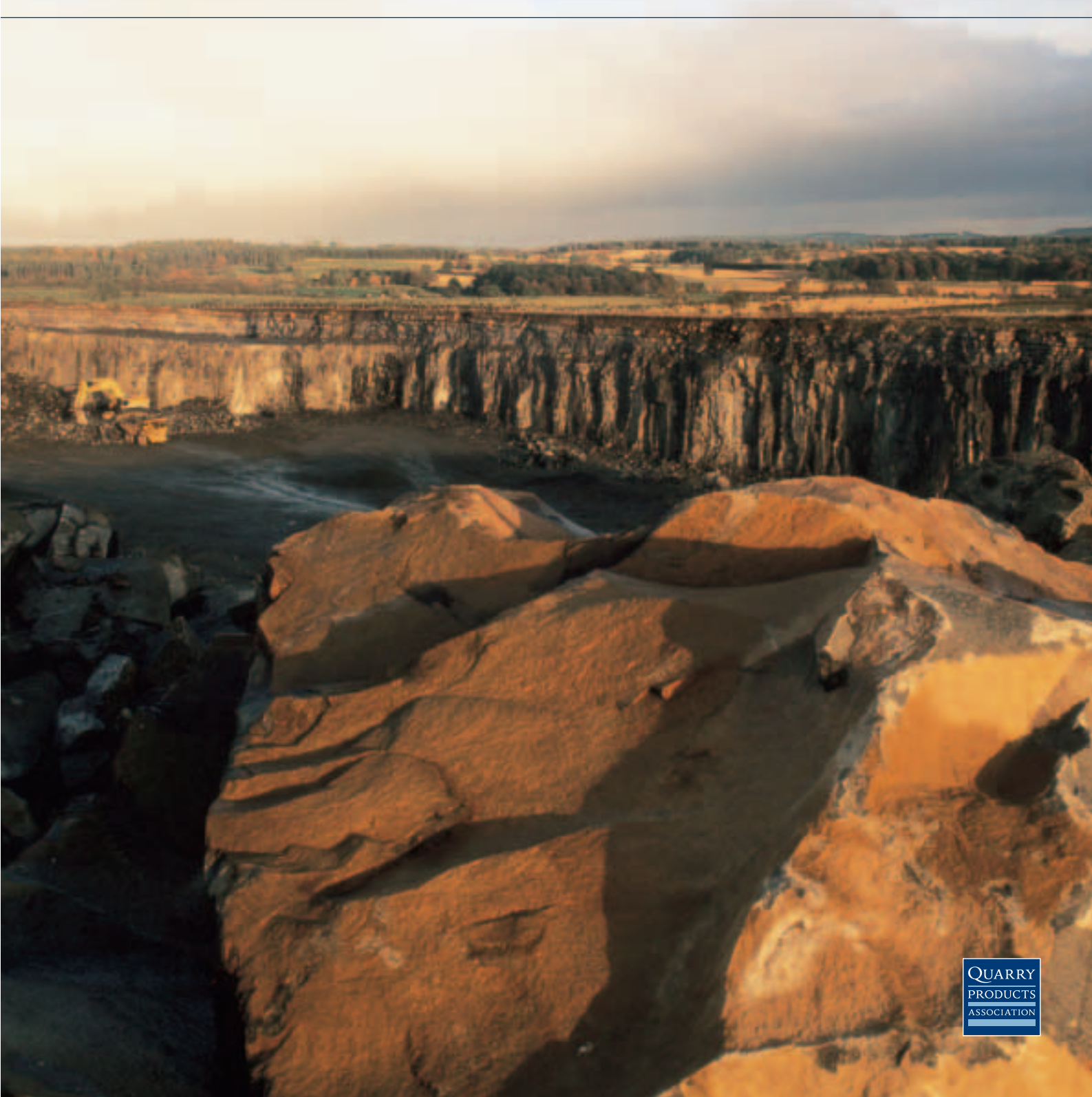


What's in a quarry?



An essential industry



Aggregates - crushed rock, sand and gravel - are essential to our way of life; as important to us in their own way as the food we eat. They literally underpin our society, providing us with places to live, places to work, places to play, and much more.

Quarrying for aggregates does, however, have environmental implications, requiring a responsible approach from the industry and a considerate attitude to its neighbours.



It is easy to regard a quarry as a hole in the ground. It takes a bit more imagination to appreciate that many of the good things of life come out of that hole. In a typical year, the UK's quarry network helps to provide:

- 180,000 new homes each requiring an average of 60 tonnes of aggregates
- £1.6 billion of school building
- £1.3 billion of hospital building
- £1.7 billion of improvements to water services
- maintenance of our 230,000-mile road and 10,000-mile rail networks
- 4.6 million tonnes of special sands vital to other industries.

Quarrying is a major industry. There are over 1,300 quarries in the UK producing products valued at some £3 billion a year. The construction industry, which contributes around ten per cent of the nation's gross domestic product, is totally reliant on quarrying.

Demand for primary aggregates amounted to around 205 million tonnes in 2000 - the equivalent of 3.6 tonnes for every one of us or a lorry load for the typical family. The industry has committed itself to reducing the call on primary aggregates and is investing in facilities that will increase the proportion of recycled aggregates. Recycling currently contributes 45-50 million tonnes per annum, giving a total market (both primary and recycled aggregates) of 250-255 million tonnes.

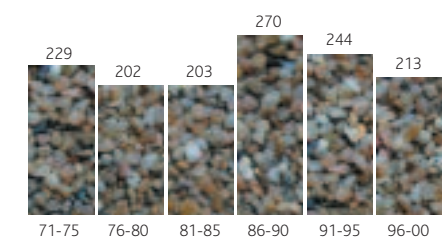
Quarrying supports some 40,000 jobs. Many of these jobs are in rural areas where there are limited employment opportunities.

Land Use in the UK

Quarrying (Eng & Wales)	0.35%
Urban Development	12%
Forestry	10%
Agriculture and Rural	77%
Roads	1.5%

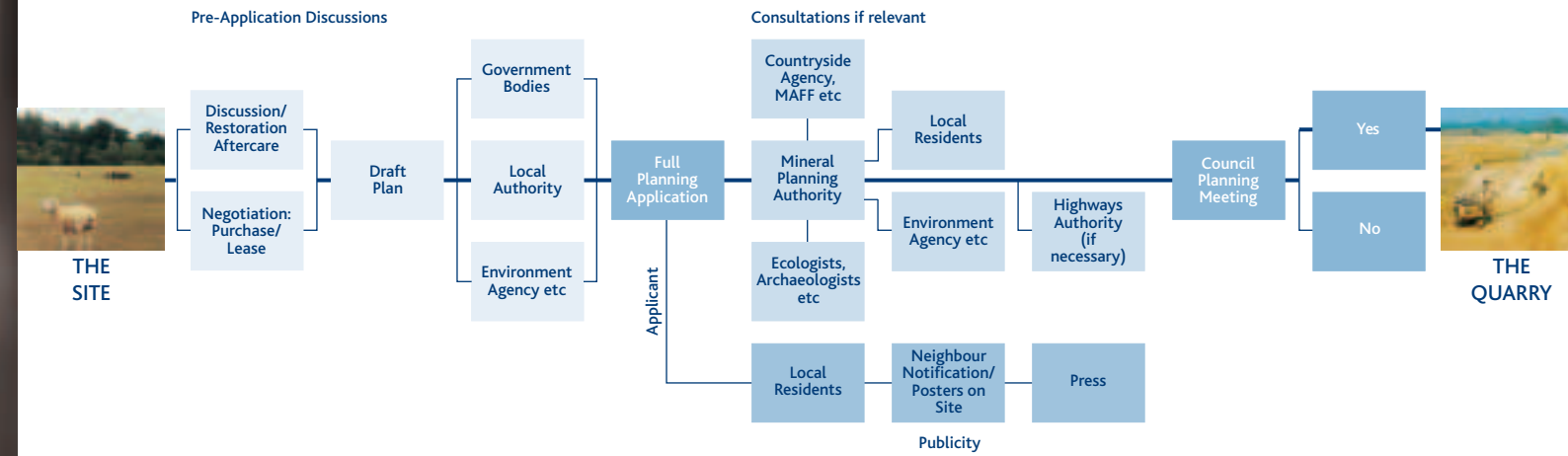
Aggregates Demand 1971 - 2000 GB

million tonnes averages in 5 year periods



Quarry products can only be dug where nature has placed them. This means that most of our quarries are located in the countryside where pressures on development are intense. A balance has to be struck between our need for raw materials and the necessity to protect all that is best about our environment. The quarrying industry is pursuing ever higher performance standards and works closely with government at all levels and with others to try to achieve that balance.

Striking a balance



The industry recognises that it works in a sensitive environment and that its operations, like any change in land use, are bound to be of concern. It is the role of the planning system to establish the necessary balance and to come up with a framework that allows aggregates to be provided from the most environmentally acceptable sources. In England, the Department of the Environment, Transport and the Regions (DETR) has set up regional aggregates working parties to offer advice. It also publishes policy on supply and other planning issues in the form of guidelines for planning authorities. Scotland, Wales and Northern Ireland each have their own systems.

It is within this policy framework that individual quarry operators then develop applications for consideration by the planners - county councils or unitary authorities. Companies will often consult with local people and local organisations before lodging an application, which then goes through a more formal consultation stage involving bodies such as the Environment Agency, English Nature and the relevant highways authority.

It rarely takes less than four years and often as much as ten years to bring a new operation on-stream. The total investment in a new rock quarry can be as much as £10 million. Once the new site is underway, the operator must pay close attention to the conditions and legal agreements placed on the permission and satisfy the mineral planning authority and the Environment Agency in particular that their requirements are being met. The planning and regulation processes are rigorous - and rightly so.

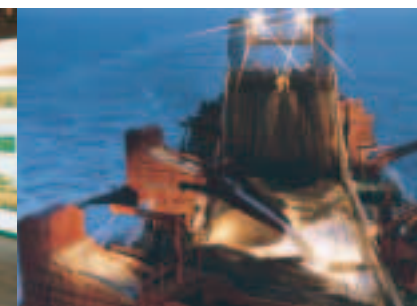
Planning at sea

The Crown Estate owns the mineral rights to the sea-bed around the UK and issues licences for extraction. It will, however, only issue a licence if there is agreement from government - the DETR, the National Assembly for Wales or the Scottish Parliament. An application to dredge must include an environmental impact assessment made up of a range of studies. A Government decision is reached after wide consultation with local authorities, fishing organisations, Government advisers and other bodies. Conditions are commonly attached to

licences including regular monitoring and zoning restricting the area dredged at any time.

Environmental assessments

Environmental impact assessments are normally required for minerals projects. Such documents are designed to ensure that every possible impact is considered and, where necessary, dealt with. A typical report provides a comprehensive assessment of noise, dust, traffic, water, ecology and landscape. It adds up to a vital safeguard for local communities as well as for the environment.



Sources of aggregates

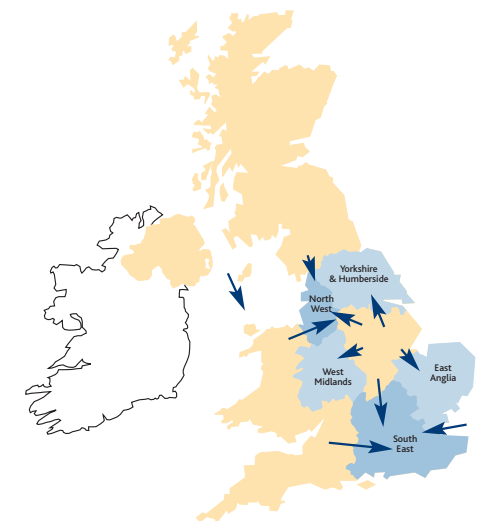
There are two main types of aggregates in Britain. A line drawn roughly from The Wash to Portland Bill would separate the two - sand and gravel to the south and crushed rock plus limited sand and gravel outcrops to the north. Land-based quarries satisfy some 76 per cent of the nation's needs, and marine aggregates provide five per cent. Recycled and secondary aggregates are of growing importance and now contribute around 19 per cent.



Land aggregates

Aggregates are plentiful in most parts of the UK. Local resources can, therefore, often satisfy local needs. Aggregates are only transported long distances when it is absolutely necessary because the cost can double for each 30 miles travelled and the environmental consequences of heavy lorries increase.

As with many raw materials, resources are not always distributed evenly and some inter-regional movement is necessary. The south-east, for example, has its own supplies of sand and gravel but relies heavily on crushed rock brought in by rail from the East Midlands and South West and by sea from Scotland and Wales. It also requires marine-dredged sand and gravel from coastal waters.



Crushed rock

Rock quarries have long lives and the way they are worked means that progressive restoration opportunities are more limited than those for sand and gravel. However, modern techniques allow faces to be restored by planting trees, shrubs and grass when quarrying has been completed.

Three main types of rock are used to produce crushed rock aggregates:



Sedimentary Created by settlement of particles (eg gritstones) or organic remains (eg limestone) in ancient seas



Metamorphic Created by heat or pressure (eg hornfels, quartzites)



Igneous Solidified molten rocks (eg basalt, granite)

Sources of aggregates



Sand and gravel

Sand and gravel derives from the erosion of particles that were transported and deposited by water or ice.

These quarries are usually shallow, sometimes only five or six metres deep. Operations are likely to be shorter term than for a rock quarry and, with progressive restoration normally following closely behind extraction, the working area can be comparatively small.

Marine aggregates

At a time when land-based quarrying is under increasing environmental pressure, aggregates from the sea are an additional resource that is growing in importance. Government policy is that at least seven per cent of the UK's aggregates needs should come from the seabed. Some 72 per cent of marine aggregates are used in the UK while 28 per cent goes to mainland Europe.

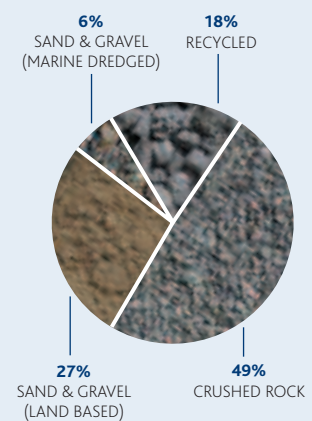
Direct delivery of marine aggregates to rail-linked wharves on the Thames effectively removes the equivalent of 50,000 lorry loads from the streets of London every year.

Licensed areas for dredging account for less than one per cent of the seabed around the UK - and some 90 per cent of all material is sourced from just 21 square kilometres.

The industry accepts its responsibility to operate with care and concern for other users of the sea and in particular for our coastline, beaches and marine ecology. Operators believe this challenge should be approached as a partnership with all the other parties involved and have instigated a voluntary initiative designed to restrict dredging to the level necessary to meet society's needs.



Shares of Aggregate Supply for Great Britain (2000 est)



Recycled and secondary aggregates

Recycled and secondary aggregates are making an increasingly important contribution to the UK's needs. By reducing unnecessary demand on primary aggregates, they are helping the industry to become more sustainable. Current use of recycled and secondary aggregates is estimated to be 45 to 50 million tonnes per annum.

Recycled aggregates are produced from demolition and construction waste. Secondary aggregates include a range of industrial by-products and wastes such as colliery spoil, china clay waste, slate waste, power station ash, blastfurnace slag and even green glass that is not commercially recyclable. The most widely available and widely used resource from this sector is construction and demolition waste.

The challenges that go with recycled and secondary aggregates are fourfold:

- **environmental** - the recovery, processing and transport of recycled materials have some similar environmental impacts as those for primary aggregates. The right environmental balance of supply has to be struck
- **technical** - quality constraints have to be considered. Concerns about product quality and an absence of adequate technical specifications have inhibited wider use of recycled materials in some cases
- **economic** - recycling isn't always cheaper. Transport costs, for example, can make recycled aggregates expensive in areas where they do not occur
- **supply** - only a finite amount of material is available to recycle. In urban areas, for example, the use of demolition waste is a well-established process

How a rock quarry works

Rock quarries usually operate for at least 30 years and are developed in distinct 'benches' or steps. A controlled explosion is normally used to release the rock from the working face. It is then transported by truck or conveyor to a crusher to go through a series of crushing and screening stages to produce a range of final sizes to suit customers' needs.

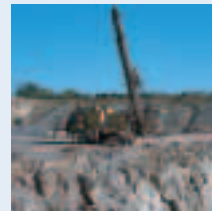
Working in quarrying

Quarries are important rural employers and offer a range of interesting job opportunities - from operating massive and expensive machinery at the quarry face, to managing an entire site, or to providing specialist service advice. Quarry companies take their training responsibilities seriously and work closely with EPIC, the national training organisation for the

extractive industries. Through EPIC, and through other internal and external training schemes, an increasing number of employees are achieving national vocational qualifications. Health, safety and environmental considerations feature strongly in training agendas across the length and breadth of the country as these issues are of paramount importance for business success.

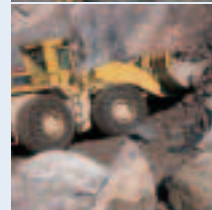
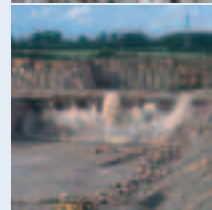
1 Drilling

Soils are removed and stored for use in landscaping and restoration. A drilling rig then drills a series of strategically-located and angled holes in the underlying rock.



2 Blasting

An experienced and licensed shot-firer charges each hole with just sufficient explosive to break the rock and to drop it into a neat pile. In the quarry shown, blasting takes place twice a week, releasing about 15,000 tonnes on each occasion.



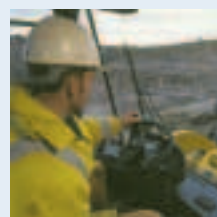
3 Loading and transport

A powerful excavator loads the rock into 65-tonne quarry dumper trucks for delivery to the primary crusher.



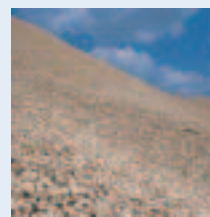
4 Haul roads

Safety is paramount on the quarry haul roads, the edges of which are protected by substantial barriers.



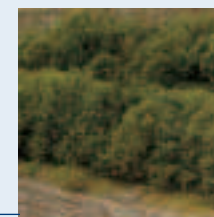
6 Stockpiles

Larger rock together with soils and clays are separated at this stage. The rock may be used for the base layer in roads while soils and clays, known as 'scalpings', are required for bulk fill.



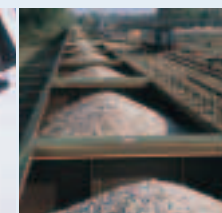
11 Landscaping and restoration

While the quarry continues to be worked deeper, its impact is being reduced by progressive restoration of the upper faces and by planting on the benches that have been completed. Soils have also been used to create a screening mound that breaks distant views into the quarry. The site offers a range of important wildlife and plant habitats.



8 Storage

This quarry has both storage silos and covered storage bays. The stone is stored in a range of sizes: 40mm, 28mm, 20mm, 14mm, 10mm, 6mm and dust. It is drawn from here for a variety of end uses.

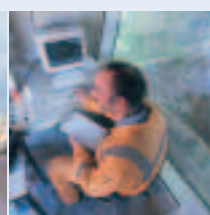


9 Dry stone loading

Lorries use pre-programmed 'smart cards' to load automatically. Dry stone is generally delivered over a 30-mile radius. Some large quarries also have rail connections for longer distance deliveries, so reducing the impact of lorries on the roads.

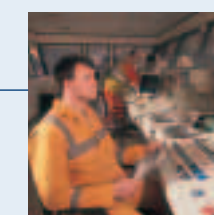
5 Primary crusher

Powerful hammers within the primary crusher break the rock down. An operator supervises the process from an air-conditioned control room. From this point, the process is fully enclosed to control both dust and noise.



7 Screening

The rock passes through a series of screens that sieve it into different sizes. It may also pass through further crushing stages.



10 Asphalt plant

This quarry has a plant that coats the stone with bitumen to create asphalt for use in surfaces ranging from motorways and runways to driveways. Many quarries also have plants that mix the stone with cement to make ready-mixed concrete, and some have factories to make concrete blocks.

How a sand & gravel quarry works

Sand and gravel quarries are much shallower than rock quarries and are usually worked and restored in progressive phases. This means that the area exposed for quarrying at any time can be minimised and land that has been 'borrowed' is out of productive use for a limited period.



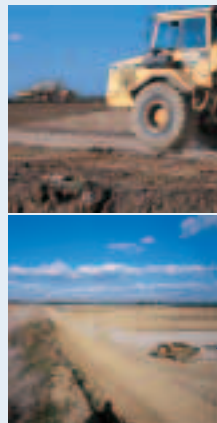
The majority of marine extraction involves 'trailer' dredging. A draghead connected to powerful suction pumps is trailed along the seabed while the vessel moves at between one and three knots. Satellite navigation enables the ships to work to within five metres accuracy.

Marine aggregates



Soil removal and storage

Careful stripping, storage and subsequent replacement of soil are fundamental to good agricultural restoration. Care is taken to avoid unnecessary compaction during the stripping stage and to store topsoil separately from subsoil. Such standards may well result in restored farmland ultimately achieving a higher quality.



Silt settling ponds

Washing of the gravel during processing leaves sediment that is then left to settle in a series of silt ponds. Clean water may be discharged into a local river or recycled into the production process. The fertile silt may be used in restoration.



Inert fill

This quarry is using inert material to allow the land to be returned to its former contours.

Screening banks

Soils that have been stripped are often used to create banks to screen specific parts of the site during operation.

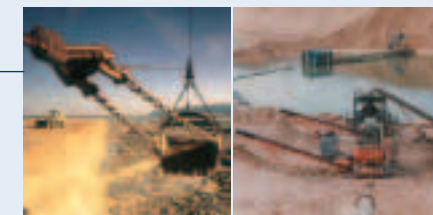
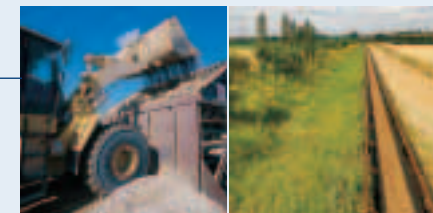


Restoration

The quarry shown is being progressively restored to agriculture. It will also have a lake to attract wildlife. Other sites may offer opportunities for restoration as nature reserves or for water-based leisure, sports pitches, forestry or for some form of development.

Hopper and field conveyor

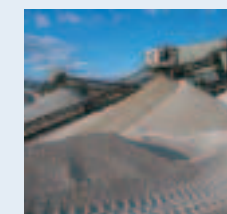
In the quarry shown, raw material is loaded into a hopper that feeds it onto conveyors for transport to the processing plant. Other quarries may transport the material by lorry.



Extraction area

The area actually being quarried at any time is minimised by ensuring that restoration runs hand-in-hand with extraction. Quarries like the one in our main photograph are pumped to allow them to be worked 'dry'. Others, like the one shown left, are operated as lakes with the aggregate extracted from below water.

Gravel stockpiles



Processing separates gravel into a range of sizes. Greatest demand is for 10mm, 20mm and 40mm gravel. Some plants include a crushing unit to break down larger stones. Lorries are loaded from the stockpiles.

Sand stockpiles

Sand separated from gravel during processing is then de-watered before passing to stockpiles.



Site of Special Scientific Interest

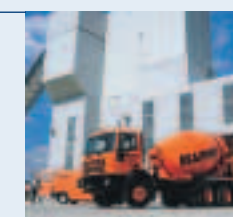
An area of ancient woodland is protected within this site. Other quarries give special protection to archaeological remains.



Weighbridge

Every load leaving the site passes over a weighbridge to ensure that the customer receives the quantity he requires. Larger quarries may use computerised systems that automatically load the required grade and quantity.

Ready-mixed concrete plant



This quarry incorporates a ready-mixed concrete plant. Here, sand and gravel are mixed with cement to produce one of our most important building materials. Other quarries may have an asphalt plant making surfacing for roads.

Processing plant

A conveyor draws raw material from a stockpile into the plant where it is washed to remove unwanted clay and to separate sand. Gravel then passes over a series of screens that sieve the material into different sizes. The process is controlled from a central control room.

Quarry products

Strength provided by quarries is keeping you safe at this very moment. If you are in a building, aggregates are sheltering you. If you are travelling by road or railway, they are beneath you. If you happen to be in an aeroplane you will have particularly good reason to thank aggregates for a safe landing! And if you took a bath or shower this morning, the pure water - filtered through sand - came to you courtesy of concrete pipes. All this comes from quarries.



Asphalt

Asphalt keeps our feet (and wheels) safely on the ground. As the surface for some 95 per cent of our roads as well as for playgrounds, car parks, airport runways and much more, it is resilient and versatile.

The aggregates industry produces 26 million tonnes of asphalt every year. While the strength comes from stone, the bonding mechanism is an oil-based bitumen. The 'recipe' is varied to suit the end use. Greater skid resistance, increased durability, reduced noise and less spray are just some of the properties offered by the latest range of asphalts. National and local highway authorities are now making increasing use of low-noise asphalt road surfaces.

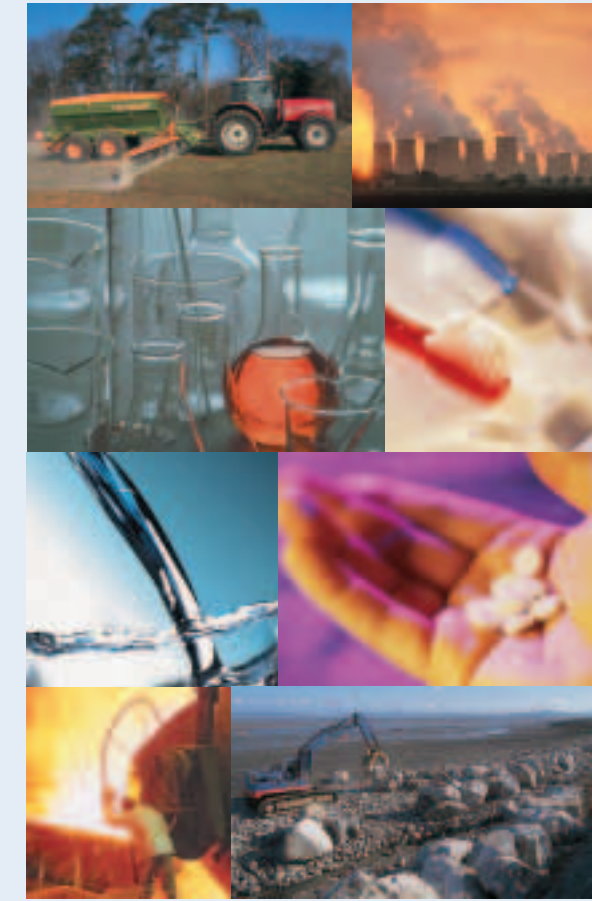
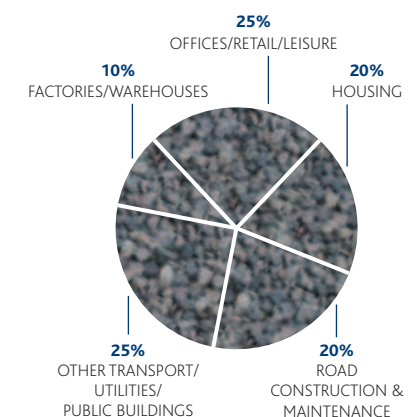
Asphalt production plants are normally situated in quarries, but they may also be temporary installations on a major road or airfield site. The production process involves blending the aggregates and then heating them to a temperature suitable for coating with a bitumen binder.

Ready-mixed concrete

Concrete is the most universal of all construction materials. Widely used in all types of construction, concrete provides the hidden strength in foundations, floors, walls and roofs. Concrete also partners and underpins the other major structural materials - steel, timber, brick and glass. Without it, none of the others can function. Particularly with high quality modern finishes, it can also provide an attractive outer face for buildings and structures.

Made from a carefully balanced mix of aggregates, cement and water, ready-mixed concrete is produced at strategically located plants. There are some 1,150 such plants in the UK producing around 23 million cubic metres a year.

End Uses of Aggregates (2000 est)



Amazing aggregates

Some less familiar uses of aggregates:

- **for agriculture** - ground limestone neutralises acidic soils
- **for power stations** - powdered limestone is used to clean chimney stack emissions
- **for glass** - silica sand is used to make bottles, jars and glasses
- **for steel** - burnt lime is used to make steel
- **in toothpaste** - powdered limestone is a gentle abrasive
- **in medicines** - pills are made from finely crushed rock
- **for our water** - special sands are used for filtering drinking water - stone is used to clean dirty water
- **for beach and coastal protection** - large rocks are used as breakwaters, while sand is pumped onto eroded beaches to increase protection and to restore their attraction to tourists

Borrowed land

Restoring quarried land is one of the great skills of the industry. Extraction of minerals is a temporary land use which may last no longer than 10 years for sand and gravel, and perhaps 30 years or more for a typical rock quarry. Restoration is usually phased through the life of a site and may involve a return to the previous use. Alternatively, it may offer a once-only opportunity for change to a new use that benefits wildlife and the community. The industry is, therefore, constantly recycling land, a resource that is in reality only borrowed - and is usually returned with interest!



Thorpe Park, Surrey



Holme Pierrepont, Nottingham



Cotswold Water Park



Restoration Awards Scheme which, over more than 30 years, has rewarded excellence at some 400 sites.

Sand and gravel

The majority of sand and gravel quarries have been returned to agriculture and there is increasing awareness of the contribution restored sites can make to wildlife habitats and to promote biodiversity. The progressive nature of this type of quarrying means that restoration can follow closely behind extraction so the land can be returned to farming in a matter of months.

Careful stripping, storage and handling of soils is fundamental. Working of the site will always be against the background of a restoration scheme agreed at the outset.



Restoration achievements by Britain's sand and gravel quarries are some of the finest in the world. Often, the industry leaves no mark at all - restored farmland may well be of a higher quality than that which existed previously. More spectacularly, the industry has given us Thorpe Park in Surrey, the Holme Pierrepont national watersports centre near Nottingham and the Cotswold Water Park. It has also created numerous wildlife reserves, golf courses, sports pitches and much more. These and many other sites have featured in the Quarry Products Association's annual

Rock quarrying

Rock quarries offer a very different restoration challenge. Usually much deeper than their sand and gravel counterparts and involving progressively deeper working of the same limited area, opportunities for progressive restoration are more limited.

Modern techniques do, however, mean that the upper 'benches' can be treated and planted as they are completed. While the final quarry floor can often be successfully returned to agriculture, such sites have much to offer for forestry, nature conservation, water-based leisure and country parks.



Tree planting

Through its landscaping and restoration programmes the quarrying industry is probably the UK's biggest planter of new trees. Over the last 10 years, Quarry Products Association members have planted many millions of trees and shrubs.



Biodiversity

The quarrying industry's compatibility with nature is not always appreciated. A survey has identified that more than 100 Sites of Special Scientific Interest (SSSIs) have been created by QPA members. English Nature has estimated that some 700 SSSIs owe their origins to the minerals industry. Partnerships with conservation bodies, local government and communities are fundamental. The industry is playing an important role in helping to achieve the government's biodiversity targets and the Quarry Products Association has signed a landmark joint statement of intent with English Nature and the Silica and Moulding Sands Association designed to encourage environmentally sustainable development.

Quarrying in Society

The contribution the quarrying industry makes to local communities is substantial, though often unseen. Quite apart from its products, it also provides precious rural jobs and invests in local services. As an industry which operates in the countryside, it nonetheless has the potential to impact upon its neighbours and accepts the need to maintain close relationships and to set high standards of performance.



Part of the community

Quarries tend to be located in rural areas and operators are usually an important contributor to community life. Companies welcome organised visits to their sites and open days are especially popular. Particular assistance is given to schools, which find that local quarries offer rare opportunities for added interest in studies across wide areas of the curriculum. Some quarries have formal liaison committees comprising of council officers and community representatives as a means of ensuring regular dialogue.

Awards

The QPA encourages high site standards through two award schemes, one for restoration and another for general site housekeeping standards. Around 160 sites a year are vetted under the latter scheme, a comprehensive environmental process that checks everything from external visual appearance to dust control.



Archaeology

Some of the most exciting archaeological discoveries have been made as a direct result of quarrying. Finds over recent years have included a Saxon warrior king's helmet in Northamptonshire, a vast Roman amphitheatre in Yorkshire and a bronze age logboat in Derbyshire. All have added greatly to the better understanding of our past. The industry operates to a CBI code of practice, giving its full co-operation and extensive funding to ensure that archaeologists have every opportunity to unlock the hidden secrets of a site before, and during, quarrying.



Play Safe...Stay Safe

The industry mounts a major campaign at the start of each summer to alert children to the dangers of playing in quarries. The Quarry Products Association's Play Safe...Stay Safe resource pack includes a video and a series of project cards designed to help teachers use the subject within the national curriculum.

A good neighbour

The Quarry Products Association has launched a nationwide scheme designed to encourage collective commitment amongst members to a common Good Neighbour code. Those operating the scheme promise to be caring, clean, considerate, committed and co-operative.



The Quarry Products Association welcomes comments and requests for further information about the industry's work

Providing Essential Materials for Britain

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