

The way of computer aided handling maintenance events

[Technology](#), [Computer](#)



The way of computer aided handling maintenance events and processes in a network technical system Andre Looks, Marcia Keyboards Abstract The paper presents the results of research on the possibility of computer-aided maintenance management of a network technical system. The first part discusses particular organizational and technical features of the servicing and repair work in the selected network technical system (water supply).

As a result of research, In the second part of the paper, a quantitative computerized system for complex assessment of the maintenance of water supply network system, was presented. The yester is based on the method of operational analysis of technical objects. Operation of this system consists of simultaneous determining the set of values of maintenance indicators for defined technical subsystems (parts of pipe networks) and on this basis, generating maintenance scenarios.

Supplementary to the functionality of the system Is visualization of analysis results In the Integrated GIS module. Keynotes use 3 - 5 keywords. Network technical system, maintenance indicators, water supply network system, GIS.

1. Introduction Network technical systems, or networks for short, distribute products such as gas, eater, and electricity. These networks typically consist of conduit components (pipes and cables) and control components (pumps, valves, transformers and switchgear), and they link few producers to numerous consumers.

Network systems are a crucial foundation for the infrastructure ensuring adequate quality of life for the residents of a given area and economy growth [3]. A typical example of a technical network system is a water

supply system which functions as a collective water supply which consists of the recognition, treatment and water supply to its customers. Water supply operating should meet the needs of the population in terms of water supply in such a way that it is delivered to customers in an organized and constant manner, with the required level of pressure and of appropriate quality.

From a technical point continuity and quality of facilities within an extensive technical infrastructure of geographically dispersed over a large area. This simply means the need to ensure an adequate level of reliability. 2.

Technical network system operational specification In order to determine the operational characteristics of a network system being studied, the research which included the identification and inventory of operational events from selected Polish water supply systems has been conducted.

On this basis it was concluded that with regard to technical objects that are in the area of operations of the technical services of water supply companies, most operational decisions arising from the use of one of the typical operational strategy: the strategy according to the damages (Breakdown Maintenance), the strategy according to the amount of work (Preventive Maintenance) or strategy according to condition of technical objects (Predictive Maintenance).

With the biggest share have the work carried out in accordance with the Breakdown Maintenance strategy, while the least object is supported in part by the Predictive Maintenance strategy. This structure works mainly due to the specific construction and location of the water supply system. The vast

majority of the elements of such a system is located and operates underground, making it difficult or impossible to carry out such preventive work, which are characteristic for the typical manufacturing companies. Another significant aspect is that technical facilities are scattered over a large area.

Taking into consideration the results of studies, repair and maintenance work characteristic for the water supply system has been classified, in four groups [2, 5]: 1 . Maintenance of water pipes, fittings and connected equipment capable of full technical efficiency, through systematic monitoring of network devices and objects, overview and control of technical infrastructure, maintaining the state of pipes and securing them against weathering (egg. Freeze). These works are very important because they allow the prevention of many defects and failures. 2.

Constant monitoring of water supply yeast's operating parameters in terms of quantity and quality of water supplied. To achieve this aim, the network is under continuous monitoring of parameters, including flow and pressure in the pipes and mains distribution network, consisting mostly regulatory work on the manipulation of valves to compensate for flow and pressure in the network. Continuous monitoring of pressures and flows allows the observation of unusual situations such as the increased abstraction of water at night, which may be associated with a water leak resulted from the defect on the network. . Carrying out planned and corrective maintenance work, which should be based on plans drawn up taking into account the considerations and calculations of individual elements of the system

reliability. Among corrective work to be carried out these must be distinguished: protecting the water supply system against infection, the compounds of chlorine disinfection, decontamination of water pipes, which can be carried out by such methods, planned inspections, repairs and possible replacement of individual elements of the water supply system. 4.

Removing caused damage and accidents that result in water supply systems, most of the longitudinal and erosion, damage to welds, unsealing of the valves, defects of the globe valves in hydrants, etc. This type of work should also include defrosting pipes and connected elements, especially those arranged in shallow under the surface of ground. All entries in this category should be exercised in such a way that on the one hand to eliminate or minimize interruptions in the supply of water to customers, on the other to prevent damage from occurring in the environment. . The concept of operational analysis to support the water supply system Analyzing presented in the previous paragraph selected operating conditions of eater supply systems, the question arises, while the research problem, namely: how to increase the operational efficiency of a typical technical network system. The answer to this problem may be proposed by the authors of this article, the conduct of operational analysis based on individual fragments of water supply proportioning.

The proposed method of proportioning technical infrastructure components was described in [1] and involves the construction of the rank of individual objects based on a set of standardized and aggregated measures of service (Key Performance Indicators - KIP). Calculated in this way, the rank order and

form the basis for proportioning the objects for the purpose of conducting the work maintain. This method of proportioning technical objects became the basis for developing a concept support, which then became a computer system called ISSUE (Intelligent System for Supporting Operational Events).

The concept of an intelligent support system based on the assumption that the source data for calculating operating ratios should be the ERP system (Enterprise Resource Planning) or CAMS / AM (Computerized Maintenance Management System / Enterprise Asset Management) representing the effect of Rockford in the organization of water supply companies. Figure 1 presents a model that shows the linkage of IT tools supporting the proposed system.

[pick] Fig. 1. IT tools - support system link model.

The above model includes three basic components (modules): ; ERP system (or the CAMS / AM) - allowing the collection of data and information resulting from carried out maintenance and repair work, thus giving it a resource of data about objects and implemented operational processes, ; analytical module - allowing the determination of values for service and rank of individual objects, ; expert module - allowing for the formulation of proposals for the recommended maintenance activities and the construction of operational scenarios, ; GIS system - allowing the visualization of measurement values and rank the objects in relation to the analyzed area. The way of visualizing this kind of sources is presented [4]. 4.

Prototype Intelligent System for Supporting Operational Events (ISSUE) In general, the ISSUE system can be presented as a three-level application

architecture (Fig. 2). [pick] Fig. 2. Three-level architecture of ISSUE system different categories of users. With this layer the authorized users of the system can access information generated by the system. The presentation layer is also available for presenting the mechanisms for identifying the GIS map analysis results carried out on Key Performance Indicators (Fig. 3). [pick] Fig. 3. Identification of objects with the values of selected indicators of rank and supplies Analytical layer represents the middle level of ISSUE and is responsible for analytical calculations performed by the system (Fig.) and an expert part (Fig. 5) providing operational scenarios recommending action to ensure improvement of the individual operating indicators (KIP), and consequently improve the condition of the network reagent and optimization of connected organizational and economic parameters. [pick] Fig. 4. Sample screen representing the analytical layer of the ISSUE system Fig. 5. Sample screen representing the expert layer of the ISSUE system The last ISSUE system layer is a database layer that stores information resources and data used in the calculation of KIP. Source of input data into the ISSUE system is largely a collection of data from the ERP system (or the CAMS/AM). The manner and extent of the possible use of ISSUE The main purpose of the ISSUE system is to support the water supply companies management to take decisions on operational events occurring in the water supply. The ISSUE system assumes there are three levels of decision-making, which include: ; top management level of exploitation, ; the level of middle management (the company technical department) ; the lower- level management (operational brigades). The above-mentioned decision-making levels are reflected in the system defined in terms of users. According to research, each of the levels of

decision-making is assigned a set of technical, economic and organizational indicators, which are analyzed and form the basis for decision-making at different levels of management.

According to the developed method of assessing the operational technical objects [1], based on selected KIP, users are able to use ISSUE system analysis on a set of measurements assigned to specific passages in the water supply. Figure 6 placed in a ML (Unified Modeling Language) use case diagram shows the example of the system usage by the user of a top management level (CEO). [pick] Fig. 6. Top management ISSUE use case diagram The use case diagram shows that the authorized users, belonging to the top management level, have an opportunity to see within the system 20% of technical according to the Parent principle, they represent 80% of the problems (costs, losses, etc.) in the ISSUE system. For some technical objects it is possible to accurately look at the KIP - for top management level it is 20% of the leading indicators, which should be improved firstly. 5.

Conclusions Presented in the article ISSUE prototype computer system is the result of research conducted by The Institute of Production Engineering team, to develop intelligent IT tool for supporting operational events in water supply system. Now the work of ruining the ISSUE system to the area businesses, as well as using the current operations of the company is taking place. The effects of these works will be subject to further publication.