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Handling of quarry waste from schist production at Oppdal, Norway

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A significant amount of aggregate research in Norway has been focused on the recovery and use of surplus sizes from hard rock aggregate quarries. The use of sand sized quarry waste (QW) from crushing/processing has been motivated by the rapid depletion of traditional sand/gravel resources, increasing land-use conflicts, and the need to minimise QW deposits which for some quarries are becoming a critical factor for economy as well as for environmental reasons. With an annual aggregate production of 77 million tons, out of which approximately 83 % comes from hard rock, the annual volume of size < 4 mm will be of the order of 19 million tons. Converting this into construction aggregates is a major challenge in order to obtain satisfactory mass balance.

This challenge is even bigger for quarries producing decorative stones. E.g. the quarrying and production of schist products for building purpose normally utilises as little as 10-15 % of the excavated rock. Oppdal in central Norway is a main supplier of schist products for flooring, roofing and decorative purpose. The high percentage of QW is due to strict requirements to the finished products, both regarding processing and the character of the parent rock. The need to deposit large amounts of QW is a serious setback for the quarry economy. Within a limited time horizon the volumes of QW can threaten the further exploitation by merely choking the quarry. On the opposite side – any process that can convert the QW into sellable products will give a tremendous added value for the producer. Besides, the area in question is about to drain out its available aggregate resources, having to rely on long-transported sand and gravel. This has consequences not only for the economy, but also for the environment since heavy lorry transport will not be sustainable.

An on-going project is now looking into converting the QW into quality aggregate both for road construction and concrete. Novel crusher technology and processing strategy is being applied and adapted, and the finished products will be tested in laboratories to establish the relevant application parameters and obtainable quality. By producing coarse aggregates for primarily road purpose, it is estimated that the QW can be reduced from today′s approx. 90 % to approx. 40 %. The potential by also installing the latest inventions of crusher technology designed for making manufactured sand, is to further reduce QW down to < 10 %. Making all these materials sellable in the market, the economic – and also environmental – potential will be considerable.

Understanding the geological conditions and petrographic properties of the rock is vital. This is a quartz-feldspar rich metamorphic rock – a meta-arkose - containing rhythmically distributed planar lamina (less than 2 mm thick) or scattered occurrence of mica, separated by layers composed predominately of quartz and feldspar. The rock can be split along the lamina to slabs varying from 0.5 cm to more than 10 cm in thickness, and the microstructure can be characterized as being granoblastic to gneissic. . This makes it possible by well designed crushing process and careful selection of the in-going rock particles, to obtain well shaped aggregates up to at least 20 mm.

The on-going project will also study the total cost situation depending on the QW utilisation, discuss the environmental and sustainability issues with a societal perspective, and also consider the market opportunities.