Sustainability in the UK construction minerals industry

Clive Mitchell, Industrial Minerals Specialist, British Geological Survey, Nottingham, UK

Email: cjmi@bgs.ac.uk

ABSTRACT

Sustainability is not just about environmental protection it also concerns biodiversity, community relations, competence, employment, geodiversity, health and safety, resource efficiency, restoration and stakeholder accountability. The UK construction minerals industry aims to supply essential materials in a sustainable manner that is economically viable and socially and environmentally responsible. It was seriously affected by the economic downturn with a significant reduction in sales over the 2008 to 2012 period. The recovery of the construction sector in the UK started in 2013 and is expected to continue through 2015. Over this period resource efficiency has improved alongside an increase in recycled and secondary materials and a reduction in mineral waste.

In response to concerns about climate change, the construction minerals industry is working to reduce its carbon footprint. The manufacture of cement and lime are the most energy intensive processes in the industry. Over the period 2008 to 2012 the industry reduced emissions significantly, although there is a limit as 60% of the CO_2 comes from the thermal decomposition of calcium carbonate. The supply of minerals to market is dominated by road transport however there is an increasing focus on rail and marine alternatives which can deliver larger volumes, help reduce freight costs and environmental impact. The UK Aggregates Carbon Reduction Portal provides advice and guidance on reducing carbon emissions and energy consumption.

The construction minerals industry plays its part in preserving the biodiversity and geodiversity of its operating sites. Best practice is underpinned by the UK Government Biodiversity 2020 strategy, supported by schemes such as *Nature After Minerals* and recognised by the high profile annual Restoration & Biodiversity Awards. Local heritage is preserved through archaeological investigations that follow the industry Code of Practice.

The UK construction minerals industry employs 35,000 with a further 35,000 in support businesses. It operates a “Zero Harm” policy with hard targets to reduce the Lost Time Incident Frequency Rate and advice and guidance through www.safequarry.com. Staff competence is developed and supported by the Mineral Products Qualification Council (MPQC). It has excellent relations with local communities and stakeholders, saw 27,589 visitors to sites in 2013 and plays its part in education as shown by the web portal www.virtualquarry.co.uk.

INTRODUCTION

Construction minerals are vital to our modern economy. However, the extraction of minerals impacts on the environment, economy and people. These impacts can be negative or positive, temporary or permanent. Whilst there may be positive contributions to the economy and social progress through quarrying there may also be negative impacts to the environment. To ensure the needs of tomorrow are met, the negative impacts need to be minimised and the benefits or positive impacts need to be maximised (MineralsUK, 2015).

This paper is largely based on the sustainability reporting of the Mineral Products Association (MPA) which is the trade association for the aggregate, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries in the UK. The MPA covers the majority of construction mineral production in the UK. The sustainability vision of the MPA is for the supply of "essential materials for a sustainable future in a manner that is economically viable and socially and environmentally responsible" (MPA, 2015).

PEOPLE

The UK construction minerals industry has placed relationships with people as its main sustainability focus. The health and safety of its employees is the industry's top priority with the aim of "Zero Harm" (Figure 1). There has been a significant reduction in the number of reportable injuries. Currently the MPA have set a target of reducing the Lost Time Incident Frequency rate (LTIFR) by 50%, with this target rising to a 65% reduction by 2019. In 2013, the LFIFR was 5.13 lost time incidents per 1 million hours worked (MPA, 2014). Health and safety best practice and guidance is shared via annual health and safety awards and through the regularly updated www.safequarry.com website which is used internationally (MPA, 2015).

Figure 1. Health and safety poster at sand and gravel quarry, UK.

The UK construction minerals sector employs 35,000 people directly with an additional 35,000 jobs in supporting companies. The industry is committed to developing trained and competent staff with the ethos that this will ensure the continued safety of its workforce and its operations. Stakeholders and local communities are engaged by the industry through liaison groups, meetings, seminars, workshops, conferences, events, the media, visits to working sites and as part of an educational programme spearheaded by the Virtual Quarry website (www.virtualquarry.co.uk) (MPA, 2015).

CONSUMPTION AND PRODUCTION

The UK is well endowed with widespread and varied geological resources that enable it to be virtually self-sufficient in construction minerals. The UK construction industry works to the highest standards of environmental management and continually strives to improve operational efficiencies, such as reducing energy consumption and increasing resource utilisation. The industry experienced a significant fall in sales during the economic downturn, with sales picking up in the last few years. In 2013, the UK produced 143m tonnes of primary aggregate (Figure 2), 55m tonnes of recycled and secondary materials, 19.2m tonnes of asphalt and 19.8m tonnes of cement and cementitious products (MPA, 2015).

Figure 2. Crushed rock aggregate in a UK quarry.

CLIMATE

The wide acceptance of the need to address climate change is increasingly affecting the way that the UK construction minerals industry operates. Construction projects will increasingly demand construction materials that have the lowest environmental impact, such as those that comply with the Building Research Establishment Environmental Assessment Method certification scheme (Building Research Establishment, 2009). One of the chief means of assessing the environmental impact is to determine the 'embodied energy' of mineral production (Figure 3). This is calculated by measuring the energy used at each stage of production, including stripping of overburden, drilling and blasting, haulage, primary crushing, surge stockpiling, transfer/ conveying, crushing, screening, stockpiling, loading and transport off site. All other site operations that consume energy, such as offices, workshops, waste handling and storage, dust and other environmental controls, water management and site remediation work, are also included. Energy values are typically quoted in

kilowatt hours per tonne (kWh/t) of production. The carbon dioxide emissions are calculated from the energy values using greenhouse gas conversion factors, and are typically quoted in kilograms of carbon dioxide per tonne (kg/CO_2/t) (Mitchell, 2012).

Figure 3. Cement and lime works at limestone quarry in the UK

The embodied carbon for UK primary crushed rock aggregate production in 2013 was 3.7 kg/CO_2/t, for sand and gravel it was 3.9 kg/CO_2/t, whereas for cement production it was 694 kg/CO_2/t (MPA, 2015). This markedly higher figure for cement is due to its energy intensive production process and the thermal decomposition of limestone which leads to the generation of significant quantities of CO_2 (a theoretical maximum of 440kg per tonne of limestone used). The UK cement industry has made great efforts to reduce its CO_2 emissions with a reduction of 21% between 1998 and 2012 achieved through technological improvements and an increasing use of non-fossil fuels (MPA, 2015).

RESOURCES

A key aspiration of the UK construction minerals industry is to make the most efficient use of its resources. In most cases this means maximising the proportion of saleable products and minimising the amount of waste produced. In the best cases the amount of mineral waste produced can be as low as 0.5% of material extracted from the quarry whereas in the worst cases the amount of waste can exceed 50% of the material extracted. Construction mineral waste is generally inert and non-hazardous. It is produced from overburden/ interburden materials, from washing of sand and gravel to remove fines, and from scalping, crushing and dry screening. To some extent it has become waste because no market currently exists for it, due to its location with respect to potential markets and market economics. Mineral operations carry out regular process optimisation audits to ensure that they produce the lowest achievable proportion of waste. It cannot be eliminated altogether but operations that produce high volumes can be optimised to reduce waste, increasing resource utilisation and increasing the amount of saleable product (Mitchell *et al*, 2008).

The industry has also played its part in improving resource use efficiency by helping to increase the amount of previously used construction material that is recovered and reprocessed to create recycled aggregate. The proportion of recycled and secondary aggregate used in UK construction has increased from 10% to 28% over the last 20 years (MPA, 2015).

Figure 4. Poppies in a sand and gravel quarry, UK (Image © Sarah Hannis, BGS, NERC)

The UK construction minerals industry has worked hard to dispel the myth that its quarrying operations are barren and devoid of life (Figure 4). In reality, many quarries are havens that preserve the biodiversity of an area and provide much needed habitats and refuges for wildlife. The industry has an excellent record of site management, restoration and after use of former quarries to a very high standard which protect and enhance the existing biodiversity. This is complemented by the *Nature After Minerals* programme run in partnership by the minerals industry, the Royal Society for the Protection of Birds (RSPB) and Natural England. The annual Restoration and Biodiversity Awards highlight best practice and recognise the achievements of responsible mineral companies (MPA, 2015).

Local heritage is preserved through archaeological investigations that follow the industry Code of Practice which ensure that archaeological excavations are carried out within acceptable standards. The geodiversity within the UK construction industry operating sites is also preserved and protected. In Britain there are 500 geological Sites of Special Scientific Interest (SSSI) that exist due to quarrying (MPA, 2015).

CONCLUSIONS

Construction minerals are important to modern society but cannot be produced at any cost, particularly at the expense of the environment, economy and communities. The UK industry has made great strides in protecting the health and safety of its employees, developing their potential and ensuring that they are competent to look after their own safety and that of their operations.

The UK construction industry has improved the efficiency of its production processes to minimise the carbon footprint of its operations, increase the saleable proportion of the resource extracted and minimise the waste production. At the same time it protects the biodiversity, geodiversity and archaeological heritage of the land that it occupies.

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REFERENCES

British Geological Survey. 2015 Sustainability. British Geological Survey website, available here: http://www.bgs.ac.uk/mineralsuk/sustainability/home.html

Building Research Establishment, 2009. BRE Environmental & Sustainability Standard BES 6001. http://www.greenbooklive.com/filelibrary/responsible_sourcing/BES_6001_Issue2_Final.pdf

Mineral Products Association (MPA), 2014. Engagement and delivery…a continuing commitment: Summary Sustainable Development Report 2014. Available to download from: http://www.mineralproducts.org/sustainability/pdfs/MPA_SD_Report_2014.pdf

Mineral Products Association (MPA), 2015. Sustainability. Mineral Products Association micro-website, available here: http://www.mineralproducts.org/sustainability/index.html

Mitchell, C.J., Mitchell, P. and Pascoe, R.D. 2008 Quarry fines minimisation: can we really have 10mm aggregate with no fines? In: Walton, Geoffrey, (ed.) *Proceedings of the 14th Extractive industry geology conference.* EIG Conferences, 37-44, 109pp. Available to download from: http://nora.nerc.ac.uk/4932/1/QuarryFinesMinimisationEIGPaper.pdf

Mitchell, C.J. 2012 Aggregate carbon demand: the hunt for low carbon aggregate. In: Hunger, Emily H; Walton, Geoffrey, (eds.) *Proceedings of the 16th Extractive industry geology conference.* Extractive Industry Geology Conferences Ltd, 93-99, 7pp. Available to download from: http://nora.nerc.ac.uk/13147/1/Aggregate_Carbon_Demand_EIG_2010.pdf