Building waste – construction materials from your waste

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Abstract

Global demands on natural sand and gravel are growing beyond 50bn tonnes per year and there is a very real need to find alternative sources for construction. The basic processing of C&DW involves the introduction of dry processing equipment such as crushers and screens. This approach limits the use for the recycled sand and aggregates to low value construction applications such as backfill. This approach does not capitalise on the huge opportunity that construction, demolition and excavation waste offers both in terms of material recovery and the creation of high value products. These high value recycled sand and aggregates produced can be used across a wide range of construction applications including pipe bedding, concrete and block construction. There are even applications for the only waste product from the system, Filter Cake, such as pond lining, canal lining, landfill capping and trench fill. By using Filter Cake for these applications, the higher grade products can be conserved for higher value applications. A number of example past projects who are deploying innovative technologies and methods to sustain their business can be referred to during the presentation including – Inert Landfill, Scotland – Beginning life as a traditional quarry that had filled a disused quarry with C&DW over a period of 30 years, the company is now able to process 80% of this material and sell into the construction sector in Glasgow, while also extending the lifespan of the landfill. Recycling Facility, Germany – Supported by the EU Eco-Innovation Programme this facility installed an innovative wet processing system for C&DW recycling. The recycled materials are now used in concrete products. Construction Company, Norway – The world’s largest wet processing plant for C&DW with a capacity of 300tph. Examining the overburden from the company’s hard rock quarry the plant allows them to not only recycle the C&DW but also to recover material from the overburden which could subsequently be used in their integrated operations.

Introduction

Global demand for natural sand and gravel is growing beyond 50 billion tonnes per year and there is a very real need to find alternative sources for the construction sector. With sustainability now a requirement in the construction materials sector, recycled and secondary aggregates are making an increasingly important contribution to green building practices. By reducing demand on primary aggregates, the production of construction materials from inert waste is helping the industry to become more sustainable and fulfil its regulatory responsibilities and environmental aspirations.

Research by the European Commission, ‘Resource Efficient Use of Mixed Waste’ found that Europe produces over 800 million tonnes of construction and demolition waste every year, this represents 25 – 30% of all waste generated in the EU. Typical materials include concrete, bricks, gypsum, wood, glass, metals, solvents, asbestos and excavated soil.

The business case for recycling construction and demolition waste is ever more appealing as the costs of landfill disposal continues to rise. For example over the last for years prices in the UK have risen by 32%. This increase is driven by increased costs associated with disposal, scarcity of disposal sites and WDF and Landfill Directives coupled with Green Public
Procurement (GPP) at national, regional and local levels. The revised Waste Framework Directive, which requires EU member states to recover a minimum of 70% of construction and demolition waste by 2020, will encourage further use of recycled/secondary aggregates and minimize waste from an environmental and cost-saving point of view.

**Regional Landscape**

A key motivation for the end user is the increased costs and restrictions associated with landfill disposal. Around Europe, there are a range of different initiatives and regulations for those operating within construction to work within. There are a number of relevant regulation which apply across Europe.

- The Waste Framework Directive (2008/98/EC) - sets down the basic concepts and definitions related to waste management and lays down waste management principles such as the "polluter pays principle" or the "waste hierarchy".
- Landfill Directive (99/31/EC) – sets down the EU’s aim to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from the landfilling of waste, during the whole life-cycle of the landfill.
- Green Public Procurement (GPP) - European public authorities are bound by Green Public Procurement (GPP) creates a critical mass for the use of recycled aggregates and landfill waste minimization.

How the regulations are implemented vary across the EU and each region may have their own set of regulations. Some examples of specific regional regulations are shown below.

Germany has a target of 80% of waste to be managed in closed cycle processing. The construction sector in Germany has also made a voluntary commitment to cut C&D waste by 50%. The German Sustainable Building Certificate sets a criterion on waste prevention, dismantling and recycling of waste material.

The Flanders region of Belgium operates under a waste framework policy (VLAREA) specifying the nature of the waste to be used as secondary raw material in construction and the concentrations of heavy metals and aromatic hydrocarbons. In addition, it has landfill ban for recyclable fractions of C&D waste.

In Finland the relevant regulations are the Government Decision on Construction Waste in 1997 (50% recycling and recovery target, including energy recovery, by 2000). There is also a policy in place for the recovery of certain wastes, promoting waste recycling in some constructions activities (public roads, parking areas, sports grounds, etc.).

Construction & Demolition Waste in the UK is controlled under, The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites and WRAP (Waste & Resources Action Programme) whose mission is to accelerate the move to a sustainable resource-efficient economy through a number of methods.

**Current processing technology**

The basic processing of construction and demolition waste involves the introduction of dry processing equipment such as crushers and screens. This approach limits the use for the recycled sand and aggregates to low value construction applications such as backfill. This approach does not capitalise on the huge opportunity that construction, demolition and
excavation waste offers both in terms of material recovery and the creation of high value products.

**Advanced wet processing technology**

CDE designs wet processing equipment which is used in construction & recycling applications, in particular in the processing & recycling of construction and demolition (C&D) waste, mineral processing and waste water treatment industries. CDE’s core industrial washing technology uses physical and aqueous based methods to recover the recycled materials.

The main areas CDE works in are in sand washing, crusher dust washing, construction and demolition waste recycling, lignite removal, specialist sand production, grit washing and recycling and iron ore washing and beneficiation. The company has a strong environmental ethic and has through its products and services has a strong background in reuse, rework & recycle, enabling C&D waste to be processed to produce recycled aggregates which can be reused.

Due to the highly variable nature of construction, demolition and excavation waste each CDE plant is built according to the specific requirements of the project. Differing levels of contamination, fines content and variability of input materials (excavation waste, railway ballast etc.) requires an individual approach to each recycling plant. Each plant includes a variety of processing phases depending on customer requirements; feeding and pre-screening, aggregate scrubbing, contaminant removal, metals removal, sand washing, aggregate sizing, primary stage water treatment and sludge management.

**Applications for recycled aggregates**

When processed properly recycled sand and aggregates can be used across a wide range of construction applications including pipe bedding, concrete and block construction. There are even applications for the only waste product from the system, Filter Cake, such as pond lining, canal lining, landfill capping and trench fill. By using Filter Cake for these applications, the higher grade products can be conserved for higher value applications. High-end applications for the recycled aggregates have included construction of the Commonwealth Games Athletes Village in Glasgow in 2014 and renovation works on Grade 1 listed buildings in England.

Companies using CDE advanced washing systems include an inert landfill recycler in Scotland. This company began life as a traditional quarry in 1964 who had went on to fill their disused quarry with construction and demolition waste over a period of 30 years. After the installation of a CDE wet processing system the company is now able to process 80% of this material and sell into the construction sector in Glasgow. They have been able to offer a range of new products to the market. The smallest aggregate is suitable for pipe bedding, the mid-size aggregate is sold for closed drainage and the largest aggregates have applications in open drainage. The 0-4 grit is in high demand for block making, the company also produces 0-2 fine sand and a concrete sand.

A recycling facility in Stuttgart, Germany, installed a wet processing plant supported by the EU Eco-Innovation Programme, which was set up to assist the adoption of environmental technology across Europe. The recycled aggregates are now used in concrete products. The world’s largest wet processing plant for construction and demolition waste and overburden can be found in Norway and was installed by CDE. With a capacity of 300tph the plant allows the company to not only recycle the construction and demolition waste but also to recover material from the overburden which could subsequently be used in their integrated
operations. The plant was installed in 2014 and is now producing two grades of sand, 0-2mm and 2-4mm. A range of washed aggregates are also being produced in the form of 4-11mm, 11-16mm, 16-22mm, 22-90mm and an oversize +90mm aggregate. The company are also utilising the dry cake output from the filter press. The dry cake which contains +80% of dry solids content is being used for the creation of embankments. The plant diverts 600,000 tonnes of construction and demolition waste per year as a result of this new washing technology.