Igneous rocks are the principal source of aggregates in Scotland. Of total land-won extraction of all minerals in Scotland in 2004, aggregates accounted for about 73% and igneous rock 53%. Of the other minerals produced in Scotland, opencast coal is the most important.

Igneous rocks are hard, crystalline rocks, which were formed by the cooling and solidification of molten rock (magma) either at, or below, the Earth's surface. They are commonly divided into two main groups; intrusive igneous rocks, formed from molten rock solidified at varying depths below the Earth's surface, and extrusive (volcanic) igneous rocks, formed from lava flows and fragmental volcanic ash (tuff) erupted or ejected at the Earth's surface.

Metamorphic rocks were formed by the alteration (metamorphism) of both pre-existing igneous and sedimentary rocks either by heat (thermal metamorphism) or by heat and pressure (regional metamorphism). A wide variety of metamorphic rocks occur in the Highlands of Scotland, many of which, like igneous rocks, are hard and resistant and suitable for use as aggregates. Igneous and metamorphic rocks are commonly included together in descriptions of the minerals industry, and also in official statistics; this is the case in this factsheet.

A glance at a geological map of Britain shows that igneous and metamorphic rocks are overwhelmingly concentrated in Scotland where they are widely distributed and produced on a substantial scale. They are used almost entirely as sources of crushed rock aggregate and, to a much smaller extent, building stone (see Factsheet on Building Stone).

Demand
A variety of rocks are, when crushed, suitable for use as aggregates. Their technical suitability for different aggregate applications depends on their physical characteristics, such as crushing strength, porosity and resistance to impact, abrasion and polishing. Higher quality aggregates are required for demanding applications, such as in road pavements and in concrete. Lower quality aggregates may be acceptable for applications, such as constructional fill, capping layers, type 2 sub-base and as local variants to type 1 sub-base. Similarly lower quality material may be acceptable in situations of low intensity of use. Igneous rocks and some metamorphic rocks generally produce good quality aggregates.

Aggregates are the most important minerals produced onshore in Scotland. They are essential for constructing and maintaining what is literally the physical framework of the buildings and infrastructure on which our society depends.

Aggregates are defined as being hard, granular, materials which are suitable for
Igneous rock

use either on their own or with the addition of cement, lime or a bituminous binder in construction. Important applications include concrete, mortar, roadstone, asphalt, railway ballast, drainage courses and bulk fill. European Standard (EN12620: 2002) defines aggregates as ‘granular material used in construction. Aggregate may be natural, manufactured or recycled.’ These are defined as:

**Natural aggregate** — aggregate from mineral sources which has been subject to nothing more than mechanical processing (crushing and sizing);

**Manufactured aggregate** — aggregate of mineral origin resulting from an industrial process involving thermal or other modification, e.g. slag;

**Recycled aggregate** — aggregate resulting from the processing of inorganic materials previously used in construction, e.g. construction and demolition waste, and road plantings.

In Britain, however, it is common practice to distinguish between primary aggregates and alternative sources, such as secondary aggregates and recycled aggregates.

**Primary** aggregates are produced from naturally-occurring mineral deposits, extracted specifically for use as aggregate and used for the first time. Most construction aggregates are produced from hard, strong rock types by crushing to produce crushed rock aggregate or from naturally-occurring particulate deposits such as sand and gravel. In England and Wales the most important source of crushed rock aggregate is limestone. In Scotland, reflecting the underlying geology of the country and, notably, a paucity of limestone resources, igneous rocks are the most important source of aggregate.

**Secondary** aggregates are usually defined as (a) aggregates obtained as by-products of other quarrying and mining operations, such as china clay and slate waste, or (b) aggregates obtained as by-products of industrial processes, such as blastfurnace/steel slag, coal-fired power station ash and incinerator ash. In European specifications, mineral waste sold as aggregate is classified as a natural aggregate, and by-product aggregate derived from industrial processes is classed as manufactured aggregate. In Britain the term ‘secondary aggregate’ is also often used to refer to mineral that is produced as an ancillary activity to the primary product, whether that is limestone for industrial use or higher qualities of aggregate. Consequently the term ‘secondary aggregate’ is becoming increasingly unclear and may require more rigorous definition or replacement.

<table>
<thead>
<tr>
<th>Major use</th>
<th>Thousand tonnes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadstone, coated &amp; surface chippings</td>
<td>3 195</td>
<td>13.9</td>
</tr>
<tr>
<td>Roadstone, uncoated</td>
<td>6 322</td>
<td>27.6</td>
</tr>
<tr>
<td>Concrete aggregate</td>
<td>2 181</td>
<td>9.5</td>
</tr>
<tr>
<td>Graded aggregate</td>
<td>6 147</td>
<td>26.8</td>
</tr>
<tr>
<td>Rail ballast</td>
<td>1 036</td>
<td>4.5</td>
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<tr>
<td>Armourstone/gabion</td>
<td>175</td>
<td>0.8</td>
</tr>
<tr>
<td>Constructional fill</td>
<td>3 866</td>
<td>16.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22 922</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 1 Scotland: Sales of igneous rock by major aggregate use, 2005.
(Source: Annual Minerals Raised Inquiry, Office for National Statistics).

Igneous rocks tend to produce strong aggregates and with a degree of skid resistance they are suitable for many road surfacing applications, as well as for use in
the lower parts of the road pavement. The high strength and attrition resistance of certain igneous rocks results in their use as railway track ballast. Igneous rocks are also used for concrete aggregate, particularly where alternatives such as sand and gravel and limestone are absent. Their suitability for aggregate depends mainly on fabric and texture (mineral grain size), together with the degree of alteration or weathering they have undergone. Some igneous rocks are valued for their distinctive colours, notably those that are red. Table 1 shows sales of igneous rock in Scotland by major end-use. Most aggregate is used as roadstone in new road building, and repair and maintenance. Smaller amounts are used as concrete aggregate, as railway track ballast and, in substantial amounts, as constructional fill.

Demand for aggregate, and thus igneous rock, is driven by activity in the construction industry and the economy as a whole. The major conurbations of the Central Belt of Scotland is where the main demand for igneous rock aggregate is generated. However, Europe and England, particularly South East England, also account for some 25% of total demand. Igneous rock serving these markets is shipped out by sea.

The Scottish Executive recognises the strategic importance of the construction industry to the Scottish economy and consequently the need for minerals to serve it. The construction of roads, housing, schools, offices and industrial buildings together with other infrastructure requirements such as rail links, airport facilities, and water and sewage facilities, all depend, to varying degrees, on a continuing and steady supply of construction aggregates.

As part of its commitment to sustainable development, the Scottish Executive wishes to maximise the contribution made by recycled and secondary sources to total aggregates supply. However, despite an increase in the use of recycled aggregate, it is likely that the major proportion of future aggregate demand in Scotland will be supplied from primary sources and igneous rock in particular.

### Supply
A range of aggregate types contribute to overall supply in Scotland (Figure 1). Crushed rock, and sand and gravel are the most important sources, accounting for...
an estimated 85% of the total. Substantial quantities of alternative materials are also being used, notably recycled construction, demolition and excavation waste (4.3 million tonnes in 2003). However, igneous rock is by far the most important contributor to overall supply, accounting for an estimated 58% of total aggregate supply and about 93% of total crushed rock aggregate production. Sales of crushed rock and the contribution made by igneous rock for the period 1974-2005 are shown in Figure 2.

The increase in igneous rock production after the late 1980s corresponds with the large coastal quarry at Glensanda on Loch Linnhe on the west coast of Scotland coming into operation in 1986. Since then production has been relatively stable. The marked increase in production in 2004 is believed to be due to an improved coverage of operational quarries by the Annual Minerals Raised Inquiry rather than a marked increase in demand. The regional distribution of igneous rock production in Scotland is shown in Figure 3.

**Trade**

Scotland has very large resources of rocks that can be profitably worked for use as aggregate and imports have, therefore, not been necessary. Small quantities of aggregate from coastal quarries in Norway are believed to be landed in central Scotland but the amounts are not known. Scotland is, however, a significant net exporter of igneous rock mainly from Britain’s only large coastal quarry at Glensanda on Loch Linnhe in western Scotland. All of the 6 Mt/y output of the quarry is transported by sea with the major proportion (about 60%) being exported to Europe through depots in the Netherlands, Germany, France and Poland. The remainder is shipped to England, mainly...
South East England, through terminals on the Isle of Grain in Kent and Southampton. Smaller quantities of coloured aggregates are also exported to the continent from other sites.

There is significant potential for Scotland to increase exports of igneous rock. The Glensanda Quarry has not yet reached its design capacity of 15 Mt/y and there are a few other coastal sites that are capable of being developed as large coastal exporting quarries. However, such developments raise substantial environmental concerns. The potential for developing smaller-scale units may be greater and have less impact. However, the use of smaller vessels would effect economies of scale.

Consumption
Igneous rocks are consumed in greater quantities in Scotland than any other mineral. As Scotland is a net exporter of igneous rock it is estimated that total consumption of igneous rock is about 17 million tonnes, giving a per capita consumption of 3.4 tonnes.

Economic importance
The value of igneous rock production in Scotland is estimated at about £190 million based on ex-quarry sales. However, this figure considerably undervalues the contribution that aggregates make to the construction industry and to the Scottish economy as a whole. For example, transport is the key element of the supply process and of the delivered price of aggregates, and a substantial industry is required to move aggregate to the market.

More importantly, however, aggregates are at the start of the supply chain and are sold in a number of value-added products, including coated roadstone, concrete products and ready-mix concrete. These too are near the start of the supply chain and the ultimate value of aggregates resides in their use by the construction industry in buildings and infrastructure.

Igneous rock quarries and their associated infrastructure and transport requirements are significant employers, both directly and indirectly; many of these are in rural areas.

Structure of the industry
There are over 100 igneous and metamorphic rock aggregate quarries in Scotland. These range from single quarry owners to multi-national companies operating many sites. The largest producer, with an output of about 6 Mt/y, is Foster Yeoman Ltd, which operates the large Glensanda Quarry. This single site accounts for about 25% of igneous rock production in Scotland. The company has been acquired by Aggregate Industries.

Other major producers who all operate several (>10) quarries are:
- Tarmac Group
- Ennstone Thistle
- Bardon Aggregates (Aggregate Industries)

Other important producers are: Cloburn Quarry Co Ltd, Cemex UK Materials, Hillhouse Quarry Group Ltd and Hanson Aggregates. A further 35 operators also contribute to total supply.

The Quarry Products Association (QPA) is the principal trade association representing the aggregates industry. The British Aggregates Association (BAA) represents independent and privately-owned quarry companies throughout the UK.

Resources
Scotland has very large resources of hard rock suitable for use as aggregate and...
almost all of these comprise igneous and metamorphic rocks. A broad assessment of aggregate resources in Great Britain carried out in 1975 for the Advisory Committee on Aggregates (the Verney Committee) estimated that resources of igneous and metamorphic rock in Scotland were 4000 billion tonnes, accounting for about 85% of the total for Great Britain.

Igneous rocks as crushed rock aggregate

Both intrusive and extrusive igneous rocks are quarried for crushed rock aggregates in Scotland, although the latter are the more important. Igneous intrusions are classified according to shape, size and relationship to adjacent rocks. Plugs (volcanic neck intrusions) are vertical pipe-like bodies; dykes are usually steeply inclined sheets discordant with the bedding in the host rocks; sills are gently inclined sheets usually concordant with the bedding of adjacent rocks. Large stocks and bosses (plutons) show a range of contact features with conspicuous metamorphism and alteration of surrounding rocks. The type of intrusion has a considerable bearing on yields. Quarries developed in large plutons can be developed to depths of several hundred metres whilst sills and dykes are relatively thin or narrow.

Large intrusions usually cooled slowly to give coarse-grained rocks, whereas smaller masses (dykes, plugs and thin sills) cooled more rapidly to form medium to fine-grained rocks. In many of the thicker basic sills there is a pronounced vertical variation in grain-size, texture and mineral composition.

The rocks are further divided according to silica content into acid (>66% silica), intermediate (52-66% silica), basic (45-52% silica) and ultrabasic (<45% silica).

The majority of the igneous intrusions in Scotland are formed of either acid or basic
Igneous rock

rocks; basic fine-grained ones being varieties of basalt and medium-grained ones of dolerite; coarse-grained ones of diorite and gabbro are rarely exploited. Fine- to medium-grained, acid to intermediate intrusions are common as sills, dykes and plugs of felsite and trachyte but are little quarried. Coarse-grained acid rocks, including granite and granodiorite, are more extensively quarried because of their lateral and vertical extents.

Extrusive rocks are mainly lava flows. These rocks cool rapidly at the surface to form fine-grained or glassy rocks. A feature of many lavas are larger individual crystals (phenocrysts) in a fine-grained matrix; these rocks are described as being porphyritic. The former presence of gases in the lava melt is reflected in the occurrence of gas cavities (vesicles) often filled with minerals such as agate (amygdales).

Lavas form irregular sheets; individual flows can exceed 30 m in thickness but are often less. The profile of each flow usually consists of a slagggy, rubbly top, compact heart and rubbly, slagggy base. Reddened weathered tops to lava flow indicate surface weathering at the time of eruption. Variation in thickness laterally in lava flows is quite common and restricts their use as aggregate to some degree.

The majority of lavas worked for aggregate are basic rocks such as basalts or basaltic andesite. Acidic rocks such as trachyte and rhyolite are also quarried locally.

As has long been recognised in mineral planning, rock resources can only be exploited where they occur geographically. Resources of igneous rocks are overwhelmingly concentrated in the remote upland areas of the Highlands where demand is limited. Quarrying of igneous rocks is, however, centred on those outcrops which are best placed to serve the main markets, unless at coastal locations with seaborne access.

Elsewhere extraction is mainly concentrated on small, fine to medium-grained intrusions, mostly of dolerite, such as in the Midland Valley. Extrusive volcanic rocks are generally more variable in quality, although Carboniferous volcanics are worked in central Scotland.

Coarse-grained granite intrusions are not generally extensively quarried despite their large size, as they usually produce relatively weak aggregates. In the western Highlands of Scotland there are large intrusions of granite and these are worked at a few localities for crushed rock aggregates. Of particular importance is the Strontian Granite on the northwest side of Loch Linnhe and here, at Glensanda, the granite is quarried on a very large scale for aggregate production. The granite aggregate from Glensanda is of high quality material and used for roadstone, rail track ballast and concreting aggregate.

Some igneous rocks may be deeply weathered or heavily mineralised or found as relatively narrow intrusions in ‘soft’ rocks. Working these materials may therefore require removal of substantial quantities of overburden and careful planning of blasting, extraction and processing operations is required to maximise recovery and to ensure quality.

Many metamorphic rocks, notably schists, are foliated or highly micaceous, which reduces their value as aggregates. Non-foliated varieties such as some gneiss and quartzite are used for aggregates. Lewisian Gneiss is worked at several sites in the Western Isles, as are some Dalradian and Moine quartzites.
Regional distribution of igneous rocks in Scotland

In the Highlands (Aberdeen, Aberdeenshire, Highlands, Morayshire and Argyll and Bute) there are 34 quarries of which 15 are in coarse-grained igneous rocks (mainly granite, and two in basic igneous rocks of the Belhelvie and Insch Masses. The granitic rocks worked are the Corennie, Cove, Kemnay and Peterhead Granites in the Aberdeen area, Monadhliath Granite near Aviemore and the Strontian and Etive Granites, the Crathes Granodiorite and the Reay Diorite. On Arran, the Arran Granite and two acid Palaeogene (Tertiary) felsite sills are extracted. The Strontian Granite is host to the Glensanda Quarry. Much younger rocks, the basalt lava flows of the Palaeogene (Tertiary) Mull and Skye Lava Groups, provide aggregate to these isles.

Central Scotland, with over 40 igneous rock quarries has a provinciality that reflects local geology. In the north and east, Angus, Perth & Kinross and Clackmannanshire between them have six working quarries all in Lower Devonian basalt and andesite lavas (Ochil Volcanic Formation) with a further such site located in north Fife. All these quarries are located in either the Sidlaw or Ochil Hills. Important decorative as well as other aggregate types are extracted from Siluro-Devonian felsite intrusions at only two sites located in Fife (Balmullo) and South Lanarkshire (Cloburn). In East Ayrshire, coarse-grained diorite is extracted at Tincornhill (Sorn).

Medium to coarse-grained intrusive igneous sills of dolerite dominate production in the central belt of Scotland. The Midland Valley Quartz-dolerite Sill complex in central and eastern parts of Central Scotland is the setting for two quarries each in Edinburgh and Fife, three in Falkirk and seven in North Lanarkshire. This widely distributed rock type is particularly favoured because of its thickness that commonly exceeds 60 m but locally is more than 130 m. Basic dolerite sills (of Carboniferous to Permian ages) account for one quarry each in Edinburgh and Fife in the east and, in the west one in South Lanarkshire, two in Renfrewshire and three in South Ayrshire. These sills are often similar in thickness to the Quartz-dolerite but more locally distributed.

Working quarries in the basaltic lavas of Lower Carboniferous age (Clyde Plateau Volcanic Formation) are found in Argyll & Bute (2), East Renfrewshire (2) and Renfrew (1) in the west and acid lava (rhyolite) is extracted at one site in North Ayrshire. In the eastern part of the central belt, trachytic (acidic) Carboniferous lavas (Garleton Hills Volcanic Formation) house two working sites in East Lothian. Two basaltic plugs of similar age to all these lavas are exploited in West Dunbartonshire on the north side of the Firth of Clyde.

In the South of Scotland (Scottish Borders, Dumfries and Galloway), there are only four working igneous rock quarries including one in the Criffel Granite, one in a Siluro-Devonian acidic intrusion and two in basalt Carboniferous plugs.

Reserves

In mineral planning, the term ‘reserves’ or ‘mineral reserves’ refers to mineral that has a valid planning permission for extraction. Without a valid planning permission no significant mineral working can legally take place. Continuity of mineral supply thus depends on land with workable deposits having planning permission for extraction. There is currently no up-to-date information on permitted reserves of aggregates or igneous rock for Scotland, although a survey is currently being carried out. The last survey of
permitted reserves was undertaken in 1993, when there were some 940 million tonnes of crushed rock in active and inactive sites, the major proportion of which would be igneous rock. Permitted reserves of granite at the Glensanda Quarry are some 400 million tonnes.

Commonly a ‘landbank’ is quoted for aggregate minerals, which is the sum of all permitted reserves in active and inactive sites at a specified time, and for a given area. It is usually expressed in terms of years supply at an average rate of output. The landbank is the key indicator in assessing when new permissions should be considered. The minimum length of a landbank reflects the time needed to obtain planning permission and to bring a site into full production. In Scotland a minimum 10 year landbank is proposed.

Relationship to environmental designations
The increasing number and extent of landscape, nature conservation and other designations of international, national and local importance, in conjunction with constraints relating to other factors (groundwater, airports, archaeology), is significantly reducing the choice of potential sites for the extraction of aggregates. Aggregates can, however, only be produced where the geological resources exist. The igneous rocks of Scotland, and particularly in the Highlands, give rise to some spectacular mountain scenery. Large areas are, therefore, designated for their landscape quality, although most of these are remote from sites that are likely to be of economic interest.

The extent of the principal landscape and nature-conservation designations in Scotland is shown in Figure 5.

Figure 5 The extent of the main landscape and nature conservation designations in Scotland.

Extraction and processing
Few rocks can be used ‘as dug’ and the purpose of aggregates processing is to prepare the extracted material in a form suitable for use. This is normally defined in terms of particle-size distribution,
Igneous rock processing typically involves screening off clays and fines followed by a series of crushing and screening stages designed to produce material with specified size grades, but with the associated minimum production of fines. Products include both single sizes and...
material containing a range of sizes. Crushed rock sands may also be produced where natural sands are in deficit. For a few applications, such as asphalt filler, very fine material is required. Typically crushed rock is produced in various sizes, 40 mm, 28 mm, 20 mm, 14 mm, 10 mm and 6 mm being typical sizes. Some rock is also sold as mixes of sizes often referred to as ‘all in’ or crusher run. The particle size of the crusher product will determine the yield of saleable product. The finer the product, the more waste fines are likely to be produced. Particle shape may be an important consideration and together with the rock involved this will affect the type and range of plant. Considerable quantities of crushed rock go to value-added processing, such as the production of coated roadstone. Processing produces fines which can be difficult to sell and results in a waste product. In addition, rock that is contaminated with clay (known as ‘scalplings’) is screened out and may be sold as a low-grade, low value product. However, to some extent this has become more difficult because of competition from recycled materials, which have a cost advantage being exempt from the Aggregates Levy. Washing plants are, therefore, being specially built to treat this material and upgrade its quality.

By-products
Igneous rock aggregate producers have limited opportunities for producing by-products. However, almost all igneous rock quarries are capable of producing building stone to a greater or lesser extent, and small amounts of basalt are used to produce rock wool insulation.

The overburden from most aggregate quarries will be used for screening and ultimately for site restoration. Some may be sold for lower quality aggregate applications: clay and mudstone (shale), which are exempt from the Aggregates Levy, may be used as fill.

It is important that the use of all resources at a specific site are maximised.

Alternatives/recycling
The principles of sustainable development require that suitable alternative materials of all sorts now be considered as resources in the same way as primary minerals. Encouraging the efficient use of materials through construction practices and methods that consume less material is also an important element of this strategy. However, the issues are complex and alternative construction materials, such as cement, lime, steel and glass are all energy intensive to produce and transport. The extent that changing construction practice is currently having on aggregate demand is not known.

With aggregate minerals, physical properties such as strength and abrasion are not changed irreversibly in use, except for an element of decay. They can, therefore, be recovered, for example, from construction and demolition waste, and asphalt planings and used, at least for less demanding applications.

It is the Scottish Executive’s policy to maximise the use of alternatives aggregates where practicable and environmentally acceptable and to maximise the contribution from recycled and secondary aggregates sources. A survey of the arisings and use of construction, demolition and excavation waste in Scotland in 2003 estimated that of arisings of 10.8 million tonnes, 4.3 million tonnes was recycled as aggregate. Data on the use of secondary aggregates and asphalt planings is not available, but usage is likely to be small.
However, it should be recognised that potentially recyclable materials are relatively limited in their arisings (production) from a single source. They also need to be sourced carefully if consistent properties are to be assured to users. Moreover, it is increasingly recognised that their use is fast approaching their ceiling.

**Transport issues**

Aggregates are low value, high weight/volume products. Most aggregate is transported by road, the average delivered distance being about 40 km.

Primary aggregates are, where possible, produced close to major centres of demand so as to minimise costs. Large aggregate resources that are distant from major markets and with poor transport links may be only worked on a small scale. However, good transport links, notably by sea, and economies of scale may support the development of resources remotely located from major centres of demand.

Transport is a key element of the supply process. There are two main issues associated with the transport of aggregate. First are the environmental effects of the supply of aggregates immediately around the quarry (more distant transport movements are generally dissipated within the whole transport system). Second, since aggregates are probably the lowest value materials that are transported by road, rail and sea, the cost of transport is an important element of the final delivered cost of the aggregate.

The uneven distribution of aggregates resources and notably the almost complete absence of hard rock resources in southern and eastern England, means that there is substantial and increasing movement of aggregates within the UK. In Scotland most igneous rock is transported by road. There is some movement of igneous rock in Scotland for use as rail ballast but there are no rail-linked igneous rock quarries. Other than by road, the principal movement of aggregate is from Scotland to England by sea. The precise quantity is not known but unlikely to exceed 3 Mt/y. By far the largest tonnage is shipped from Scotland’s only large coastal quarry at Glensanda on Loch Linnhe in western Scotland, principally to the Isle of Grain in Kent or to Southampton. On the Isle of Grain some stone is transhipped onto barges for movement up the Thames to Tilbury, as well as to other ports in southern and eastern England.

Shipments from Glensanda are also made to other terminals, including Northfleet on the Thames, Liverpool and Newport, but also to Greenock. Coastal shipments of rock are also made from the Shetlands. Substantial tonnage of igneous rock from Glensanda are also exported to Europe.

The concept of large, remotely located quarries with seaborne access was recommended by the Advisory Committee on Aggregates (the Verney Committee) in 1975, notably to supply South East England. Since then a number of sites have been evaluated in Scotland to various levels of detail but only the Glensanda Quarry, developed by Foster Yeoman, has come into production. The site opened in 1986 and is adjacent to deep water capable of taking vessels with carrying capacities of up to 88 000 tonnes (dwt).

Glensanda is likely to remain Britain’s only large coastal quarry for the foreseeable future. However, Scottish Planning Policy 4: Mineral Working Consultation Draft (2005) states that where environmental concerns can be satisfied and where there is support from local communities, new coastal quarries may be acceptable in a limited number of locations.
Two economic instruments affect the supply of aggregates: the Landfill Tax and the Aggregates Levy.

The Landfill Tax was introduced on 1 October 1996 as a tax on waste disposal at landfill sites. The purpose of the tax is to encourage business and consumers to produce less waste, to discourage landfill and encourage waste minimisation and investment in other forms of material recycling and/or resource recovery. There are two rates of tax:

- £2/tonne for inactive or inert waste listed in the Landfill Tax (Qualifying Material) Order 1996. These are wastes which do not give rise to gases and have no potential for polluting groundwater;
- £21/tonne (from 1st April 2006) applying to all other taxable waste, subject to an escalator of £3/tonne a year up to a maximum of £35/tonne.

Some types of waste are exempt from the Landfill Tax, including mine and quarry wastes. Inert waste used in the restoration of active mineral workings and landfill sites was also given an exemption from the Landfill Tax in 1999. This tax stimulated greater recycling of aggregates, prior to the introduction of the Aggregates Levy. However, there are concerns that insufficient inert waste is now available to
restore mineral workings and in particular wet sand and gravel workings.

The Aggregates Levy was introduced at the rate of £1.60/t in April 2002. It applies to sand, gravel and crushed rock subjected to commercial extraction in the UK, including aggregate dredged from the seabed. It is intended to address the environmental costs associated with quarrying operations (noise, dust, visual intrusion, loss of amenity and damage to biodiversity) in line with the Government’s statement of intent on environmental taxation. Its objective is to reduce demand for virgin aggregate and encourage the use of recycled materials and secondary aggregates such as china clay waste, slate waste and colliery spoil, which are exempt. ‘Clay’ and ‘shale’ are also exempt.

The growth in the market share of recycled and secondary aggregates, which are mainly used for less demanding applications, has displaced some low-quality primary aggregates in applications such as fill because they are no longer competitive with non-taxed materials. Consequently it is reported that the build up of substantial stockpiles of mineral waste at some crushed rock quarries is creating disposal problems and sterilising reserves, as well as a loss of revenues. Therefore industry argues that although sales of primary aggregates have declined somewhat, this has not translated into decreased aggregate extraction because of the build up of unsaleable mineral waste.

**Planning for, and licensing of, extraction**

The planning system applying to aggregates consists of:

- the preparation, including public consultation, of development plans, particularly local plans and minerals subject local plans, which set out policies for extraction. These need to be conformable with Scottish Planning Policy; and

- the determination of specific planning applications by local authorities or by Scottish Ministers if an appeal is lodged.

**Scottish Planning Policy 4: Planning for Minerals (2006)** sets out the planning policy framework for the extraction of a number of minerals, including igneous rock, which is the most important mineral produced onshore in Scotland. It recognises that minerals are important national resources and that an adequate and steady supply is required for a variety of purposes. SPP4 also aims to safeguard minerals as far as possible for future use, encourage sustainable working practices and to minimise potential adverse impact on communities and the environment.

Sustainable development objectives relate to aggregate extraction and supply in a number of ways. In considering the overall use of resources, the extent to which aggregate can be sourced locally to demand centres is a significant issue because of the direct implications on fuel consumption and greenhouse gas emissions if aggregate is transported over greater distances by road. There are also the indirect effects related to vehicle life, amenity, accidents and the degradation of the road system. Other modes of transport such as rail and sea are more sustainable over long distances, but such options are few. There are no rail linked quarries in Scotland but some potential may exist for using the rural line network to deliver aggregate to major centres of demand in central Scotland.

Reduction of harm to landscape and habitats is an important sustainable development consideration. This can be
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minimised by proper location of quarries and good environmental management of sites. Aggregate extraction is a temporary use of land, albeit a sometimes protracted use, particularly for igneous rock. However, effective restoration can bring the site back into appropriate use and has been used to create new opportunities for habitats, biodiversity and geodiversity.

Sustainability considerations require that the use of recycled and secondary aggregates is maximised before primary aggregates are utilised. It is the aggregates industry’s policy to put recycled and secondary aggregates at the top of the supply chain. Currently in Scotland some 18% of total aggregate demand is supplied by alternative materials, mainly construction and demolition waste, with the capacity to supply about a quarter. However, primary aggregate, and particularly igneous rock, will continue to be required to supply a major proportion of Scottish demand. Currently Scottish internal consumption of aggregate is estimated at about 30 million tonnes a year, but with additional exports. Ensuring that sufficient reserves of the right quality are permitted to meet this demand will be a real challenge to the planning system. Part of that process is the application of effective safeguarding mechanisms to prevent the unnecessary sterilisation of aggregate resources so that they may be available for the future.

Landbank policies have been an important element of aggregate planning for many years at both national and local level. Landbanks relate to both years of supply and tonnage of supply in permitted reserves over that specified period. The purpose of these policies is twofold. First they set out a minimum provision that is considered the least amount required to maintain supply to the construction industry. Secondly they can provide a guide against which planning applications for extraction may be determined subject to detailed considerations.

Further information


Quarry Products Association
http://www.qpa.org/

British Aggregates Association
http://www.british-aggregates.com/

Scottish Executive
http://www.scotland.gov.uk/Home

University of Leeds—Mineral Industry Research Organisation
http://www.goodquarry.com

Waste and Resources Action Programme (WRAP)
http://www.aggregain.org.uk

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