Summary

The purpose of this thesis is to design an algorithm for the selection of a clay mortar composition for the reconstruction of stone masonry, considering not only its appropriate strength properties but also several characteristics related to the exposure of the reconstructed objects to environmental conditions, the compatibility of the material solution used with the existing masonry element and the requirements related to the authenticity of the objects after reconstruction.

The thesis presents international standards for the reconstruction of historic structures and gathers literature data on historically used mortars and the classification of stone masonry. Archaeological sites where – as part of archaeological missions – reconstruction works of stone masonry are carried out by the Fundamentals of Building Team of Warsaw University of Technology – on which this thesis is based – are described.

The following chapters of the thesis collect the properties that a clay reconstruction mortar for stone masonry should meet and aggregate them into mechanical (compressive strength, adhesion), technological (grain size, consistency), durability (frost resistance, salt resistance, water erosion resistance, limited shrinkage) and compatibility issues.

Based on the mineralogical and fractional composition of clay from the excavation area in Kerch and Tanais (Black Sea Basin) and the original mortar from the stone wall in Tanais, the selection of a substitute material was made, and clay mortar compositions were proposed for further research. The proposed compositions were selected based on the strength tests conducted, and then verification analyses were carried out for the selected group.

In the next step, an application was created to assess the risk index (incompatibility) of the substitute material application (which is an important part of the composition selection algorithm), and the risk of using the selected compositions was assessed. The composition with the lowest risk index of its application (and at the same time meeting the other criteria – mechanical, technological, and durability) and the unmodified composition (closest to the original one) was selected for the semi-technical scale testing, which allowed the final acceptance of the selected solution – mortar with 33% clay, 66% sand and 25% CEM I 42,5 R cement for sites in the Black Sea Basin.

Keywords: clay mortar, reconstruction, stone masonry, compatibility