

# DERBYSHIRE AND DERBY MINERALS LOCAL PLAN

## CEMENT SUPPORTING PAPER

FEBRUARY 2015



## **Contents**

## **Page**

1	Introduction and Background	1
2	National and Local Policy	1
3	Cement Manufacture	4
4	Resources	5
5	Demand	6
6	Production and Reserves	8
7	Conclusions	13



## **1. Introduction and Background**

- 1.1 Cement is a manufactured product. It is made by heating a carefully controlled mixture of limestone and clayey raw material at very high temperatures to firstly produce cement clinker which is then finely ground together with gypsum/anhydrite to create the finished cement; a dry white/grey powdery substance. The most important use of cement is in the production of mortar and concrete.
- 1.2 Cement is an essential constituent of concrete, which is a mixture of cement, and coarse and fine aggregate. When mixed with water it can be placed in situ or cast in moulds making it a highly versatile building material. Mortar (a mixture of cement, fine aggregate and water) is used for joining structural block and brickwork and plastering. Both concrete and mortar are vital and essentially irreplaceable construction materials for the building and civil engineering industries.<sup>1</sup>

## **2. National and Local Planning Policy**

- 2.1 The National Planning Policy Framework (NPPF) recognises that minerals are essential to support sustainable economic growth and our quality of life and that it is important, therefore, that there is a sufficient supply of material to provide the infrastructure, buildings, energy and goods that the country needs. It also recognises that minerals are a finite resource so it is important to make best use of them to secure their long term conservation.
- 2.2 There are no national demand targets for industrial minerals. Paragraph 146 states that Mineral Planning Authorities (MPAs) e.g. Derbyshire County Council and Derby City Council should plan for a steady and adequate supply of industrial minerals by co-operating with neighbouring and more distant authorities to coordinate the planning of industrial minerals to ensure adequate provision is made to support their likely use in industrial and manufacturing processes. Safeguarding or stockpiling should also be encouraged to ensure that the minerals remain available for future use.

---

<sup>1</sup> BGS, Minerals Planning Factsheets – Cement, March 2014

2.3 Additionally for particular uses, such as cement manufacture, the NPPF requires that MPAs should make provision for a stock (landbank) of permitted reserves of limestone to support the level of actual and proposed investment required to maintain or improve an existing plant or to provide a new kiln. For the maintenance and improvement of existing plant the landbank should be at least 15 years for primary cement materials (chalk and limestone) and secondary cement materials (clay and shale). To support a new kiln the landbank should be 25 years for primary and secondary materials. These figures apply to individual sites or feeder sites rather than the whole Plan area.

2.4 NPPF, paragraph 163, requires that, in preparing local plans, MPAs should develop and maintain an understanding of the extent and location of mineral resources in their area and assess the projected demand for their use taking into account any opportunities to replace the need for primary minerals. NPPF, paragraph 182 sets out the need for plans to be positively prepared based on a strategy which meets objectively assessed development requirements, including unmet requirements from neighbouring authorities where it is reasonable to do so and consistent with achieving sustainable development.

### 2.5 **National Planning Practice Guidance**

The National Planning Practice Guidance (NPPG) sets out guidance on how MPAs should plan for the steady and adequate supply of minerals (in order of priority):

- designating Specific Sites – where viable resources are known to exist, landowners are supportive of minerals development and the proposal is likely to be acceptable in planning terms. Such sites may also include essential operations associated with mineral extraction
- designating Preferred Areas, which are areas of known resources where planning permission might reasonably be anticipated. Such areas may also include essential operations associated with mineral extraction, and/or
- designating Areas of Search – areas where knowledge of mineral resources may be less certain but within which planning permission may be granted, particularly if there is a potential shortfall in supply.

The NPPG provides additional advice on how MPAs should plan for industrial minerals. It suggests that recognition should be given to any marked differences in geology, physical and chemical properties, markets and supply and demand between different industrial minerals which can have different implications for their extraction.

Such differences include:

- geology influencing the size of a resource, how it may be extracted and the amount of mineral waste generated
- the market demand for minerals to be of consistent physical and/or chemical properties, resulting in the fact that industrial minerals are often not interchangeable in use
- the potential for the quality of a mineral extracted from a single site varying considerably
- the economic importance of the mineral as a raw material for a wide range of downstream manufacturing industries
- some industries are dependent on several industrial minerals and the loss of supply of one mineral may jeopardise the whole manufacturing process.

The NPPG also provides advice on the purpose of stocks (landbanks) of permitted reserves and how and when the required stock of permitted reserves for industrial minerals should be calculated. Stocks of permitted reserves should be used as an indicator to assess when further permitted reserves are required at an industrial minerals site. They should be calculated when a planning application is submitted to extract the mineral (through either a site extension or a new site) or when new capital investment is proposed. The overall amount required should be directly linked to the scale of capital investment to construct and operate the required facility (such as a cement kiln or brick factory).

The NPPG includes guidance on the 'duty to co-operate' regime which requires local planning authorities, County Councils and public bodies to engage constructively, actively and on an on-going basis on strategic cross boundary matters.

### **3. Cement Manufacture**

- 3.1 There are a number of different types of cement; Ordinary Portland Cement (OPC), also known as CEM I, is the most widely produced both in the UK and elsewhere. However, blended or composite cements, for example CEM II, are becoming more important.
- 3.2 The process of manufacturing cement involves mixing together limestone or chalk and clay/ shale which are then fired in a rotary kiln to a temperature of about 1400 -1500 degrees Celsius. Small amounts of other materials, such as silica sand, may be added to optimise the mix. During firing, water vapour is given off first, followed by CO<sub>2</sub>, indicating the decomposition of first the clay/shale and then the limestone to a mixture of anhydrous compounds known as cement clinker. Depending on how the material is handled prior to being fed into the cement kiln there are three basic types of process; the dry, semi-wet/semi dry and wet processes. The moisture content of the raw material (3% for hard limestone and over 12-16% for chalk) is the main criterion governing the process used. Over the decades there has been a move away from the wet process to the more energy efficient dry process.
- 3.3 On exit from the kiln, clinker is cooled from approximately 1200 degrees Celsius to less than 150 degrees Celsius. The clinker is then conveyed and stored in dedicated silos in readiness for being milled into cement. The milling process involves finely grinding the cooled cement clinker, typically with 5% gypsum/anhydrite to form the final cement.
- 3.4 Previous reference has been made to the growing importance of blended or composite cements; in the UK these are mainly produced by fine grinding cement clinker with either Pulverised Fuel Ash (PFA) from coal fired power stations, granulated slag from the iron industry or limestone fines, together with gypsum or andryhite. As well as being cheaper these secondary materials also provide additional technical benefits as both pfa and slag have cementitious properties that improve the long-term strength and durability of concrete. The quantity of PFA, slag or limestone



finer used also reduces the amount of cement clinker required and consequently the amount of primary minerals needed. Their long-term availability is not assured, however, in view of the existing and expected future decline in coal fired power generation and steelmaking in the UK.<sup>2</sup>

3.5 The milled cement is conveyed to cement silos in readiness for despatch, either bagged or supplied in bulk. It is then transported to the customer either by road or rail.

3.6 Cement plants are large consumers of raw materials (and energy intensive) with about 1.6 dry tonnes of materials being required for each tonne of cement clinker produced. Modern cement plants are highly capital intensive; the construction of a new plant costs around £250 million. Ongoing capital investment at individual plants can also typically amount to several million pounds a year. Cement raw materials must be available in sufficiently large quantities to justify these large capital investments. Consequently modern cement operations are usually large-scale and long-lived. The economies of scale needed to make them viable demand long reserves of raw materials and mean that a typical plant has cement clinker capacity of between 0.48 million tonnes per annum (mtpa) to 1.5 mtpa.<sup>3</sup>

3.7 Cement manufacture is, by its nature, energy and carbon intensive. The industry has made great strides in reducing its CO<sub>2</sub> emissions and energy costs through the use of alternative waste fuels, such as natural rubber from scrap tyres, sewage sludge, meat and bone meal, and waste solvents.

## **4. Resources**

4.1 The availability of suitable raw materials is normally the determining factor in the location of a cement works. The manufacture of Portland cement requires raw materials that contain the four main components; lime, silica, alumina and iron

---

<sup>2</sup> UK Minerals Forum – Trends in UK Production of Minerals 2014

<sup>3</sup> BGS Minerals Planning Factsheet, March 2014

oxides. Limestone or chalk is the main source of lime and typically accounts for 80-90% of the raw mix. Clay or mudstone accounts for some 10-15% and provides most of the silica, alumina and iron oxides to optimise the mix. The quality of the cement clinker is directly related to the quality of the raw materials used.

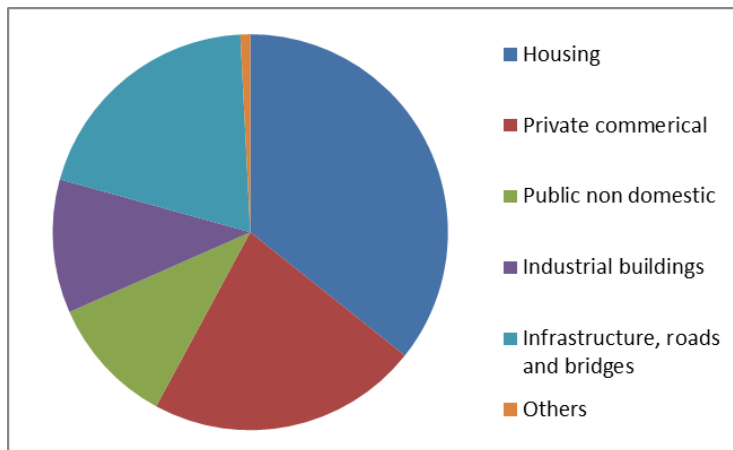
4.2 The United Kingdom is fortunate in having very large resources of the raw materials used in cement manufacture; limestones of various geological ages are widespread. They vary considerably in their chemistry and thickness and thus their suitability for cement manufacture on a large scale. Dolomites and magnesian limestones are unsuitable because of their high magnesia content. This precludes the use of limestones (dolomites) of Permian age in England. Carboniferous Limestones are the most important source of raw material for cement production; they occur extensively as thick deposits that are easy to work and which are generally of relatively high purity. Within the Plan area the Carboniferous Limestones are an important deposit for cement production whilst the Permian Limestones in the east are unsuitable for this purpose.

4.3 Resources of clay and mudstone/shales suitable for cement manufacture are widespread and usually obtained from quarries adjacent to cement plants. The majority of plants using Carboniferous Limestone use stone from the Visean (Upper Dinantian) Stage and in many instances a shale formation lies immediately above the limestone, and is consequently used.

## **5. Demand**

5.1 The main demand for cement is linked to its use in the production of mortar and concrete. These products are widely used in all construction sectors, such as house building, road construction, bridges, and dams and in other infrastructure projects such as railways, airport facilities, hospitals, schools, new offices and shops. The demand for cement, therefore, is reliant on economic activity as a whole but particularly construction activity, which can be highly cyclical.

The diagram below shows how cement is used in the United Kingdom, 2009<sup>4</sup>



## 5.2 Economic importance

The value of UK sales of Portland cement, including blended cements was £656 million in 2011. Some 2,500 people are employed directly in the industry, with a further 15,000 jobs supported indirectly.<sup>5</sup>

The second cement kiln line at Tunstead involves £200 million of investment, the 30 month construction period will involve up to 800 construction personnel and, once complete, will generate almost 60 full time jobs and approximately 40 elsewhere in the UK.<sup>6</sup>

## 6. Production and Reserves

### 6.1 National production

The production of limestone/chalk for cement manufacture has declined significantly over the years from around 27 million tonnes in 1974 to 9.3 million tonnes in 2012<sup>7</sup>. This is partly due to a decline in cement production which has declined from approximately 18 million tonnes in 1974 to around 8 million tonnes in 2012<sup>8</sup>. This decline may well be closely linked to the decline in aggregate demand, the shift away

---

<sup>4</sup> The UK cement industry, Minerals Product Association Cement, 2009

<sup>5</sup> BGS Factsheet, Cement, March 2014

<sup>6</sup> Planning Application CM1/0309/240 Non-Technical Summary, Socio-Economics, 2009

<sup>7</sup> UK Minerals Yearbook, BGS, 2013

<sup>8</sup> UK Minerals Yearbook, BGS, 2013

from concrete-intensive major civil engineering projects in recent years and the current economic recession. However, it may also, in part, reflect a decline in the more energy intensive wet process using chalk (with its much higher moisture content) in favour of limestone using the dry process. In addition, there has been a reduction in domestic cement capacity, increased imports and increasing use of blended cements where a proportion of the cement is replaced by other materials.<sup>9</sup>

There are five producers of cement in the UK, although only four are currently operating. These are (with their approximate share of capacity in 2014): Lafarge Tarmac (36%), Hanson Cement (27%), CEMEX UK Cement (21%), Hope Construction Materials (12%) and Aventus Group (5%). The UK's supply of cement is produced at just 12 plants (2014); UK Cement plants with details of their operating clinker capacity, raw materials and transport together with other locations used only for the grinding and/ or blending of cement is set out in the following Table.<sup>10</sup>

In the late 1970s, the UK was a significant exporter of cement. However, increasing competition in overseas markets has led to a decline in exports and since 1987 onwards the UK has become a net importer of cement.<sup>11</sup> It is not difficult to see how cement manufacture could be driven overseas through higher energy costs and penalties on carbon emissions and so making the UK increasingly dependent on imports for this 'strategic' material.<sup>12</sup>

---

<sup>9</sup> UK Minerals Forum – Trends in UK Production of Minerals, 2014

<sup>10</sup> BGS Minerals Planning Factsheet, Cement, March 2014

<sup>11</sup> BGS Minerals Planning Factsheet, Cement, March 2014

<sup>12</sup> UK Minerals Forum – Trends in UK Production of Minerals, 2014

**Cement plants with details of clinker capacity, raw materials and transport, together with other locations used only for the grinding and/or blending of cement, 2014**

Company	MPA	Plant	Cement clinker capacity (thousand tonnes/year)	Process	Raw Materials	Transport
Lafarge Tarmac	Staffordshire	Cauldon	900	Dry	Carboniferous limestone/mudstone	Road
Lafarge Tarmac	Vale of Glamorgan (South Wales)	Aberthaw	500	Dry	Jurassic limestone/mudstone/ and Carboniferous Limestone	Road
Lafarge Tarmac	East Lothian (Scotland)	Dunbar	900	Dry	Carboniferous limestone/mudstone	Road/Rail
Lafarge Tarmac	Tyrone (Northern Ireland)	Cookstown	480	Semi Dry	Carboniferous limestone/mudstone	Road
Lafarge Tarmac	Derbyshire	Tunstead	1095	Dry	Carboniferous limestone/mudstone	Road/Rail
Lafarge Tarmac	Kent	Northfleet		Grinding and Blending		Road/Rail
Lafarge Tarmac	Nottinghamshire	Barnstone		Grinding and Blending		
Lafarge Tarmac	Northern Ireland	Belfast		Blending		
Lafarge Tarmac	Fife (Scotland)	Scot Ash		Blending		
Lafarge Tarmac	County Durham	Seaham		Blending		
Lafarge Tarmac	Essex	West Thurrock		Blending		
Hanson Cement	Rutland	Ketton	1390	Dry	Jurassic Limestone and mudstone	Road/Rail
Hanson Cement	Lancashire	Ribblesdale	750	Dry	Carboniferous limestone/mudstone	Road/Rail
Hanson Cement	Flintshire (North Wales)	Padeswood	820	Dry	Carboniferous limestone and colliery spoil	Road
CEMEX UK Cement	North Lincolnshire	South Ferriby	750	Semi Dry	Chalk and Kimmeridge Clay	Road
CEMEX UK Cement	Warwickshire/Bedfordshire	Rugby	1500	Semi Wet	Chalk and Jurassic Mudstone	Road
CEMEX UK Cement	Essex	Tilbury		Grinding and Blending		
Hope Construction Materials	Peak District National Park	Hope	1300	Dry	Carboniferous limestone/mudstone	Road/Rail

Company	MPA	Plant	Cement clinker capacity (thousand tonnes/year)	Process	Raw Materials	Transport
Aventus Group	Fermanagh (Northern Ireland)	Derrylin (mothballed)	500	Dry	Carboniferous limestone/mudstone	Road

## 6.2 Cement production in the Plan area

### **Tunstead cement works, Lafarge Tarmac**

The availability of raw materials is normally the determining factor in the location of cement works and since limestone generally comprises 70-90% of the mixture, it has the greatest influence on siting. Within the Plan area there is one operational cement plant located at Tunstead on the Carboniferous Limestone resource. It is operated by Lafarge Tarmac and supplied by the two adjoining quarries Tunstead and Old Moor (part of this quarry lies within the Peak District National Park (PDNP) outside of the Plan area).

Large scale quarrying began at Tunstead in 1929 and later at the adjoining Old Moor Quarry in the mid-1980s. The two quarries together are about 350 hectares (ha) and are worked in tandem, principally for geological reasons, to form one of the largest quarry complexes in Europe extracting about 6 million tonnes of stone a year for both aggregate and industrial limestone uses. The quarry complex benefits from a dedicated freight railway line that is connected to the national network with rail depots in Leeds, and London; approximately half of the quarry products are sent out by rail.

Whilst Tunstead Quarry was originally established to provide high quality limestone for the chemical industry, which continues, both quarries also supply stone to the energy and construction industries and for the manufacture of cement. Planning permission for the original cement plant at the quarry was granted in 1964 and production began in 1966. In 2000, planning permission was granted for the construction of a replacement cement kiln (now known as 'K1') with an associated rail loading facility. K1 was commissioned in 2004 and now has an operational capacity of about 1 million tonnes per annum (mtpa).

A planning application<sup>13</sup> for a second cement kiln (K2) at Tunstead was approved in 2011, which will increase overall capacity to 2.15 mtpa. The development works will commence during 2015. Commissioning of K2 and its associated infrastructure will take several years. When commissioned the new kiln will have a basic operational capacity for Portland cement production of 1 mtpa but would be designed to enable the reception of imported Pulverised Fuel Ash (PFA) (maximum of 250,000 tpa), for blending with cement to produce a product called 'CEM II' which would increase capacity to 1.15 mtpa. The flexibility to manufacture this product will only be introduced if the market for CEM II dictates. The permitted reserves of industrial limestone at Tunstead and Old Moor quarry are substantial<sup>14</sup> and according to the Operator, even with production at the maximum level suggested including K2, are sufficient to last well beyond the end of the plan period to 2030, also taking into account the 25 year landbank requirement required by NPPF to support the development of a new kiln.

At the Tunstead plant, the main raw materials to make cement - limestone and clay – are both sourced on site and make up 80% of the materials required for cement making. Small quantities of 'correctives' are imported to add to the raw meal; these include marl, shale, mill scale and silica sand. The dry crushed limestone consists of a mixture of Chee Tor and Woo Dale stone extracted from both Tunstead and Old Moor quarries. Most of the clay required comes from the quarry in the form of slurry resulting from the washing of limestone for the production of chemical stone for industry. This is thickened to a paste and the excess water re-used in the washing plant. Small quantities of other raw materials - sand, marl, shale and mill scale - are imported. Importation of these raw materials will increase proportionately with the commissioning of K2 but much is sourced outside the Plan area. Further investigation is required with the Operator about these movements in line with the duty to co-operate requirements.

---

<sup>13</sup> Planning Application CM1/0309/240 Planning Statement, March 2009

<sup>14</sup> Permitted Reserve information supplied in confidence for Annual Mineral Surveys, Minerals Aggregate Working Party, 2013

Cement kilns are both energy and carbon intensive. To reduce the demand for and impact of fossil fuels alternatives such as tyre chips, meat and bone meal and solid recovered fuel from waste are being used increasingly at the Tunstead plant. This will continue to be the case with the operation of K2.

### 6.3 **Duty to Co-operate**

#### **Cement production in close proximity to the Plan area**

NPPG sets out that in planning for minerals extraction, mineral planning authorities, local planning authorities and other public bodies are expected to cooperate on strategic cross border matters. In view of the landbank requirements for cement raw materials and the fact that two cement plants lie close to the Plan area it is important to assess if those sites will make a call upon cement making raw materials from within the Plan area.

### 6.4 **Hope cement works, Hope Construction Materials, Peak District National Park**

Hope cement works operated by Hope Construction Materials, lies approximately 10 km from the County boundary, and is located within the Peak District National Park. It has a production capacity of around 1.5 mtpa and is supplied by adjoining quarries i.e. (Hope Limestone Quarry and Hope Shale Quarry) also operated by Hope Construction. The company also blends imported pulverised fuel ash (PFA) (up to 0.1 mtpa) with shale as a partial shale replacement in the production of cement clinker.

Information supplied by the Peak District National Park Authority (PDNPA)<sup>15</sup> indicates that based on current annual production of approximately 1.58 mt (2012) there are about 22 years (2034) of limestone reserves remaining. The situation with shale is more complex in that the resource is split into high and low sulphur shale and the degree that shale is substituted for by PFA has a major impact on the life of shale reserves. Without the importation and blending with PFA only low sulphur shale can be used reducing the lifespan of shale reserves to an estimated 6 years (2018). However using the combined high and low shale reserves with PFA would extend the

---

<sup>15</sup> Email to Derbyshire CC from Peak District National Park 16/5/14



lifespan of the reserves to over 50 years (2064). This period of time figure would rise if the use of PFA was increased to further supplement or entirely replace the use of shale.

The PDNPA estimates that there is more than 15 years' worth of supply of limestone at the quarry (21.8 years) but assuming the annual figure of 1.58 mt is maintained then the 15 year minimum landbank requirement figure would be breached in 2019. The PDNPA has informed the County and City Council that the Operator may seek to extend the quarry or alternatively, they may look to import limestone to the site sourced from elsewhere. One possibility is Dowlow Quarry, within the Plan area, which the Company also owns and which has substantial permitted limestone reserves.<sup>16</sup> Consequently there may be a call on reserves of industrial limestone from within the Plan area to support cement manufacture at Hope. This matter is being investigated further with the Operator and the PDNPA.

#### **6.5 Cauldon cement works, Lafarge Tarmac, Staffordshire**

The second nearby cement plant, Cauldon operated by Lafarge Tarmac, lies approximately 0.6 km away over the border in Staffordshire. It has a capacity of approximately 0.9 mtpa and is supplied with limestone from an adjacent quarry. Information from Staffordshire CC indicates that permitted reserves of limestone are anticipated to be adequate up to 2030. Additional shale resources will be required but this need is not anticipated to affect resources within the Plan area.<sup>17</sup>

## **7. Conclusions**

- 7.1 At this stage it is unclear whether, based on our current information of anticipated production rates, the level of permitted reserves and 'duty to co-operate' matters, there will be an additional need for industrial limestone or clay/shale reserves to support the manufacture of cement over the Plan period.

---

<sup>16</sup> Permitted Reserve information supplied in confidence for Annual Mineral Surveys, Minerals Aggregate Working Party, 2013

<sup>17</sup> Information supplied by email to Derbyshire CC from Staffordshire CC 10/4/14

7.2 In view of this uncertainty, the most appropriate policy approach would appear to be one of flexibility, which would allow for additional reserves of primary and secondary minerals to be worked where they are needed to support the manufacture of cement taking into account the 15 and 25 year landbank requirements set out in NPPF and including the possible requirements of sites lying outside the Plan area.