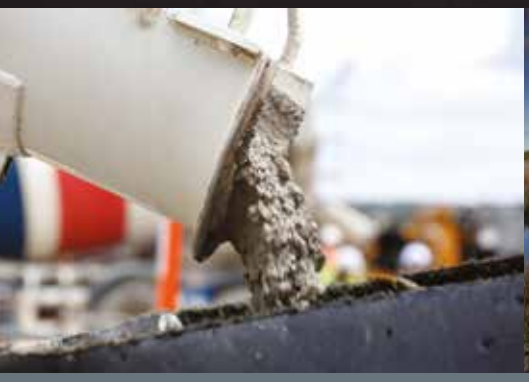
mpa
essential materials
sustainable solutions



Ready-mixed concrete

…essential…local…sustainable

make the link
to mineral products

brmca british ready-mixed concrete association

Mineral Products Association

From family homes to high rise offices – ready-mixed concrete underpins life

A vital industry

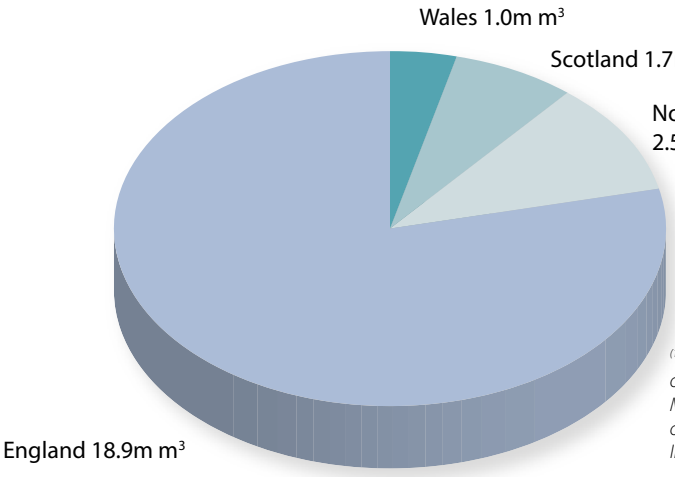
After water, concrete is the most used material on earth. Without it, we would not have the buildings and infrastructure upon which our lives depend; no homes, schools, hospitals, factories, and offices and no means of travelling between them. Society as we know it could not exist.

Nearly all foundations, floors and the majority of building structures are made of concrete. Concrete is also often key to the architecture of our buildings, contributing greatly to their energy efficiency and visual appeal.

All in the mix

Ready-mixed concrete is made by mixing coarse and fine aggregates, cement and water in controlled proportions. Invariably, chemical admixtures are also used to reduce water content and improve fresh and hardened concrete properties. Delivered to site on a just-in-time basis, ready-mixed concrete may be cast into any conceivable shape with almost no limit on volume. When hardened, concrete can carry substantial compressive loads by itself, but is more frequently reinforced to substantially increase its tensile and flexural strength.

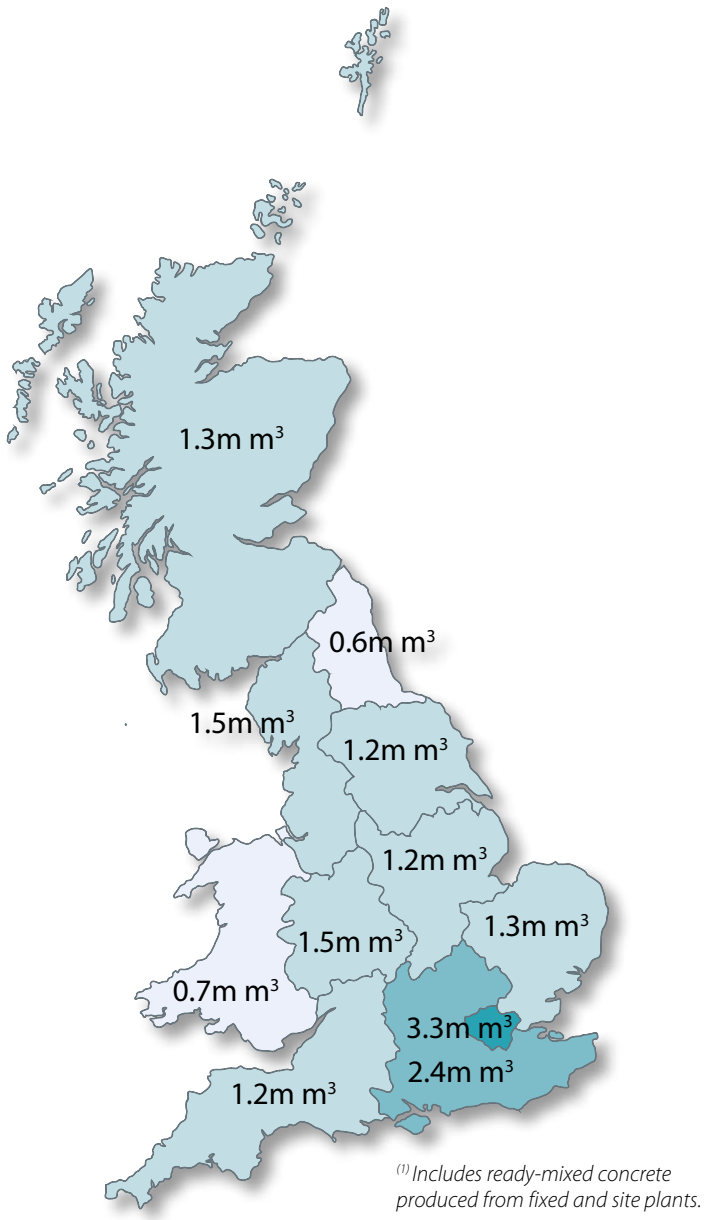
We utilise around 16 million cubic metres of ready-mixed concrete in Britain each year. To put that in perspective, it's enough to build a concrete motorway and all its associated infrastructure from Land's End to John o'Groats. Largely due to the global financial crisis, demand fell from a peak of around 24 million cubic metres a year but is now rising again and it is estimated it will reach around 25 million cubic metres by 2025. London and the South East consumes nearly three times as much as most other UK regions.



(1)GB Estimates are based on the assumption that MPA sales represent 75% of the total GB market. Includes fixed & site plants.

Estimated total UK ready-mixed concrete[1] sales 2014. Source: MPA, QPA Northern Ireland

Cover photo (top right): John Sturrock



(1) Includes ready-mixed concrete produced from fixed and site plants.

MPA ready-mixed concrete sales[1] by region 2014. Source: MPA

The big picture

While ready-mixed concrete is an industry in its own right, it is also a key part of the wider mineral products industry which also includes the aggregate and cement producers that provide the constituents for concrete.

300mt	**GB production of aggregates and manufactured mineral products**
£21bn	**Annual turnover**
£6.7bn	**Total gross value of the industry**
£445bn	**Turnover of industries we supply**
£135bn	**Value of construction as our main customer**
80,000	**People directly employed in our industry**
3.3m	**Jobs supported through our supply chain**

Techni

Controlling quality

Ready-mixed concrete is in many ways a simple material made from basic materials, but the batching, mixing and delivery process is crucial to the construction projects that depend upon it. If the concrete fails then the whole structure is at risk.

The fact that ready-mixed concrete is made under factory conditions means that high standards of quality are assured. BRMCA members have adopted the highest levels of product conformity certification and control, either through the Quality Scheme for Ready-Mixed Concrete (QSRMC) or the British Standards Kitemark Scheme for Ready-Mixed Concrete. Both these schemes include the three essentials for effective product conformity certification:

- approval of a concrete producer's quality management system to BS EN ISO 9001;
- product testing by or calibrated against a laboratory accredited for the tests undertaken;
- surveillance that includes checking the validity of the producer's declarations of conformity by an accredited certification body.

While it is easy to think of ready-mixed concrete as a single product, it can be specified in an infinite number of ways to suit different end-uses. From trench fill for the reinstatement of openings in highways to houses, and the high-strength concrete used as the structural core and columns supporting the highest buildings in the world.

cal excellence

Special concretes

Sometimes, concrete has to meet special performance and uniformity requirements that cannot be achieved using conventional materials and normal mixing, placing and curing practices. It may be that the end-use requires the concrete to gain strength faster; to resist the corrosive effects of sea water; or can only be sprayed into position in a tunnel. BRMCA members supply a range of special concretes for those situations and are constantly refining the most traditional of all construction materials to meet customers' needs. Here are some concrete options:

High-strength concrete is produced in industrial quantities with compressive strength up to around 100 N/mm^2. These strengths are often required for the highly stressed columns at the lower levels of tall buildings and underground atriums.

Roller compacted concrete is a higher strength concrete used for industrial and road pavements. It is abrasion-resistant and inherently resistant to freezing and thawing. Its main advantage is that pavements can be constructed without dowell-bar joints or continuous reinforcement, saving cost in terms of both materials and labour.

Low carbon and tailor-made cement concrete. The UK ready-mixed industry uses within concrete-mixer combinations of Portland cement with additions. Most frequently the additions are either ground granulated blastfurnace slag, flyash or limestone fines. This means exact cementitious proportions may be used to optimise the often conflicting requirements to: minimise embodied carbon, maximise resistance to chloride or aggressive chemical ingress or minimise the rate of carbonation and vulnerability to freezing and thawing.

Lightweight concretes are often used for floors in high-rise construction to reduce overall foundation loads, and for that reason are also used for the decks of many concrete bridges.

Foamed concretes are made with up to 50% entrained air and are often used to fill redundant voids such as old fuel tanks or for the reinstatement of openings in highways where strength is matched to the surrounding ground conditions.

Water-resistant concretes are impermeable to water and other fluids, either above or below ground.

Self-compacting concrete is a highly cohesive but flowable material that achieves complete compaction into every part of the mould or formwork without the use of internal or external vibration.

CASE STUDY: repairing a vital artery

Ready-mixed concrete had a vital role to play in repairing the storm-ravaged sea wall at Dawlish in Devon in early 2014. Some 1,500 cubic metres of ready-mixed concrete was offloaded on the road above and pumped down to the site to make good the repair. In doing so, it restored a broken transport artery that had been costing the region's economy an estimated £20m a day for more than two months.

Sustainable solutions

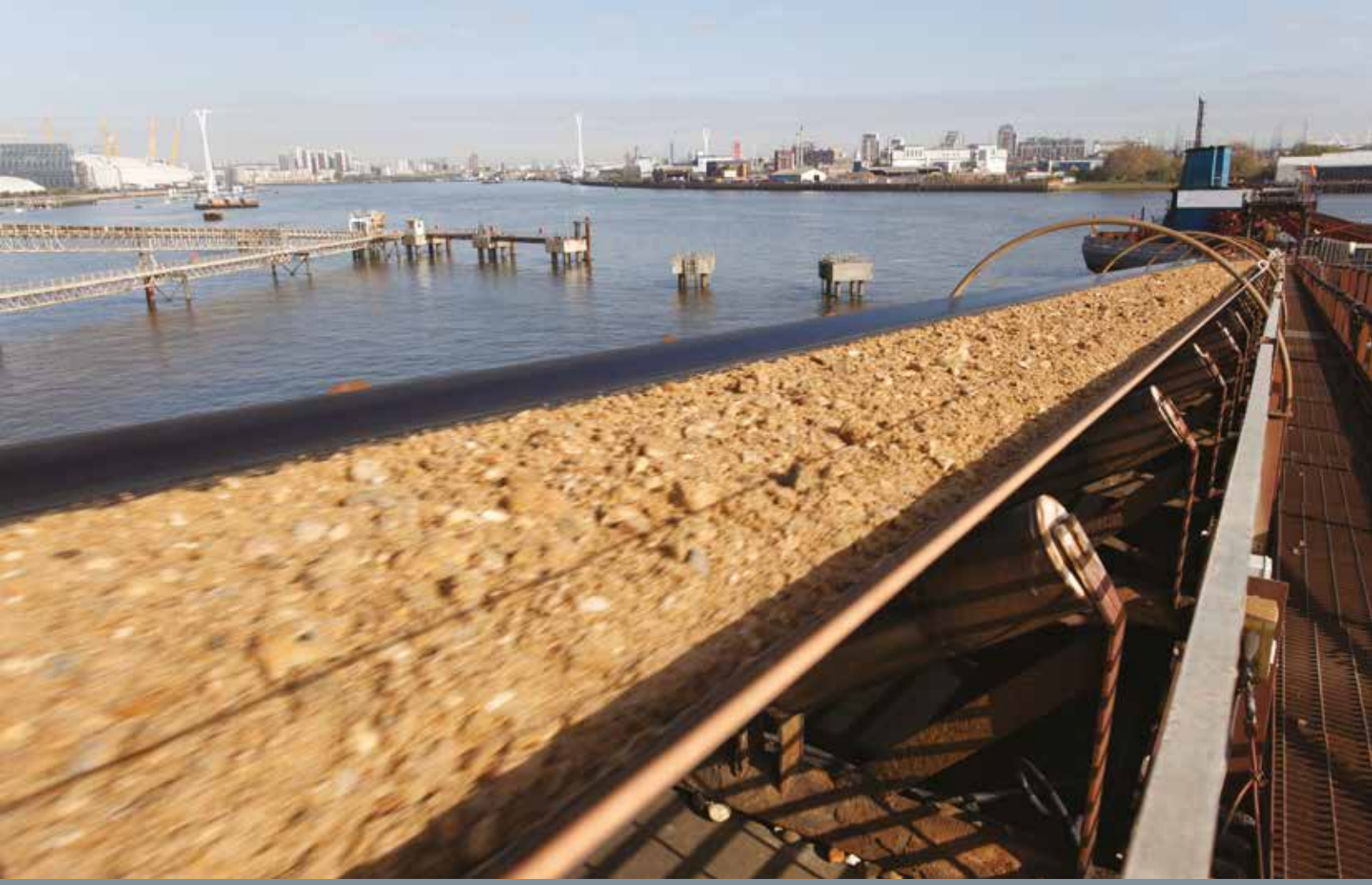
Inherently sustainable

Concrete is one of the most traditional of construction materials and has been used since Roman times. It is, however, very much at the head of the field in terms of its sustainability. Perhaps most significant is that it is by definition a local material, produced locally using local materials. The average distance travelled for delivery is just five miles, so its lorry impacts are minimised.

Concrete is also durable and robust – structures built with it have a long life, and maintenance costs are low. It resists both flood and fire while also absorbing noise and heat. It is of increasing significance in the light of climate change that concrete's thermal mass is very useful to absorb excess heat during the day for it to be released at night when the external temperature falls.

But concrete is also sustainable when it comes to the end of its life because when buildings are demolished it can be re-used as aggregates for many applications, and sometimes used as aggregates in concrete. With time, concrete re-absorbs carbon dioxide (CO_2) from the atmosphere; where this process is accelerated through the crushing of the concrete, up to 20% of the embodied CO_2 can be re-absorbed.

Cement plants have reduced CO_2 by 40% since 1990 and are a net user of waste



Aggregate for ready-mixed concrete also comes from the sea

FACTS ON SUSTAINABILITY

CO_2 the use of cementitious additions and admixtures means that the Portland cement content of concrete may be optimised such that the embodied CO_2 of concrete is minimised. Transport CO_2 is minimal, with an average delivery distance of five miles. Most ready-mixed concrete plants are located in aggregate quarries, marine aggregate wharves or aggregate rail depots.

Responsible sourcing Ready-mixed concrete is a responsibly sourced product. In 2012, over 95% of BRMCA supplied concrete conformed to the responsible sourcing Standard BES 6001.

Waste modern and efficient site management minimises ready-mixed wastage which is estimated at less than 1%. Systems are available to re-process wash-out material or returned ready-mixed concrete to minimise the volume that has to go to landfill. Ready-mixed concrete has its own Resource Efficiency Action Plan (REAP).

Resource depletion every tonne of ground granulated blastfurnace slag or fly ash used in concrete mixes saves about 1.4 tonnes of raw materials and fossil fuels.

Water the use of admixtures reduces water content by up to 30 litres per cubic metre. Most ready-mixed concrete includes water-reducing admixtures. All ready-mixed concrete plants have systems for the recovery and use of wash-out water, and where possible, rainwater is harvested.

Raw materials Ready-mixed concrete also benefits from the sustainability credentials of the materials used for its manufacture. Cement, for example, has reduced its direct CO_2 emissions by 40% since 1990 in absolute terms. On the aggregates front, the UK is the European leader in the use of recycled and secondary aggregates, which now account for 28% of the market.

Sustainable formwork most contractors use proprietary formwork systems that maximise re-use. In addition, any site-produced formwork is re-used as much as possible.

Recycling at the end of the life of a building its reinforced concrete structure may be refurbished for a new life, or the concrete is recycled as new construction materials.

CASE STUDY: across the Mersey

Continuous pours of ready-mixed concrete are key to the £2bn six-lane toll bridge which is being built across the Mersey between Runcorn and Widnes. Dedicated plants have been built on either side of the river to supply the project, which will involve some 120,000^{3}m of technically complex concretes over a 29-month period ahead of the new landmark bridge opening in 2017.

Socially responsible

Restoring sites for nature and people

The ready-mixed concrete industry is part of a wider family which delivers products that all emanate from quarries. Wherever possible, ready-mixed concrete plants are sited within aggregate quarries, marine aggregate wharves or aggregate rail depots that supply their aggregates. When this is not possible, such as in urban areas, plants are sited where the demand for the product is greatest. What is common to all mineral products is the MPA-driven collective social responsibility.

Health & safety

Protecting our people from harm and ensuring that they go home safely to their families at the end of each working day is the mineral products industry's top priority. Likewise, we are committed to doing all we can as responsible employers to encourage healthy lifestyles in which the working environment is of positive benefit. Contractors are a particular focus for health and safety initiatives.

The ready-mixed concrete sector is an increasingly safe place for people to work and is working towards a target of reducing injuries per 100,000 direct employees by 13% year-on-year from 2008 levels.

The industry shares its accident prevention and workplace health ideas between operators. This includes a raft of "Safer by ..." initiatives that embrace contractor safety, and liaison with machinery manufacturers on potential design improvements to improve safety. BRMCA members participate enthusiastically in an annual MPA awards scheme that shares best practice.

The same rigour applies to public safety, where the industry operates a "Stay Safe" campaign to discourage young people from entering quarries. There is also a "Cycle Safe" initiative that has been a leader nationally in tackling the problem of vulnerable road users being involved in accidents with heavy goods vehicles.

Protecting vulnerable road users

Prioritising health and safety

Restoration and biodiversity

The quarries from which our raw materials are sourced all have restoration plans to ensure that, in the long term, they can be used to the benefit of society. Often, they present opportunities to become nature reserves. The industry's contribution to local and national biodiversity targets is substantial, planning and delivering fragile habitats to protect species that are under threat. MPA has united dozens of restored sites across Britain into a *National Nature Park*. While the park is continuing to evolve, an area of priority habitats equivalent to at least five 'Richmond Parks' has already been created.

Training and skills

BRMCA members recognise people as an important resource and encourage employees to further develop their skills and their careers. Equality policies ensure there are opportunities for all regardless of age, disability, gender, sexual orientation or race.

Post-recession, the industry has invested heavily, not just in plant but in recruiting and training the people who will now enable it to contribute to economic growth.

Training our people

Concrete and energy

Concrete is important to every aspect of our lives and to all the industries that support us. But few of life's essentials will require it more in the coming years than energy. At a time when we desperately need to secure our own long-term generation capacity rather than rely on imports, building new resources is vital.

Supporting a new generation

At least three million tonnes of concrete will be needed to build EDF Energy's planned nuclear plant at Hinkley Point in Somerset – that's 75 times more than was used to build the Millennium Stadium in Cardiff. The project (artist impression right) represents £16 billion of construction investment in what will be the first of a new generation of nuclear reactors. Scheduled to come online in 2025, the plant will operate for at least 60 years and will be capable of producing 7% of the UK's electricity – enough for five million homes. It will take ten years to build and will create some 25,000 jobs over that time. The electricity generated from Hinkley Point will avoid 10 million tonnes of carbon dioxide emissions a year, which is 600 million tonnes over its lifetime.


Image: EDF Energy

Going with the tide

Swansea's £1 billion planned tidal lagoon will demand huge volumes of ready-mixed concrete. It is one of six that have a key role to play in Britain's next generation of energy infrastructure. The first £1 billion lagoon at Swansea (image right) has received permission and promises power for over 155,000 homes for 120 years. Developer Tidal Lagoon Power has also unveiled plans for a second site which would use a 22km-long concrete breakwater to enclose 70km^2 of the Severn Estuary between Cardiff and Newport. It will also provide the catalyst for over £2 billion of regeneration activity including housing, commerce, leisure and industrial development. All of it will require ready-mixed concrete.


Image: Tidal Lagoon Power

security

Coal-fired electricity generation is due to be phased out by 2025 with gas and oil taking up some of the shortfall in the medium term. The next stage of Britain's decarbonising journey requires heavy investment in renewables such as offshore wind and tidal energy, which already contribute around 20% of supply.

UK policy also requires new nuclear energy plants on a large scale. With all but one of the current 16 nuclear reactors due to close down by 2023, the scene is set for a £60 billion investment in new-generation reactors. Eight sites – all currently occupied by existing nuclear plants – have been identified.

Flowing in the wind

For wind turbines to do their job, they need to stand firm in the toughest conditions – and that necessitates strong concrete bases. A typical turbine may require 350m^3 of ready-mixed concrete delivered in continuous pours, often to highly inaccessible locations. The 11 turbines making up the Crook Hill Wind Farm, near Rochdale in Lancashire, for example, are expected to deliver electricity equivalent to the needs of 26,000 homes annually. There are now more than 5,000 onshore wind turbines in the UK, generating power sufficient for 5.5m homes and contributing 5.6% of total electricity needs. The future of the onshore wind industry and the energy it provides will depend upon a steady supply of ready-mixed concrete.

Image: Shutterstock

In deep water

To support offshore wind turbines, concrete gravity bases are widely accepted as an ideal solution that can drive down costs. The bases are constructed onshore at ports well placed for local wind farms and are readily deployed by tugs to site. They are installed by the controlled influx of water followed by aggregate ballasting. The durability of the bases is such that they can be re-deployed at different locations with new turbines fitted – and ultimately the concrete can be removed for recycling.

Image: BAM Energy / Van Oord

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Affiliates

Bonnar Sand & Gravel Co Ltd
Hillhouse Quarry Group Ltd
Northstone (NI)

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

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