Załącznik nr 2 do Wniosku o wszczęcie postępowania o nadanie stopnia doktora

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ABSTRACT OF THE DISSERTATION

„The use of numerical models for prestressed diaphragm walls in the context of optimising techniques, technologies and their implementation"

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The subject of this doctoral dissertation is a comprehensive analysis of the author's concept of a *prestressed diaphragm wall* (PDW) using advanced numerical modelling aimed at optimising both design and technological aspects.

The aim of the work was to develop an original, innovative and effective design and construction 'system' that would allow the development of a methodology for designing a completely new structural system that offers many previously unknown advantages, but in accordance with applicable design standards.

The dissertation includes a review of the literature and the state of knowledge in the field of slotted wall technology using various prestressing proposals, including an analysis of patent solutions and existing attempts at technological implementation. The rest of the thesis presents the author's concept of a PDW prestressed diaphragm wall, which involves the use of active prestressing of the structure to reduce the displacement of the excavation lining and improve the load-bearing capacity of the diaphragm wall. A key component of the research was a two-stage analysis: analytical and numerical. Classic calculation methods based on standards dedicated to concrete and geotechnical structures were used for the initial calibration of the static system, and then multi-variant FEM models were developed in a 2D and 3D environment in GEO5, Plaxis and Sofistik software. The numerical simulations demonstrated the significant optimisation potential of PDW technology in relation to classical solutions. An algorithm was developed for the selection of compressive forces depending on geotechnical and geometric parameters was developed, and the models were calibrated according to the requirements of design standards. The results obtained allowed for the formulation of implementation and design guidelines for the implementation of PDW technology.

The final part of the thesis contains a case study comparing the effectiveness of PDW with conventional diaphragm wall systems. The analysis confirmed the possibility of reducing displacements and accelerating the implementation of underground investments by eliminating the need for additional stabilising elements such as ground anchors or steel struts.

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