Challenges in Sewer System Maintenance

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A sewer system is an important infrastructure of every settlement. A sewer system is a set of construction facilities used for the quick removal of wastewater from the humans' immediate environment and its transport to a wastewater treatment plant or direct discharge into an appropriate recipient. In order for the sewer system to perform its purpose properly, its proper maintenance is required. Maintenance of a sewer system is very demanding since the system is mostly underground which makes it difficult to be accessed and maintained. The maintenance of a sewer system can be preventive (regular) or corrective (reactive). The regular maintenance occurs at certain intervals, whereas the reactive maintenance occurs in the case of some unforeseen event. This paper presents the history of sewer systems, as well as basic and alternative types of sewer systems. Furthermore, challenges that arise during sewer system maintenance and difficulties that maintenance employees face in their work are presented in this paper, as well as the ways in which sewer systems are maintained.

maintenance rehabilitation sewer history sewer system

The sewer system, along with the drinking water supply system, is the most important asset of a city's public health system. When properly maintained, a sewer system drains wastewater from houses and buildings to a wastewater treatment plant and protects human health [1].

Rapid population growth and a high level of migration to urban areas create large and unplanned urbanisation [2], thus increasing pressure on settlement infrastructure [3].

As the growth of the population on Earth has accelerated, and, thus, the needs of the population for water for life and work, human population is becoming an important factor for taking care of water conservation.

Water is the key element of sustainable development, a global matter that significantly affects the development or destruction of life on Earth. Due to the trend of population concentration in cities, it can be said without exaggeration that their functioning will depend on the quantity and quality of the management and distribution of water resources within cities [4] and that water-related risks will increasingly be concentrated in cities [5].

Through urban construction, more and more natural terrain is turned into impermeable drainage surfaces that have a drainage coefficient close to one, which brings a greater amount of stormwater or rainwater into the sewer system, [6] thus increasing its load.

UN General Assembly Resolution 64/292 of 2010 affirmed the right to safe and clean drinking water and wastewater drainage as a human right essential for the full enjoyment of life and all human rights [7][8]. Sufficient quantities of water must be provided to all [9].

A reliable infrastructure is the basis for the socio-economic development of the state. The phenomena of material ageing and natural disasters represent a great risk and impact on buildings and infrastructure. Ageing due to various environmental impacts reduces the safety and reliability of existing buildings and infrastructures [10], part of which is the sewer system. The sewer system is the basic city infrastructure for the preservation of public health. The construction of sewer systems requires large amounts of money and labour [11].

With the increase in the number of inhabitants in cities as a result of the industrial revolution in the 19th century, it can be observed that wastewater can no longer be discharged without treatment into the natural environment, and the development of wastewater treatment plants is starting [12].

Today, with a growing population and industrial development worldwide, wastewater is also growing [13].

Once, there was an understanding that the water supply system is a basic necessity, whereas the sewer infrastructure is a luxury, but such an opinion has been largely abandoned for a long time, although there are still some such opinions [14]. Sewer systems have been in the function of public health for centuries and are largely responsible for supporting continuous economic growth [15]. By increasing urbanisation, wastewater management is becoming increasingly important in the sustainable development of the community [16].

The sewer system together with the water supply system is classified into the municipal hydrotechnics, that is, into the municipal technical system as the infrastructure of settlements [17]. One of the most important infrastructure systems of a city is the sewer system. It helps to maintain the human health of a city and is a precondition for public hygiene [18]. That alone is enough to show its importance, and since it is of great importance, it should be maintained properly.

Maintenance of a sewer system is very demanding since it is mostly located underground and the access for and maintenance of inspections are difficult.

When looking at building management, which is also true for sewer system management, there are several requirements that need to be met. The requirements of a limited budget are set here, and certain standards must be met, including a growing number of regulations and the degree of public acceptance [19].

The challenges within the construction management activities, and, thus, the sewer system management, are presented in **Figure 1**.

This is also evident in the management of sewer systems. Every day, sewer system maintainers are placed under certain conditions and requirements that can be illustrated as easily as possible in Figure 1. Different aspects of maintenance activities are shown in Figure 1. Maintenance does more—as an example, personnel must be adequately trained. Then there should be specific maintenance standards, procedures and practices to know how proper maintenance is done. Proper maintenance also requires data. In general, Figure 1 shows that maintenance is intertwined with several components. Some of the challenges and constraints are a limited budget, as it rarely foresees a certain maintenance budget. If the budget is not calculated or estimated in advance, it is usually not

sufficient. Furthermore, it faces social pressures to ensure that the sewer system is used without any interruption in operation and without interference. Companies' operating sewer systems are facing increasing legal requirements—e.g., it is necessary to meet certain parameters of treated wastewater that is released into the recipient (river, sea), and strive to increase efficiency in every respect. All this is intertwined through personnel, costs, abilities, user culture, different procedures, building materials, users, reference service life of the building components and materials, environment, standards and regulations, available data, etc.

Figure 1. Challenges within building management activities (Sketch by D. Obradović).

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