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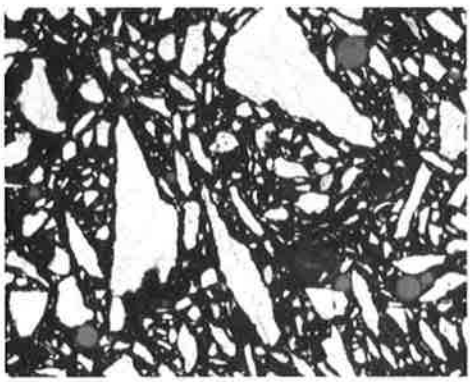

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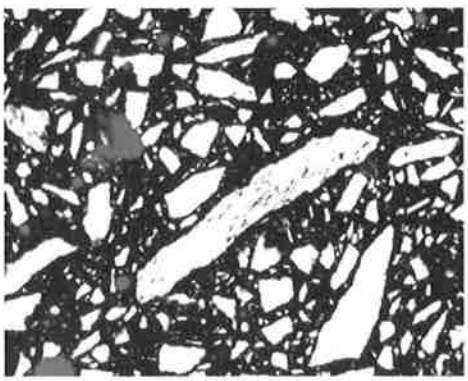

Quartzite

The influence of the fine crushed rocks and minerals on the properties of mortars and concrete

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Göteborg, Sweden 2003

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ABSTRACT

This experimental study investigated (considering the geological aspects) the use of crushed minerals and fine crushed rocks (crushed quarry sands) as aggregate in mortar. The studied minerals were quartz, potassium feldspar, biotite, muscovite, albite, anorthite, olivine, pyroxene, hornblende and talc. They represent the main rock–forming minerals of the igneous and metamorphic rocks used as aggregate in Sweden. The fine crushed rocks studied were quartzite, porphyritic textured granite, granodiorite, greywacke, alkali granite, basalt, diabase (dolerite) and gabbro collected from quarries representing the most common rocks in Sweden. In order to study the influence of the sand fraction of the crushed aggregate, research was concentrated on mortars.

The focus of this study was on the effects of the Swedish fine crushed rocks on some properties of the mortars, in the context of the influences of rock-forming minerals. Physical properties of the Swedish rock-forming minerals and their effect on the properties of the fine crushed rocks were studied too. The aggregate in the reference mortar mix was quartz, which is the main component of natural sand. For ease of comparison, only the aggregates were varied. The grain size distribution was controlled by Fuller distribution. The amount of the ingredients in the mortar mixes was decided on the volumetric bases. The flow of the fresh mortars was kept constant by varying the water-cement ratio and the amount of chemical admixture.

The aggregate properties investigated were water absorption, moisture sorption, freezing and thawing resistance. The properties investigated in the mortars made with the various aggregates were bond strength, flexural strength, compressive strength, drying shrinkage, alkali-aggregate reaction, and chloride and sulphate diffusion into the mortars.

In general terms this study has confirmed that water-cement ratio has the most notable impact on the properties (such as workability and strength) of mortars and concrete. Considering the geological aspects the mortar properties were more sensitive to mineral aggregates than to the fine crushed rocks formed from these minerals. The size and nature of the rock-forming minerals influenced the properties of the fine crushed rocks as well as the behaviour of these rocks in mortars. In comparison with the reference mortar of quartz, the mortars with the fine crushed rocks exhibited adequate strength and low drying shrinkage. There was no sign of alkali-aggregate reactivity.

The results revealed that minerals such as the biotite, muscovite, talc and albite showed a high water absorption, which increased the water requirement of the mortars and decreased the strength. Fine crushed rocks, such as the granodiorites, containing mica minerals showed a similar behaviour. While it can be inferred that fine crushed rocks can be used as aggregate in mortars, further studies need to be carried out for concrete.

Keywords: fine crushed rocks, Fuller distribution, minerals, mortars, rock-forming minerals, water-cement ratio.

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