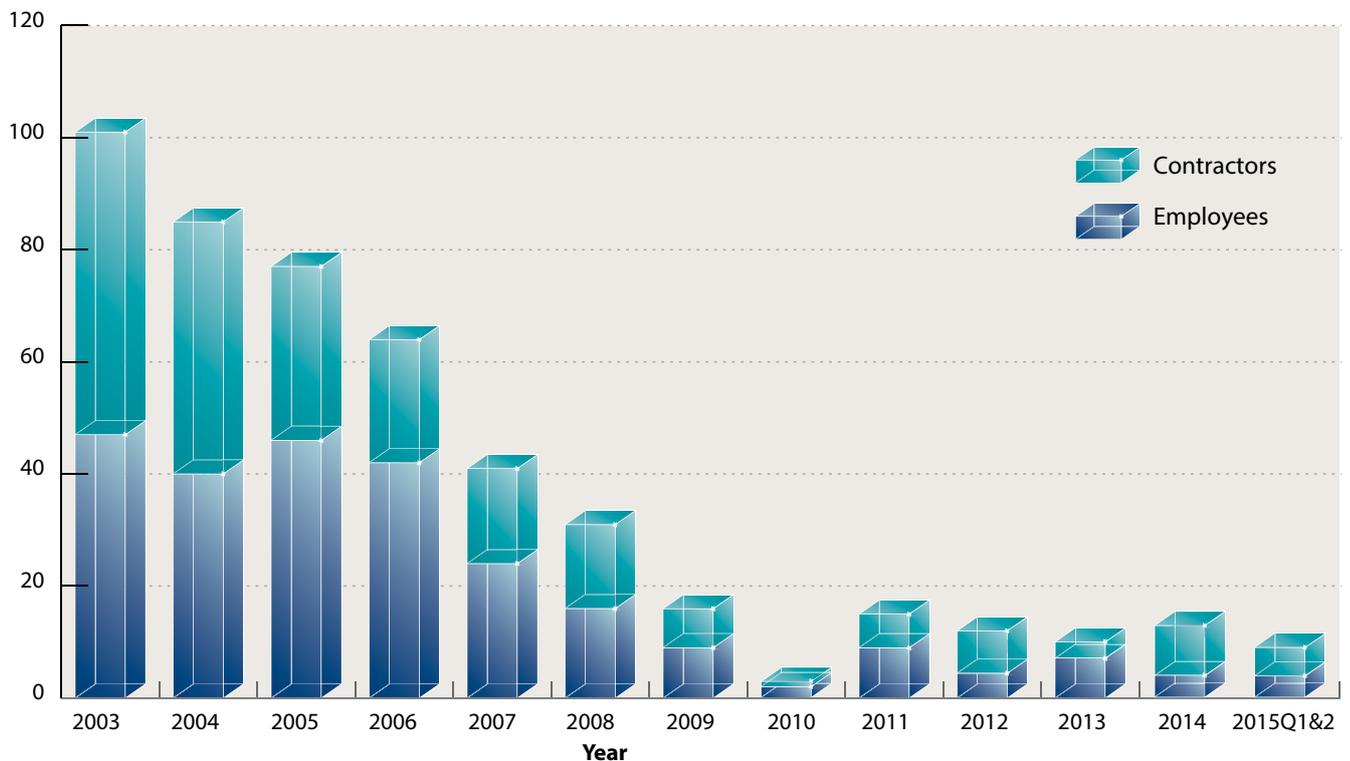
... our first priority for all of these key people is health and safety.

HEALTH AND SAFETY

"Zero Harm" is the overriding health and safety priority for MPA Cement. Our safety targets are to:

- Reduce the 2013 rate of lost-time injuries by 65% by the end of 2018 for employees and;
- Halve the 2013 number of lost-time injuries by the end of 2018 for contractors.

MPA CEMENT LOST TIME INJURIES



COMMUNICATION AND SHARING

MPA Cement members meet regularly to share information on their health and safety initiatives and to share details of any incidents that have occurred. MPA Cement shares details of its programmes with the glass, ceramic and concrete industries through the CHARGE network and participates with the rail, nuclear, chemical and petrochemical industries in the Process Safety Forum.

DRIVER SAFETY

Over half of the lost time injuries in 2014 occurred to drivers. Consequently, there has been a particular focus on driver safety through:

Visible felt leadership – Visible felt leadership is a proven health and safety philosophy that

encourages safe behaviour in the workplace; it has been implemented by all MPA Cement members. Senior managers visit sites and hold safety conversations in the workplace. Drivers have been a particular focus for the safety conversations.

Engagement – Efforts have been made to engage drivers, through the use of toolbox talks, newsletters, safety workshops and involvement in safety committees. *Near hit* reporting schemes are operated and drivers have been empowered to refuse delivery if site conditions so warrant.

Dynamic risk assessments – Dynamic risk assessments such as *Myspace* and *Take a Minute Save a Lifetime*, have been introduced to encourage drivers to consider ground conditions and the movements of other

vehicles before descending from their cabs.

Customer site safety – The MPA Cement Customer Site Safety Assessment addresses site conditions, vehicle/pedestrian segregation, manual handling issues and the risk of silo over-pressurisation. The assessment is carried out prior to the first delivery with the specific aim of safeguarding driver safety.

Specific initiatives – Campaigns such as *Get a Grip* have been launched to remind drivers of the importance of maintaining three points of contact when descending from cabs.

Health and wellbeing – Member companies are introducing driver health and well-being initiatives.

Our people: diversity in action

DIVERSITY

If keeping people safe is the top priority for all MPA Cement members, making the most of the widely diverse talent that is available to them is right up there in the mix. Every company is committed to a diversity policy and works hard to give employees every opportunity to make the best of their careers. Here, we explore the diversity strategies of four of our member companies in more detail.

The company is developing a sustained approach to diversity and inclusion so that it becomes part of its culture.

HOPE CONSTRUCTION MATERIALS

In 2014, as a very young company, Hope Construction Materials was beginning to develop its diversity policy. With its goal to become one of the best companies to work with and to work for, it wanted to look beyond the traditional definitions of diversity and focus also on inclusion. The company is developing a sustained approach to diversity and inclusion so that it becomes part of its culture and the “way it’s done around here”. Hope is not focussing on quick wins but on building a sustainable platform – an environment where people’s differences are valued and embraced and where they encourage a healthy and flexible approach.

In 2014, Hope launched its *Apprenticeship Academy*, focused primarily on its main quarry and works sites, but with a goal to extend to other parts of the business. At

Hope cement works, the company recruited a local apprentice who has since gone on to be chosen as Learner of the Year at Chesterfield College. Hope is keen to support young people in their career ambitions and welcome work experience students, internships and graduates. In addition, it partners with the local college to help pupils with CV writing and interview skills. In 2014, it also unveiled a *Hope for Others* scheme, which encourages staff to give up work time to do volunteering in the community. The first project saw a team transform the gardens at Bluebell Wood Hospice in South Yorkshire. Hope’s cement team also enjoys the benefits of a social club on site. In 2014, it launched a programme of improvements and upgrades including a gym and exercise class timetable encouraging staff to take advantage of wellbeing facilities on their doorstep.



Our people: diversity in action

The company aims to work together to develop its different skills and abilities and make the most of its diversity.

HANSON CEMENT

Hanson Cement's diversity policy is embedded in its equal opportunities policy, which covers a range of topics including age, disability, gender, sexual orientation and race, through to harassment and bullying. The company's equal opportunities policy is anchored on three pillars:

- i) A business case that ensures the company makes the best use of all its employees by creating an environment in which they can give their best and realise their potential;
- ii) Being a good employer that is fair and

equitable with both employees and with the wider community;

- iii) Recognising that many aspects of equal opportunities are now covered by legislation and case law.

Hanson Cement looks to every one of its employees to be responsible for creating and maintaining a workplace free from discrimination. It aims to ensure that people are judged on their merits rather than acting on assumptions. The company aims to work together to develop its different skills and abilities and make the most of its diversity.

CASE STUDY

Sam Loxley: dump truck driver

After spending most of her working life sitting behind a desk, Sam Loxley decided on a career change. Now she is driving a 60-tonne dump truck in a quarry. Sam was employed as an administrator at Hanson Cement's Ketton works in Rutland, but a proposed restructuring in November 2012 put her job under threat.

"I started looking for alternatives and even considered redundancy but then a list of jobs, including a quarry dumper driver, was advertised in-house," says Sam. "I thought about it and said to myself 'I can drive – why not'. I talked to a friend whose father used to work at the quarry, and he encouraged me to apply.

Now, after on-the-job training with experienced drivers, Sam hauls loads of limestone, clay and silica from the quarry face to the processing plant in a Komatsu hd 605.

"I am the first woman to do this job at Ketton and I have to thank the site management and the quarry team for their help and support," she says. "I certainly think I've made the right choice. I love the outdoor life. It's amazing to see the wildlife around the site."

Last year, Sam took part in a machinery demonstration staged by Komatsu at the three-day international quarrying and recycling show at Hillhead, near Buxton.



Our people: diversity in action

A truly integrated talent enablement strategy that will allow the business to deliver its goals and objectives.

TARMAC

Tarmac first published its *Diversity & Inclusion Policy* in March 2014 and stated publicly that its approach to diversity was not just about making sure it complies with equality law but also about capitalising on difference, to the benefit of the individual and the business. The policy states that, to achieve its D&I ambition, it will:

- Engage with all its employees confirming a clear commitment to diversity and inclusion in the actions it takes as an employer;
- Create processes, policies, plans, practices and services that meet the diverse needs of its employees;
- Promote diversity and inclusion and

encourage equality of opportunity through an integrated approach in all of its people, policies and procedures. These include: resourcing strategy, recruitment and selection processes, family-friendly policies, learning and development strategy and processes, reward and recognition policies and strategy.

To further support this, the company's *Talent Enablement Policy*, which was published in May 2014, aims to develop a truly integrated talent enablement strategy that will allow the business to deliver its goals and objectives through embracing diversity and encouraging mobility across the organisation.

As part of its Diversity & Inclusion Roadmap the company also agreed to focus on four key areas: age; gender; ethnicity; and disability.

CASE STUDY

Emma Cooper: apprentice electrical engineer

Emma Cooper is one of Tarmac's apprentice electrical engineers who joined the company last year. Emma enjoys on-the-job learning and really "getting hands-on". She is currently studying for two qualifications (an NVQ and a BTEC) to ensure that she develops a deep understanding of electrical engineering. With support from her line manager and wider team, she hopes to develop into a fully-fledged electrical engineer at the end of her apprenticeship.

"I like being an apprentice because I am learning on-the-job and getting paid whilst I am doing it," says Emma. "I am really enjoying it and the knowledge you get is massive. I am going on so many training courses – it's just excellent. After the apprenticeship, I would like to stay with the company."

Emma's manager, Andy Garwood, says: "I have been nothing but impressed with her. She has constant college reports that she is a distinction level student. Her attitude is fantastic and she looks like she is developing into a really good prospect for the company."



Our people: diversity in action

The company values the differences among its staff, and believes that it significantly contributes to the business and its customers.

CEMEX UK

CEMEX UK has 3,000 employees across its 450 sites amongst which there are 27 different nationalities represented from America to Venezuela, South Africa to Australia and Britain to Nigeria, covering every continent. As a company originating in Mexico, diversity is an intrinsic part of the CEMEX culture. The company values the differences among its staff, and believes that it significantly contributes to the business and its customers. The CEMEX diversity policy ensures that every employee is treated with dignity and mutual respect and is provided with an equal

opportunity for training and promotion without discrimination.

Roles currently fulfilled by women include a quarry manager, a block plant production manager, an independent haulier contractor in the ready-mixed concrete business, environmental manager and supply chain manager at a cement plant.

Recent recruits have included the first woman in the CEMEX logistics apprentice scheme, who will be trained as one of the team of over 400 drivers. Others include the company's first woman master of the Sand Falcon, one of its fleet of marine dredgers.

CASE STUDY

Mirren Fernandez: supply chain manager

Mirren Fernandez is a chemical engineer by training and currently works as the supply chain manager at the CEMEX

Rugby cement plant. She is responsible for the cement milling area, where clinker is crushed and ground and the packing plant where cement is bagged ready to be sent to builders merchants "I love my job because I

am responsible for a big team and I like to see them developing as individuals," says Mirren. "Although it is challenging, I have the opportunity to make a difference on a daily basis."



Environmental performance

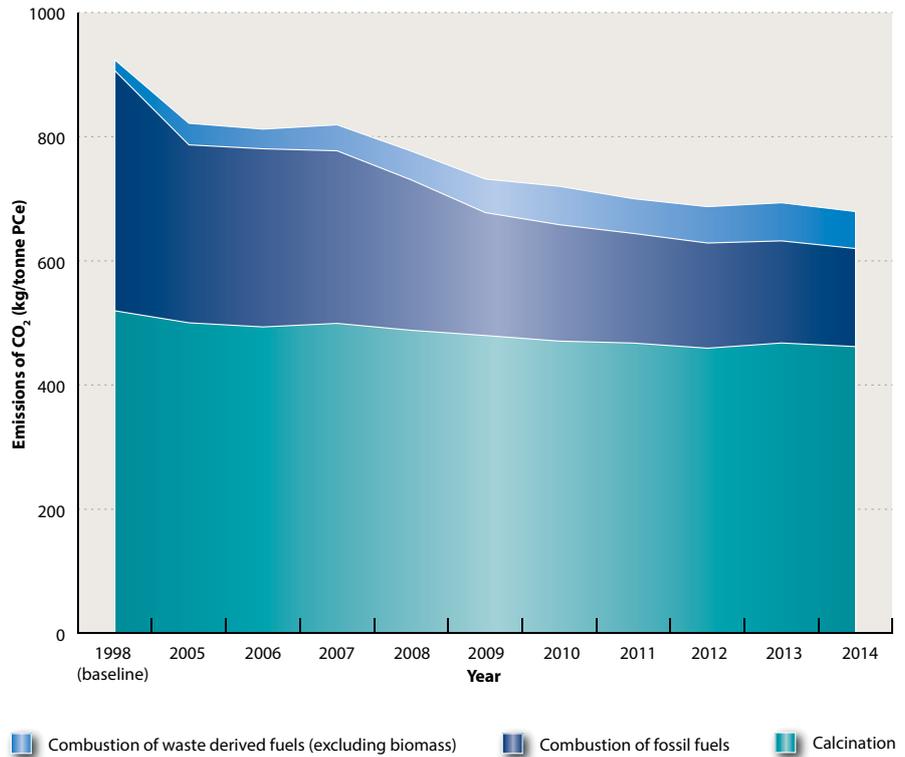
As our Sustainable Development Reports and Performance Reports show, the UK cement industry continues to build on the significant strides it has taken to improve its environmental emissions. Indeed, we have come so far from our 1998 baseline year that now we are talking about marginal changes in annual emissions as opposed to the step-changes we had been making. This reflects the technical limitations we are now up against.

Measured against a 1998 baseline and on a per-tonne basis, actual emissions in 2014 were as follows:

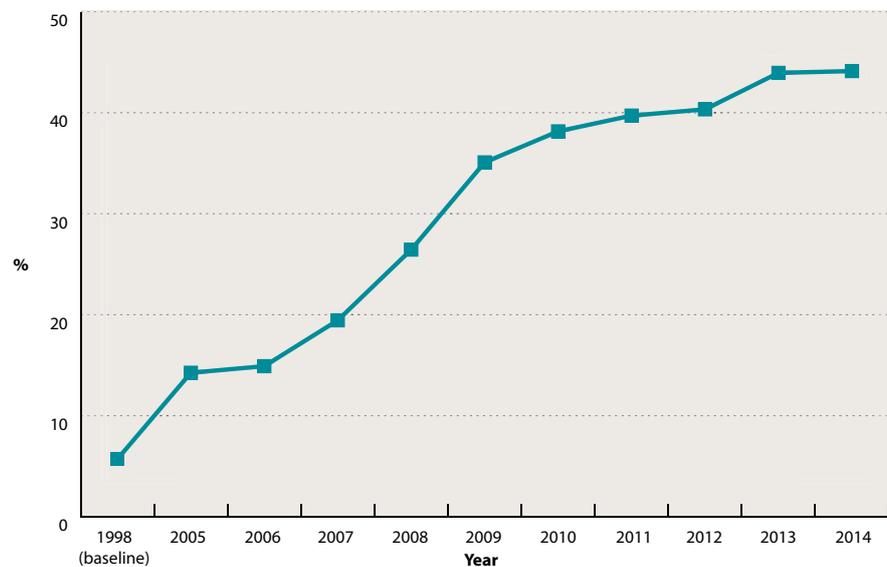
- Emissions of CO₂ directly from cement plants per tonne of Portland Cement equivalent (PCE): 26.4% reduction on 1998
- Dust emissions: 82.1% reduction on 1998
- Oxides of nitrogen emissions: 61.9% reduction on 1998
- Sulphur dioxide emissions: 84.1% reduction on 1998

In 2014, the cement industry continued to be a net consumer of waste and by-products, using 1.6 million tonnes as substitute fuels and raw materials and not disposing of any cement kiln dust (process waste) to landfill.

UK PORTLAND CEMENT INDUSTRY EMISSIONS OF CARBON DIOXIDE PER TONNE OF PORTLAND CEMENT EQUIVALENT 1998-2014



UK CEMENT KILN SITES: PROPORTION OF FUEL COMPRISING WASTE MATERIAL





mpa cement members

CEMEX UK
Hanson Cement
Hope Construction Materials
Tarmac
Aggregate Industries (*from Aug 2015*)



The Mineral Products Association is the trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries.

MPA Cement
Gillingham House
38-44 Gillingham Street
London SW1V 1HU
Tel +44 (0)20 7963 8000
Fax +44 (0)20 7963 8001
mpacement@mineralproducts.org
www.cementindustry.co.uk