WARNING OF A WORLDWIDE SHORTAGE OF SAND AND GRAVEL

Urban mining for sand and gravel
You would think sand and gravel are in abundant supply, but in fact we are heading for a global scarcity. The United Nations Environment Programme is ringing the alarm bells about impending shortages and ecologically damaging extraction methods. Urban mining can provide a solution.

During a UNEP study of coastal erosion in Jamaica we heard in a village how their traditional beach was destroyed in a matter of days when an armed group arrived, mined the sand and carted it off in lorries,’ says Professor Pascal Peduzzi. ‘I wondered if this was a more widespread phenomenon. When this was confirmed in a French news story in 2013, I decided it was time to look into it properly.’

Peduzzi is director of GRID-Geneva, one of the group of environmental information centres, the Global Resource Information Database, run by UN Environment (UNEP). He is also the lead author of a provocative article published in 2014 in which UNEP warns about a growing worldwide scarcity of sand and gravel as building materials and the widespread use of unsustainable mining practices.

Major damage

The 40 billion tonnes of sand and gravel aggregates extracted worldwide, or 68–85% of the total, make them by far the most important minerals. Traditionally these aggregates have been extracted in and around rivers, but the growing shortages in these locations have led to increasing extraction from the seabed. The rate of extraction now far exceeds the rate at which these resources are being replenished by natural processes of erosion. Although empirical impact studies are few and far between, the UNEP discovered that extraction causes major local ecological, geological and hydrological damage. The resulting biodiversity loss in turn impacts on fisheries and food chains. Damage to river basins, coasts and water tables endangers drinking water supplies and environmental safety, and the carbon footprint of transporting these aggregates over increasingly long distances is considerable. One of the possible ways to reverse the growing...
Impacts of aggregates extraction is urban mining: recovering and reusing building materials.

Growing awareness

In 2014 the UNEP complained that policymakers and scientists had largely failed to recognise the problem. What is the situation today? 'Both worse and better,' concludes Peduzzi. 'There are still no records on how much is being extracted, but from global production figures for cement and asbestos we can be fairly certain that since 2014 extraction has increased by 5%. Luckily the media and politicians have woken up to the problem. I have already given dozens of interviews. The US media are highly interested and the European Parliament is also aware of the issue. Hopefully this will stimulate researchers to throw more light on the situation.'

Monitoring and limiting

This is already starting to happen, observes Peduzzi. 'A recent study in Cambodia describes the conse-
The mineral fraction of WtE bottom ash is clean and can be used without restrictions as a building material.

JASPER DE JONG (AVR)

In the Netherlands some of the construction and demolition waste, WtE bottom ash and fly ash is processed into secondary building materials that can be used without restrictions.
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WtE bottom ash: vast improvement in raw material quality

The technology for recycling bottom ash from waste-to-energy plants (WtE bottom ash) is advancing rapidly, particularly since the Green Deal of 2012. Most of the precious metals can now be recovered, while other interfering substances are removed at the same time. ‘This cleans the mineral fraction, which can then be used as a building material without restrictions or requirements under the “isolate, control and monitor” aftercare regime,’ says Jasper de Jong, commercial director of AVR. AVR is working on this technology with Rebewi Minerals (FORZ®Factory, Zevenaar), Heros (Sluiskil) and others. This recycling process provides an acceptable business case for the waste-to-energy plants, recycling companies and potential major customers such as Rijkswaterstaat (the Dutch government agency responsible for the design, construction and maintenance of the country’s main infrastructure facilities). De Jong: ‘All we have to do now is create the demand. Local authorities are still largely unaware that they can buy perfectly good paving stones made from recycled waste. It would be ideal if this sort of raw materials saving counted towards the official recycling targets. The waste sector can also export the expertise gained during the development of this technique, and exporting these recycling products could also deliver environmental benefits, depending on the carbon footprint.’
Coal fly ash in cement and concrete

Almost all the fly ash from Dutch coal-fired power stations is used in the manufacture of cement and concrete. Coal fly ash is no longer used to manufacture gravel. ‘In the 1990s coal fly ash used to be turned into artificial gravel by Provag in Raamsdonkveer and by Vasim in Nijmegen, but that is now a thing of the past,’ says Angelo Sarabèr, senior product manager at Vliegasunie, which markets mineral residue materials from the Dutch coal-fired power stations. ‘The technology was okay and at the time it seemed logical from a marketing point of view, because we were worried that gravel would be in short supply. But then the new gravel extraction sites under the “Room for the River” programme and the growing demand for fly ash in cement and concrete put an end to it. Coal fly ash is now the main component of blended cements, which have a low leaching potential and a small carbon footprint and prolong the life of concrete. The production of artificial gravel may be sensible for limited periods in regions where there is a shortage of gravel, but the current applications will always eventually come out on top because of their economic and environmental advantages – although you can never rule out innovative new uses in the future.’

A shift from a linear to a circular materials chain. Alternatives have to be found, both by limiting the use of raw materials, for example through new construction methods such as adaptable building, and through urban mining, as in the Netherlands where part of the construction and demolition waste stream, as well as bottom ash from waste-to-energy plants and certain fly ashes, are recycled into reusable secondary building materials.’

Valuable know-how

The Netherlands has built up valuable know-how in other areas as well, according to Peduzzi, ‘such as more sustainable methods for the extraction of sand and gravel, and for “building with nature” for coastal protection. For many developing countries such alternatives to hard, hi-tech defences can be excellent ’no regret’ options that are cheaper, less resource intensive and have ecological added value.’

More information:
• UNEP article ‘Sand, rarer than one thinks’
• New WtE product deserves recycling label