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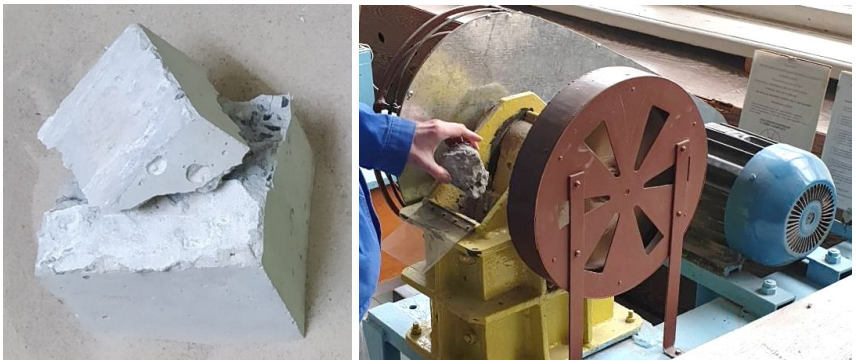
GRAIN SIZE COMPOSITION OF RECYCLED COARSE AGGREGATES

During the design of concrete mixture it is necessary to know such characteristics of aggregates as grain size composition, bulk density, specific density, voids, strength. These properties determine the mass content of the components of the concrete mixture, and also impact its characteristics (W/C ratio, plasticity, density etc.) [1].

A feature of the recycled coarse aggregate (RCA) made from concrete waste is the presence of such new phases as the residual mortar (RM) and the interphase transition zone between it and the natural aggregate [2]. RCA tests were performed to determine the effect of additional components of coarse aggregate on its properties. As a source three series of concrete samples of three different mixtures with different strength classes were made from local materials.

The samples of origin concrete were crushed at the age of 28, 90 and 180 days using a laboratory jaw crusher (Fig. 1). After grinding each mixture was marked according to the following scheme: XX/YY/K, where XX is the number of source mixture, YY is the age at which the source concrete samples and crushed mixes were tested. This work presents the results of determining the grain size composition of the RCA.



a)b)

Fig. 1.a – the split sample a cracked sample of source concrete without structural disturbance; b – laboratory jaw crusher with complex rotation.

Grain size composition of each mix was determined by sieve analysis [3]. Due to the high content of small fractions, unfractionated mixtures of small and large fractions do not meet the requirements [1]. The sieving curves of only the coarse fractions plotted on the standard graph are shown on Fig. 2. As we can see from graph in general, the grain size composition of only coarse fractions meets the requirements of standards in Ukraine.

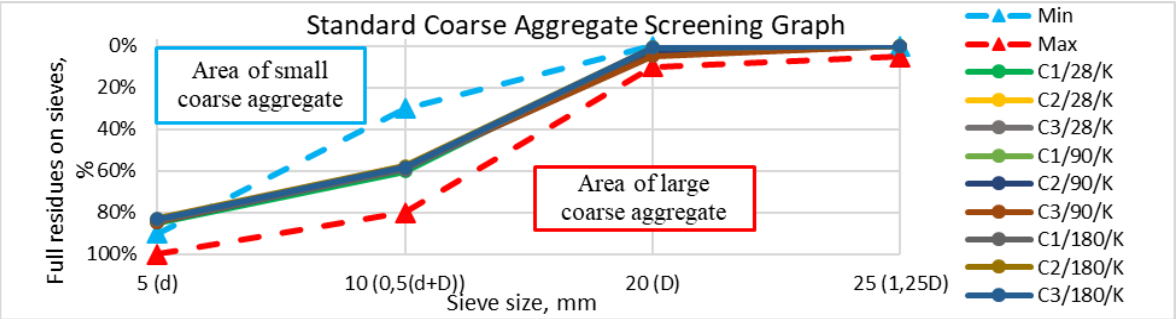
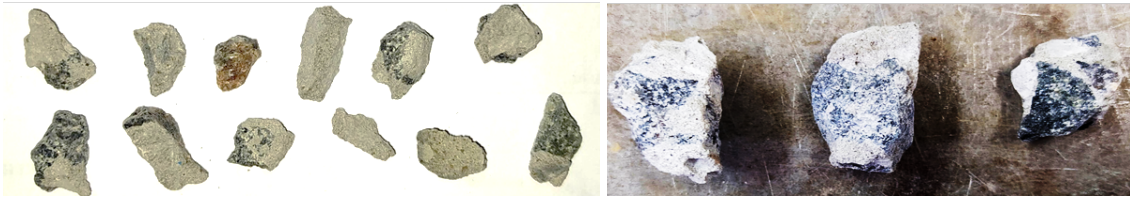


Fig. 2. Sieving curves of only the coarse fractions on the standard graph.

A visual inspection of individual grains of fractionated RCA shows that the content of adhered mortar on the grains of different fractions differs significantly. Almost 100% of grains in the 10-20 mm fraction contain both natural crushed stone and RM. In the vast majority the content of RM is less than 50%. In the fraction of 5-10 mm, a certain amount of grains does not have natural crushed stone at all and in a large number of grains the content of RM significantly exceeds 50% (Fig. 3). Such features obviously determine the different bulk and specific densities of different fractions.



a)b)

Fig. 3. Fractions of RCA 5-10 mm (a) and 10-20 mm (b).

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INDUSTRIAL WOOD-CEMENT-RECYCLED CONCRETE STRUCTURES

The increasing attention to sustainable development and environmental issues in modern construction creates the necessity for the utilization of new materials and technologies. One such innovative approach is the utilization of recycling in the production of wood-cement-recycled concrete structures. This paper is dedicated to exploring recycling technologies and their impact on the characteristics and advantages of industrial wood-cement-recycled concrete structures.

Previous research has focused on various aspects of utilizing secondary materials in construction, including wood-cement-recycled concrete structures. They indicate the potential of utilizing production waste and recycling building materials to reduce environmental impact and resource consumption.