SUMMARY

of MSc. Seweryn Malazdrewicz doctoral dissertation

entitled „ Experimental evaluation of the fundamental properties of self-compacting concrete with coarse aggregate from recycled large-panel system buildings"

This doctoral dissertation investigates the potential reuse of concrete obtained from the demolition of large panel system (LPS) buildings as recycled coarse aggregate in self-compacting concrete (SCC), with particular emphasis on material performance, microstructural characteristics, and sustainability aspects. Buildings constructed using large panel technology between 1945 and 1990 constitute a significant part of the housing stock in Central and Eastern Europe. Their progressive demolition or refurbishment raises important challenges related to the management and reuse of concrete waste.

The main objective of the study was to evaluate the influence of recycled coarse aggregate derived from prefabricated LPS structural elements on the fresh and hardened properties of SCC, as well as on its microstructure, with special attention given to the interfacial transition zone (ITZ). Experimental research was conducted on SCC mixtures in which natural coarse aggregate was replaced with recycled aggregate at levels of 10%, 20%, and 30%. The investigated properties included rheological behaviour, bleeding, setting time, compressive strength, elastic modulus, abrasion resistance, and cross-sectional homogeneity.

A detailed microstructural analysis was performed using scanning electron microscopy (SEM) combined with image analysis techniques. The investigations focused on phase composition, porosity distribution, and the characteristics of the ITZ in concretes containing natural and recycled aggregates. The results demonstrated that recycled aggregate obtained from high-quality prefabricated panels, despite the presence of adhered old mortar, can form a relatively dense and well-hydrated ITZ. This distinguishes it favourably from conventional recycled aggregates originating from mixed construction and demolition waste.

In addition, a quantitative analysis of the relationships between recycled aggregate properties—such as water absorption, porosity, adhered mortar content, and particle shape factor—and selected concrete parameters was carried out. The findings confirmed that the quality and characteristics of the recycled aggregate play a crucial role in determining the mechanical and physical performance of SCC.

The results indicate that concrete from demolished large panel system buildings can serve as a valuable source of recycled coarse aggregate for self-compacting concrete applications. The dissertation contributes to the development of sustainable construction materials and supports the principles of circular economy and resource efficiency in the construction sector.