Streszczenie pracy doktorskiej w języku angielskim

Title of dissertation: "Minimizing the frequency of rainfall flooding on the example of Gdańsk"

Name and surname of the author of the dissertation: Kamil Mironik

Name and surname of the supervisor of the dissertation: dr hab. Joanna Fac-Beneda Prof. UG

Name and surname of the auxiliary supervisor of the dissertation: dr Izabela Chlost

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The main aim of this work entitled "Minimizing the frequency of rainfall flooding on the example of Gdańsk" is to check whether it is possible to minimize the city's rainfall flooding using modernization of the road surface. When using materials that allow water infiltration, the capacity of the entire drainage system would be increased. This will cause a reduction in the number of episodes of inefficiency of the city's rainwater drainage system, causing rainfall flooding. The main assumption of this dissertation is to prove this statement.

The dissertation uses a number of research methods from a wide range of knowledge. One of the most important was the use of the Błaszczyk Model in order to dimensioning the rainwater drainage system. Another important issue was the calculation of a unified filtration coefficient of soil profiles. Crucial aspect is also the adaptation of the mathematical method of critical inequality to drainage conditions. It is an original attempt to use mathematical tools to study the safety of the city against rainfall flooding.

The dissertation has been divided into 9 chapters, the first four of which are the theoretical part of the work, while the remaining ones present the results and conclusions. **Chapter 1** is an introduction to the topic of urban flooding and describes in detail the aims and scope of the work. In addition, it presents used literature and databases. **Chapter 2** is devoted entirely to individual research methods used in the dissertation, divided into four problem groups: preparation of data for modeling, modeling with the Błaszczyk formula and its implications, possibilities of modernizing the current state of water drainage in the city and determining the safety of the city against rainfall flooding and the possibility of its increase. **Chapter 3** is a description of the environment of the study area. It includes a discussion of the geology and relief, climatic conditions, water relations and land use. **Chapter 4** shows the

functioning of the water drainage infrastructure in the city and a description the diversity of the modernizations enabling the infiltration of rainwater into the road surface. **Chapter 5** is devoted entirely to the rate of rainwater drainage in the face of various environmental conditions, divided into the situation before and after modernization. **Chapter 6** present the determination of the maximum capacity of the current drainage system under the conditions specified in the previous chapter. It also includes an analysis of the theoretical number of drainage system' overflows in the face of actual rainfall. **Chapter 7** is an analogy of the previous chapter, showing possible maximum capacities and the number of overflows, using the modernizations proposed by the author. It also includes an attempt to evaluate individual solutions depending on the environmental conditions. **Chapter 8** is an attempt to compare the results in relation to the actual rainfall flood observed in June 2019. It also includes an analysis of the possibility of extrapolation of the obtained results to larger areas like cachment. **Chapter 9** is a synthesis of conclusions from the dissertation with a summary.

The most important conclusion from the work is fact that the use of infiltration modernizations in sealed areas will allow minimizing the number of city flooding. This also confirms the thesis of the dissertation. With use of that modernizations, the capacity of the system will almost thriced. This will provide into reducing number of overflows, up to 45% compared to the situation before the modernization. In addition, this approach shows much better results than the standard expansion of the rainwater drainage system. For the most common environmental conditions, infiltration modernizations allow to reduce overflows to 31%, when system expansions provide to reduce only to 75% of their original number before modernization. Based on the author's adaptive model of critical inequality, it became possible to revaluate the results into a percentage value of improving the safety of the city against precipitation flooding, in the spectrum of various environmental aspects. Averaging all scenarios, the increase in safety would reach as much as 75% and would increase with the decrease of the density of the drainage system network. With regard to the aforementioned flooding in 2019, the use of infiltration modernization in sealed areas next to the Gallery would allow it to completely avoid its flooding and related material losses.

In the time of constantly changing climatic characteristics, the problem of torrential rains may intensify. In should be mentioned that investments supporting the rfelocation of rainwater are not created overnight. Each urban modernization costs time that should be spent on all its elements, from design and tender, through preparation of the ground, to implementation.

Elements of the urban landscape, which today are only intensifiers of water drainage, in a few years may be necessary for the functioning of agglomerations. Hence the need for public institutions to take action in this matter as soon as possible. This dissertation may therefore be a contribution to drawing public attention to the problem and should initiate further research on this issue.