

Assess operational effectiveness of the Warsaw Metro Passenger Information

Summary

While examining functioning of telematics systems and, in particular, passenger information systems from the point of view of their operation, it seems that an important aspect is their readiness to perform the task which was assigned to them. The process of analyzing the described system readiness should take into account both reliability and readiness to perform a telematics service. The so far developed methods of assessing the telematics system readiness are limited to the assessment of their operational effectiveness solely on the basis of mathematical models without using simulation models determining reliability and readiness of the described systems which significantly affect their proper functioning. Mathematical models which are used for the operational effectiveness analysis of telematics systems are complex models which on many occasions make the assessment difficult and consequently may lead to reduced usefulness of the results obtained. For this reason it seems important to develop an assessment method of the telematics system operational effectiveness which would be more accessible and would allow to use the obtained results more broadly in practice owing to the building of a simulation model which would allow us to assess operational effectiveness of the described systems at the same time taking into account operational processes occurring in them.

This work encompassing the developed methods of the readiness index determination consists of two basic parts. In Part 1 scientific literature relevant for the subject matter of the dissertation has been analyzed. It also presents the research thesis, the objective and scope of the work. Chapter Two is dedicated to the issues related to the technical system operational effectiveness assessment with particular focus on readiness indexes the measures of which characterize the operational process of the systems discussed. On the other hand, Chapter Four presents mathematical methods used to assess the telematics system operational effectiveness with Markov and semi-Markov processes in the focal point.

Literature analysis and the issues presented allowed us to develop Part 2 of the dissertation where, in Chapter Three the object of investigations – the Warsaw Metro Passenger Information System is described first, followed by the event-based model of its operational process. Next, in Chapter Five, using the Markov and semi-Markov processes described in Chapter Four for mathematical modelling, a mathematical model is outlined

which is the assessment basis of the examined system operational effectiveness. Applying the relationships obtained in Chapter Five, we have determined (in Chapter Six) readiness indexes which characterize operational effectiveness of the examined system. A mathematical model developed which is used to assess the passenger information system effectiveness was characterized by considerable limitations in its practical application. The necessity to determine n-fold convolutions of functions and characteristics describing the operational process of the examined system has also contributed to these limitations. Hence, in Chapter Seven we built a simulation model of the operational process of the examined system and owing to this an analysis of operational processes occurring in the examined system was possible. The results obtained characterizing the operational process of the Warsaw Metro Passenger Information System can be used in practice, among others, to support the process of its operation through an appropriate organization of service works as well as to assess operational properties of its technical equipment. Analysis of the results obtained, both actual/real and simulation ones, allowed us to conclude that the specificity of the operational process of the described system functioning does not depend solely on the very provision with indispensable replaceable elements but also on the human factor, which has a significant impact on the decisions made concerning replacement, repairs or maintenance service of the elements which are parts of the system. The results obtained, both real and simulation ones, revealed high compatibility, which was confirmed by the calculated value of the approximation error comparing the two proposed assessment methods of the described system operational effectiveness. Chapter Eight summarizes the research conducted.

From the point of view of the subject matter tackled it was found out that it is possible to assess operational effectiveness of the Warsaw Metro Passenger Information with the use of readiness indexes by both mathematical and simulation description. The method of assessing the examined system operational effectiveness which is presented in the dissertation can be used in practice for solving different problems related to the operation of the described systems.

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