UTILIZING INFORMATION TECHNOLOGIES TO ORGANIZE A RAILWAY JUNCTION SURVEY

Abstract. The article deals with the analysis of scientific works devoted to the problem of the methodology for conducting a pre-project survey of the work of railway junctions. In many cases, the inspection of the junction requires trips on business trips and has a significant limitation on the duration of the implementation, allocated to human and material resources. Therefore, the effectiveness of the pre-project survey essentially depends on the correct organization of work and the establishment of interaction between representatives of the developer and the customer's specialists.

Thus, the lack of a unified approach to the survey of railway systems leads to a formal description of the requirements for automated systems in the terms of reference for their development. Consequently, the lack of a unified approach affects further additional costs of funds and time at the stages of developing work projects and implementing the automated control system on the railway.

Keywords. Survey, railway junction, automated systems.

Introduction.

The main requirement for the development of successful design and technological solutions is a thorough and systematic analysis of properties and interactions processes of the facilities where the execution of their realization takes place. A challenging entity among those objects of the primary focal points within the transportation framework encompass primary and manufacturing railway junctions and centers. The performance of their examination is a mandatory stage before the development of projects for their development, the introduction of automated regulation mechanisms (ARM), enhancement of operational methodologies, investigations into transportation safety, etc.

The crucial significance of the preliminary survey phase lies in the outcome of its execution, leading not only to the acquisition of initial data for subsequent design efforts but also determining the necessity for modifications in the technical infrastructure and railway technology, shaping the client's specifications for the nature and extent of these modifications.

The railway inspection procedure is provided for in the design by rules and regulations, and in the development of junction operation technology by standard technological processes. However, the procedure for performing such a survey has not been disclosed. Considering the above, we can conclude that it is necessary to develop a standard methodology for pre-design inspection of railway facilities, which would contain the procedure for collecting and processing information for railway design and the development of effective technological processes.

Materials and Methods.

The methods of conducting a pre-project railway survey are quite difficult to typify, since their nature is determined by specific goals and conditions of work. However, their structure and content must meet the general requirements and ensure: the display of all types of data necessary for the analysis and preparation of the final documents of the survey; comparability of the same type of data obtained during the survey of various railway departments, information arrays, automated systems, etc.; unambiguity of understanding by all participants of the working group that collects data, the content and method of filling in all graphs of personal forms, for example, in questionnaires.
These requirements can be provided by the preparation of appropriate personal forms, typed response options, with brief instructions on filling out questionnaires and instructing or training the participants of the working group before conducting such a survey [1-4]. The purpose of the pre-design survey of the railway is to collect data necessary for the design of the AS, including those necessary to justify the feasibility of changing the technical equipment of the railway, a preliminary assessment of the effectiveness of technical and technological solutions and the preliminary formation of requirements for design and technological solutions.

Conducting a pre-project survey of railway junctions is designed to solve the following tasks: to reduce the time and cost of developing design and technological solutions; to contribute to achieving maximum detail of requirements for the conditions of reliability of the railway, the functional composition of systems and automated workplaces, which are developed simultaneously with the design of the railway or purchased at the appropriate stages of work; to minimize or eliminate errors in the interpretation of project requirements, the technology of implementation of automated regulation mechanisms (ARM) on the part of the customer; to ensure timely planning of the most expensive components of the systems.

This, in particular, can be achieved by ensuring the completeness of the survey of software and hardware components based on the general principles of AS design. The pre-design survey is carried out as part of a specially designated working group, which includes both representatives of the organization carrying out the design and leading employees of the design facility, for example, railway junctions. The procedure for selecting candidates who are included in the working group provides for an assessment of their level of professional training, knowledge of the organization and technologies of work performed at the railway junction, etc.

And, equally important, one should take into account the psychological attitude regarding the ideas of implementing and/or developing automation tools in the organization, department or group in which they work. It is also advisable to take into account that in the future the operation of the updated railway junction will be largely carried out by the same employees. In general, the pre-design survey is carried out in several stages and is performed in accordance with the scheme shown in Fig.1. The main stages in this case are: study of the subject area; development of the methodology and program of the survey; implementation of the survey program; processing and generalization of survey materials.

**Results and Discussion.**

Issues of studying the railway technological process is one of the stages of formalization and automation of processes in the infrastructure of railways in Kazakhstan. The methodology of system analysis is used in the examination of railway junctions. At this stage, developers should clarify the boundaries of studying the railway technological process, determine the range of users of the future system at various levels and identify classes and types of objects to be surveyed. According to the sources of information about the work of the railway junction, it can be classified as primary and secondary.

Primary information is understood to be information that is obtained directly at the research object as a result of a special examination. Secondary information is understood as information about the object of research that was collected earlier and can be obtained from internal and external sources.

In the future, various methods of obtaining information will be considered and systematized in order to determine the optimal order of their application in the examination of railway junctions. The gathering of data can be conducted through diverse approaches, varying in their degree of formalization. The categorization of these approaches is depicted in Figure 2.

The main methods of obtaining primary information about the work of the railway is a survey and observation. The main method of obtaining secondary information about the railway is the analysis of documents. The survey method is a psychological verbal and communicative method. This method consists in the fact that the interaction between the interviewer and the
interviewees (respondents) is realized. The purpose of such an interview is to get answers to pre-prepared questions from the interview subjects. Thus, the source of information in surveys is written or oral responses, or the opinions of respondents [1].

The main advantages of the survey methods are:

1) the relatively low cost of organizing surveys (in particular online);
2) the content and versatility of the information received during the surveys;
3) the ability to maximize the use of technical means (dictaphones, video cameras, online questionnaires, etc.). However, classical survey methods have their own specific disadvantages.

For example, factors that are subjective negatively affect the quality of the survey information. Such factors include:

1) the level of education and culture of the respondent;
2) the properties of the memory and psyche of the interviewee;
3) the attitude of the interviewee to the problem under study;
4) the rejection of the organization or people who conduct the survey.

And besides, the result of the survey may be negatively influenced by factors that are related to the researcher himself. For example, the lack of practical interviewing skills, incorrectly compiled questionnaires, etc.

Other factors also affect the results of surveys, for example, the presence of unauthorized persons (primarily railway managers) during the survey negatively affects the results, poorly chosen time and place of surveys, poor organization of survey procedures, etc. To minimize the impact of negative factors, one should strictly adhere to the methodological recommendations for conducting survey research.

Figure 1 – Procedure for identification of functional models of railway junctions
The survey can be conducted either in person, when the researcher is in direct contact with the respondents, or remotely with the indirect participation of the researcher or without his participation at all. Conducting a survey (interview) includes the following main stages: preparation for the survey; organization and conduct of the survey; assessment and summing up. Upon the task of examining a complex object comprehensively, it is advisable to conduct several types of surveys.

The particular approach to executing these tasks will be contingent upon the tasks nature and the development of the researches strategy. Yet, typically, it is recommended to initiate steps to engage in discussions with senior staff when interviewing personnel at railway establishments. Moreover, during the preliminary phase, it is recommended to conduct interviews with the enterprise's most skilled experts.
Typically, this data serves as the foundation for conducting follow-up interviews or creating more specialized questionnaires. It is worth mentioning that questionnaires represent the most structured survey formats.

The approach to acquiring data through written responses to a set of pre-designed and standardized queries in surveys, employing a precisely outlined manner of responses, is extensively employed in the analysis of intricate technical systems [2-6].

The benefit of the survey form in contrast to alternative research techniques lies in its capability to swiftly gather the perspectives of a substantial number of respondents. Moreover, employing statistical methods in mathematical analysis proves convenient for evaluating the survey outcomes. The primary instrument for such a survey is a set of queries.

A set of queries constitutes an organized series of interrogatives crafted to elucidate facts or associations, serving as a means to capture data.

Worksheets are regular templates where information, remarks, and viewpoints can be documented [4-10]. The purpose of the questionnaire is to obtain accurate information from respondents. In any study involving multiple people, it is important that respondents are asked the same questions in the same way. Without this structure, it is impossible to form an overall picture of an object or phenomenon that is being investigated using a questionnaire. Questionnaires facilitate data processing.

The answers are recorded on each questionnaire in the same places, so that it is easy to count the number of people who gave a particular assessment. The stages of conducting questionnaires are presented in Table 1.

Each specific study requires the creation of a special questionnaire, but they all have a common structure. Microsoft Forms were selected to execute the surveys, facilitating the development of a user-friendly platform, as depicted in Figure 3-4.

Figure 3 – An overall perspective of the questionnaires for experts to work online
Figure 4 – An overall perspective of mobile-based surveys for professionals conducting online tasks

The algorithm for matching expert assessments is shown in Figure 5.

Figure 5 - Illustrates a schematic representation for synchronizing expert evaluations while handling online surveys in the course of the railway examination
Conclusions.
Initially, a technique and framework for overseeing rail network facilities have been formulated, relying on the comprehensive utilization of alternative assistance frameworks for predicting progression and ongoing evaluation of railway operational assignments. The suggested approaches vary from current ones due to their capability to computerize the process of formulating choices for manage, activities through the utilization of Microsoft Forms surveys.

Formulated and validated in practical scenarios within Microsoft Forms rail networks for surveying analysts from outside and experts within. Microsoft Forms are configured for online professional tasks.

Observations revealed that the utilization of Microsoft Forms enhances the effectiveness of implemented systematic and engineering interventions, to boost railway effectiveness and streamline its network. Additionally, it results in a 12-15% reduction in the expenses associated with conducting surveys and polls in comparison with to current approaches.

REFERENCES


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ТЕМІРЖОЛ ТОРАБЫН ЗЕРТТЕУДІ ҰЙЫМДАСТЫРУ ҮШІН АҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАРДЫ ПАЙДАЛАНУ

Андатпа. Макала да теміржол станциялары (ТЖС) жұмысын жобалауға дейінгі зерттеу жүргізу әдістемесі мәселесі қойылатын ғылымдық әдістер мен сапаттардың қолданылуына өткіздік. Теміржол станциялары (ТЖС) зерттеуде әдістемелерді қолдау үшін қолданылатын информациондық әдістер мен сапаттардың қолданылуына өткіздік. Теміржол станциялары (ТЖС) зерттеуде әдістемелерді қолдау үшін қолданылатын информациондық әдістер мен сапаттардың қолданылуына өткіздік.

Алардың қолданылуына қатысты ортақ технологиялық әдістер мен сапаттар қолданылатын ғылымдық еңбектерді талдау қажет екен.

Мақалада теміржол станциялары (ТЖС) жұмысын жобалауға дейінгі зерттеу жүргізу әдістемесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәселесі мәс