

## СТАНДАРТИЗАЦИЯ И УПРАВЛЕНИЕ КАЧЕСТВОМ

УДК 33

### Tuulsaikhan A., Ganchimeg J., Tsetsgee B. Ways to improve the organization of repair work

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**Abstract.** *During the 84 years of the development of Mongolia's railway transport industry, certain technical reforms have been carried out in stages, but depending on the amount of investment, it cannot fully meet the requirements of high-speed trains. This method of organizing the repair work of our railway track is one of the many problems that must be solved at this time, such as the high labor consumption, the high level of workplace risk for the workers, and the high daily operating costs due to the insufficient quality and productivity of the work performed. Therefore, within the framework of this research work, in order to optimize the organization of railway track repair work, it is necessary to develop a methodology for re-establishing the required labor cost norms in accordance with the technical condition of the track. In the future, by increasing the level of mechanization and automation, developing new versions of the organization, drastically reducing the number of manual workers, freeing them from high-risk jobs, improving the safety level, improving the quality of repairs, improving the level of reliability of railway transportation, and transit transportation in accordance with international standards. while increasing the amount, it will further create the conditions for increasing the economic efficiency by reducing the amount of current expenses.*

**Keywords:** *work schedule, work load, work norm*

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#### 1. Introduction

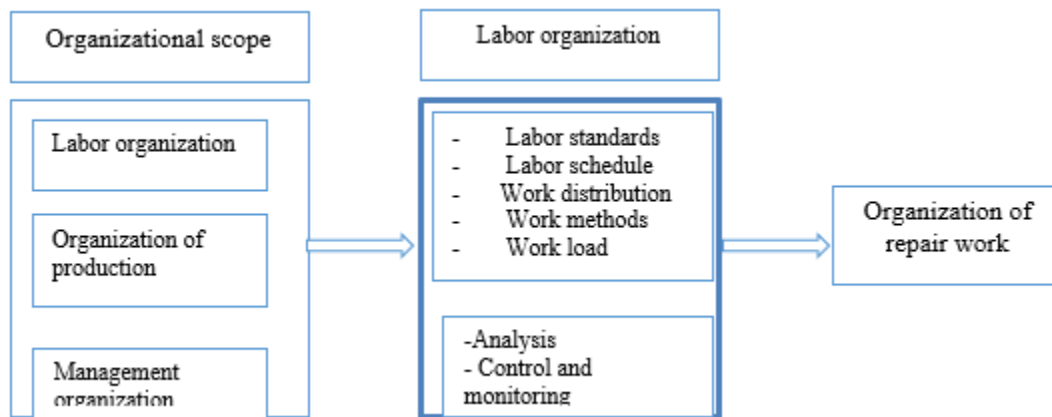
A simplified formula of management theory states that "Organization increases power (resources) tenfold." The theory and methodology of organizing and managing any human activity in order to improve labor results is specially studied in the science of labor economics. Definition of labor organization: "Labor and organization are economic, technical-scientific, and manpower complex measures that ensure the highest orderliness and efficiency by optimally coordinating the conditions and opportunities of human labor with the material things of production in the integrated operation of production". If we examine the issues of labor organization in terms of content, three main objectives are set. It includes:

1. Economic goal: to save labor and material costs by introducing new technologies in production, and to improve social labor productivity

2. Physiological goal: To protect human working ability and health by improving working and hygienic conditions

3. Social goal: To organize and manage a knowledge-based scientific production park in the era when the content of labor is becoming intellectual. In this way, Mongolian people's ability to compete with their labor will be brought up to the standard of developed countries in the world.

Organizational theory is the basis and scientific basis of the organizational concept.



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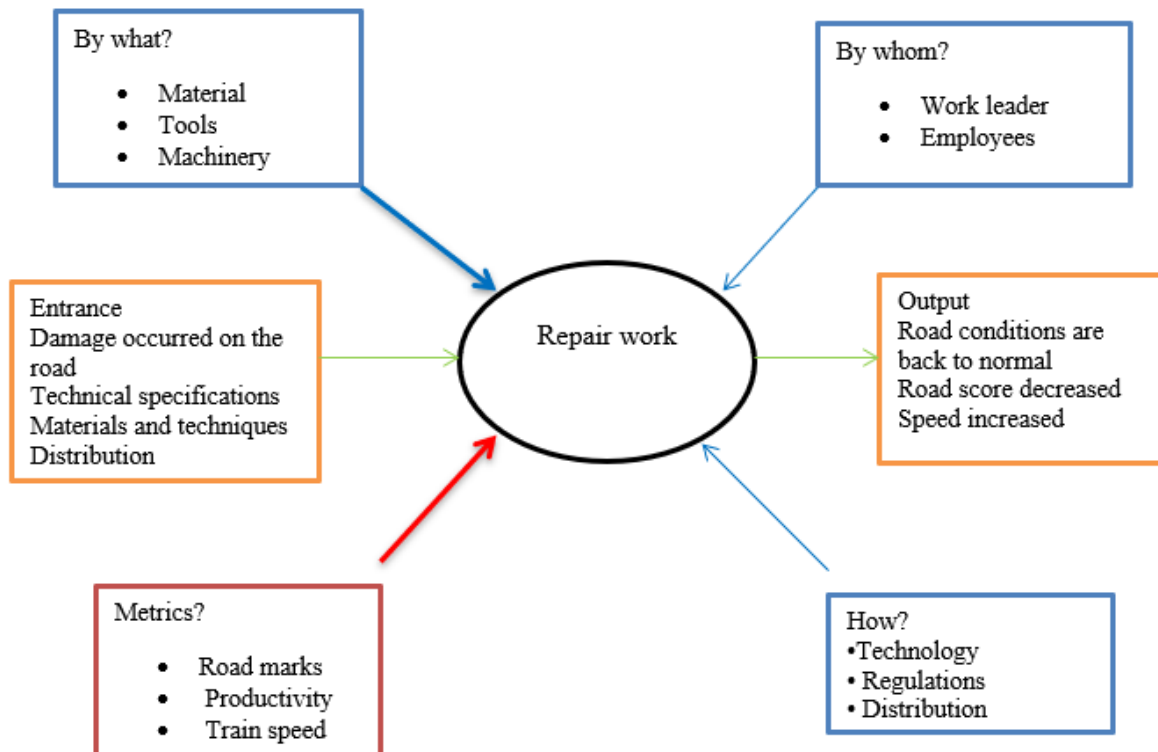
***Picture 1. The theoretical framework of maintenance work organization***

The theory of organization covers 3 areas: labor, production, and management organization. From that, within the scope of labor organization, the variables of labor norms, work regulation, and labor distribution will be considered and ways to improve the organization of repair work will be theoretically and methodologically studied.

## 2. Research section

Scope of research work:

1. Distribution of repair work
2. Work load
3. Workplace organization
4. Repair methods
5. Labor norms.



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*Picture 2. Road repair work*

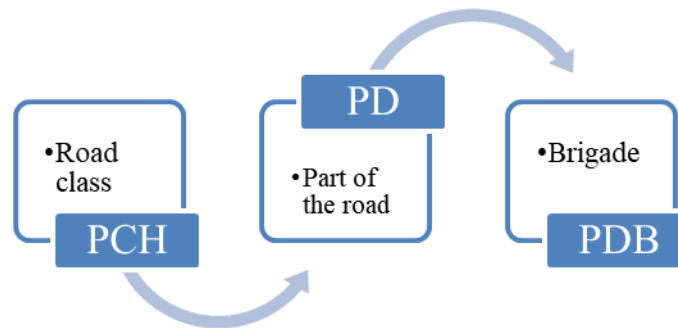
When there is damage to the road, which is the basic structure of the railway, the main goal of creating conditions for the train to pass at the specified speed will be achieved when the road condition is normalized, when the work force with materials, tools and machinery is organized in an efficient manner. During the period of 2016-2021, at the level of the Road Construction Department, there are 150 routine maintenance tasks, 56 tasks related to the operation of the repair shop, 42 tasks related to the construction workshop, 41 related to officials, and 6 technical tasks related to the operation of the bridge and pipe workshop. The card is being processed and investigated according to the order of the Chief of Roads No. A-24.

The current organization of repair of sections of the road section:

A. The total length of inter-station roads and station roads is 24 km, and when there are 4-10 station transfer stations, 1 brigade is performing the work in the section with 12 road workers.

B. When the length of the roads, stations, and branch roads is 27-30 km, and the distance between the stations is 25-30 km, the work is divided into 2 brigades with 20 road workers.

B. When the length of inter-station and branch roads is 38-45 km, and the transfer of stations is 20-47 km, the work is divided into 3 brigades with 25 road workers.



Source: Prepared by author

**Picture 3. Organization of the current repair work of the road department**

The road repair works were carried out with the help of human power and manual labor. In terms of labor consumption, 55,684 man/hours or 28.7% were used to install wooden sleepers, 34,681 man/hours or 17.9% were used to lift the road with electric screeds, and wooden sleepers were included. replacement is 19127 people/h or 9.87%, re-mowing is 16358 people/h or 8.44%.

Degree of labor mechanization %:

$$C_{MT} = \frac{34}{269} * 100\% = 13\% \quad (1)$$

Production mechanization and automation level %

$$У_{МПП} = \frac{729847648.7 - 717821622}{729847648.7} * 100 = 2\% \quad (2)$$

According to the above research and calculations, there are more than 300 types of road maintenance works, only the machinery needed to transport the materials of the road superstructure, people and tools, and the ground works, but the machinery used for road maintenance is not available in the road maintenance department, and road maintenance is carried out by electric and liquid pumps. It is done semi-mechanized with tools, the degree of mechanization of road maintenance work is 13%, the level of mechanization is 2%, and 98% of the total work is manual, 99% of road machinery and 48% of road equipment are still in use. These machines, produced in the former Soviet Union between 1978 and 1986, have low productivity, high operating costs, and have a negative impact on fleet utilization. As it turns out, the road class needs to update not only these cars, but also other vehicles.

The level of each factor of work organization of the research object is as follows. Maintenance Work Distribution (MW): The maintenance work schedule and load level were calculated based on the results of chronometric work measurements by sampling 3 total 30 jobs from each of the road sections located on the main road and branching main roads.

Job measurements were made with 10 repetitions for each job, and the overall average time was used in the analysis.

Repair schedule factor:

In the sampled workplaces, the time spent on basic functions and non-professional work was calculated by direct observation and measurement, and based on that, the level of the repair work schedule was determined as follows.

$$K_{xy} = 1 - \frac{780}{600 \cdot 10} = 0.87 \quad (3)$$

In the researched workplaces, 8 hours were considered as the duration of work in the main repair schedule. According to the research, there are fewer non-main duties in the workplace on road sections that have not undergone major maintenance. On the other hand, the work schedule is relatively poorly defined in the parts of the road that have undergone major repairs.

*Table 1*

*The level of road section repair work schedule*

Class 2 road section	Class 3 road section	Class 4 road section
0.60	0.87	0.94

In the road sections, the time spent on work that is not included in the job description varies from job to job, but there was a lot of inefficient activity. Because there was more to spend on other economic activities, which reduced the amount of basic repair work. Workload Coefficient (AA): Based on the total time spent working with equipment and machinery and performing manual and physical work in the surveyed workplace, whether the employees were fully loaded with work during the work, or whether they could work simultaneously with other duties, is as follows:

$$K_{\text{эп}} = \frac{3650.2}{600 \cdot 10} = 0.61 \quad (4)$$

Whether the employees are working at full capacity during the duration of the work is calculated based on the results of chronometric measurements made at the workplaces of the road sections where the coefficient of the repair work schedule is calculated. 10 times of observation and measurement were made at each workplace and the total time spent by the employees was averaged. In the process of observation and measurement, it was observed that workers leave the workplace, transfer necessary tools and protective equipment, and have a lot of free time. It was concluded that this is due to the insufficient organization of the repair work. The workload coefficient of 0.61 is an insufficient indicator, so the labor participation of the workers is increased. It is seen that it is necessary to improve the intensity of work.

Table 2.

*Load factor of the road section*

Class 2 road section	Class 3 road section	Class 4 road section
0.56	0.61	0.75

The study shows that the level of work load in the sections with 2nd and 3rd class roads is insufficient. Workplace Organization (WCO): Based on internal documents such as maintenance regulations and technical usage rules, data collection and measurement methods were used to determine the adequacy of workplace organization and necessary equipment and machinery. Workplace Organization Coefficient (WCO): 32 workplaces including the main and branched road sections were sampled and calculated to determine how well they conformed to the requirements specified in the job description, labor safety instructions, and technical use rules applicable to road sections.

$$K_{a6} = \frac{32}{55} = 0.58 \quad (5)$$

Inadequate organization of repair work, lack of proper use of equipment, machinery, tools, and equipment related to the operation were revealed during the observation. In addition, there were no clear instructions and regulations regarding the organization of the workplace, and no work was done to improve it. the workplace organization coefficient is insufficient. It was observed during the research that it is necessary to improve the planning of the repair work and improve the organization of the workplace according to its main directions.

Table 3

*Coefficient of workplace organization in the department*

Class 2 road section	Class 3 road section	Class 4 road section
0.33	0.45	0.58

Considering the number of workplaces adapted to the proposed project or organized in the most appropriate way for each section of the road, the coefficient of organization of this workplace, which is insufficient for sections with roads of the 2nd and 3rd class, is affected. The level of provision of workplace equipment: 10 workplaces working with mechanized tools were selected in the road sections, and a total of 32 workplaces were calculated based on whether the number of machinery and tools is in accordance with the regulations.

$$K_{T6} = \frac{32}{65} = 0.49 \quad (6)$$

In the calculation, the number of tools and equipment used in each workplace is averaged by comparing it to the total number of workplaces. Depending on the characteristics of the workplace, the supply of tools and machinery varied, but during the observation and measurement, the wear and tear of equipment and tools in all workplaces, there were many shortages due to damage.

Table 4

*The level of provision of equipment for the road section*

Class 2 road section	Class 3 road section	Class 4 road section
0.56	0.49	0.41

Workplace service level: The workplace service level of all parts and workshops in the repair department is calculated based on the workplace description, technological procedure instructions, and equipment usage rules, as follows.

$$K_Y = \frac{196}{345} = 0.57 \tag{7}$$

The service level of the workplace is insufficient. During the research, it is necessary to clearly specify the duties of the employees responsible for the workplace service, to follow the labor safety instructions, and to carry out regular maintenance of the workplace and machinery.

Repair method:

As for the road sections with the main duties, they all perform the same tasks together because they are semi-mechanized.

$$K_{6a} = \frac{(310.1 - 235.1) * 48}{600 * 10} = 0.60 \tag{8}$$

6 senior level workers were selected from each of the researched workplaces and 4 junior level workers were compared. The coefficient of labor style is related to the state of automation and mechanization of repair work, and the fulfillment of norms and standards required. Standardization of labor: The performance of repair work is evaluated by the amount of time and labor spent.

The level of labor standardization: The level of standardization is calculated based on the total number of road sections and the number of employees with labor standards, the quality of the standards or the level of intensity, as follows.

$$K_{HO} = \frac{246}{345} * 0.37 = 0.26 \tag{9}$$

$$K_4 = 0.25 * 0.92 + 0.15 * 0.9 = 0.37 \tag{10}$$

$$K^1_{\text{ч}} = \frac{100}{100 + \Delta^1} = \frac{100}{100 + 9} = 0.92 \quad (11)$$

$$K^2_{\text{ч}} = \frac{100}{100 + 10} = 0.9 \quad (12)$$

$$\Delta^2 = 100 - \frac{1.8 *}{2} 100 = 10 \quad (13)$$

It has been observed that the norms and standards have not been updated for too long, and the issue of monitoring and monitoring them in the repair work has been neglected in the sections of the roads and workplaces covered by the study. Also, although production and service standards have been established, the performance of workers in repair work is evaluated by the "time-based" system, which does not meet the conditions for proper evaluation of worker performance and optimal determination of wages and bonuses.

The level of participation of workers in labor norms: When calculating the number of norms used in the total amount of repair work in comparison with the number of norms applied in the repair works within the road classes:

$$K_{T_{\gamma}} = \frac{78}{242} = 0.32 \quad (14)$$

Career compatibility:

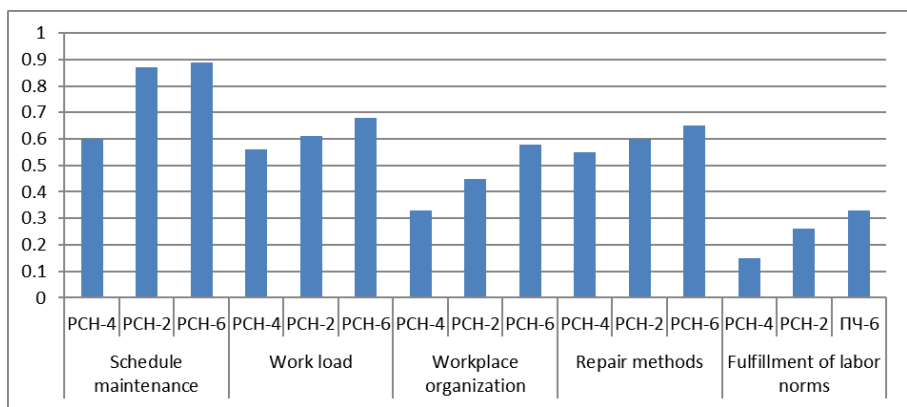
In order to calculate whether the employees have been assigned the appropriate job duties according to their profession, using the tariff professional directory, the list of positions and professional ranks in force in the road divisions:

$$K_{M_{\text{Э}}} = \frac{3.65}{3.95} = 0.92 \quad (15)$$

According to the balance of working hours in 2022, the ratio of working hours for road classes is 0.91. It is believed that the coefficient of determining the level of labor discipline calculated by the measurement method in the sections with roads of the 3rd and 4th class is 0.83, which is due to the relatively good use of working hours of the workers. This is due to the fact that the wage system is coordinated with the fulfillment of hourly norms, the worker is provided with full work during the working period, and the idle time is relatively low. based on it, it is necessary to develop a detailed schedule of repair work by improving working hours and time density. In this way, it is possible to reduce excess, inefficient and vacant positions. needs to be implemented.

As a result of the above analysis, which determined the current state of repair work organization, the level of repair work organization factors in each section and department was determined in terms of the factors that can be calculated for each road section and department. provides an opportunity to take certain measures.





**Picture 4. Organizational level of repair work**

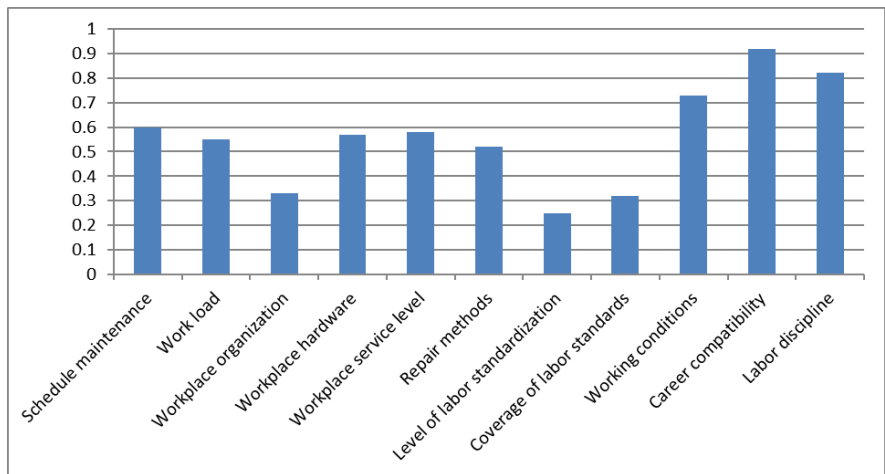
The general level of the organization of repair work of road sections was determined by the geometric mean method using the measures of organizing the repair and the 15 factor coefficients of the total 5 directions calculated above. This determines the correlation of the factors.

The general level of organization of repair work is as follows.

$$K_e = \sqrt[15]{0.87 * 0.61 * 0.58 * 0.49 * 0.57 * 0.60 * 0.26 * 0.32 * 0.92 * 0.65 * 0.71 * 0.72 * 0.65 * 0.71 * 0.65} = 0.56 \quad (16)$$

Based on factor coefficients, the overall level of repair work organization is 0.56. This means that it is lower than the possible value. Out of the 15 factors of the studied sections and workshops, the level of labor schedule, work load, workplace organization, provision of equipment, and standardization is at least 0.06 and at most 0.30. shows that things need to be improved.

Based on the results of this research, it is advisable to take specific measures aimed at improving the organization of repair work. Let's show the general level of organization of repair work.



**Picture 5. General level of repair work organization**

The data required for the study was compiled based on the quarterly and monthly financial and performance reports of the organization, analysis of the company's balance sheet, internal control information, and research to determine the level of organization of repair work.

The following six organizational stages will be implemented to improve repair work.

1. Make a plan that accurately calculates the labor schedule - All kinds of inspection results, reports, long-, medium-, and short-term plans, road technical documents, etc., necessary for planning the work organization, etc., to ensure proper planning and coordination of work. A summary of the facts will be discussed at that stage.

2. Choosing a solution for workplace organization - Work will be carried out to calculate the suitable option for the work team to perform the tasks in the planned time with high quality and safety.

3. Calculate and establish labor norms and norms - Estimate the manpower required for the planned works, accurately calculate the number of workers needed to improve the technical condition of the current road, determine the types of repair works, revise and improve the norms, and set new norms.

4. Preparation and development of human resources - selection and formation of labor teams necessary for the execution of planned tasks, training and training, training courses to strengthen, improve and develop the skills of former employees in stages according to a specific program, and conducting research on the personnel resources required when necessary preparation, management and organizational and human resource planning will be fully coordinated

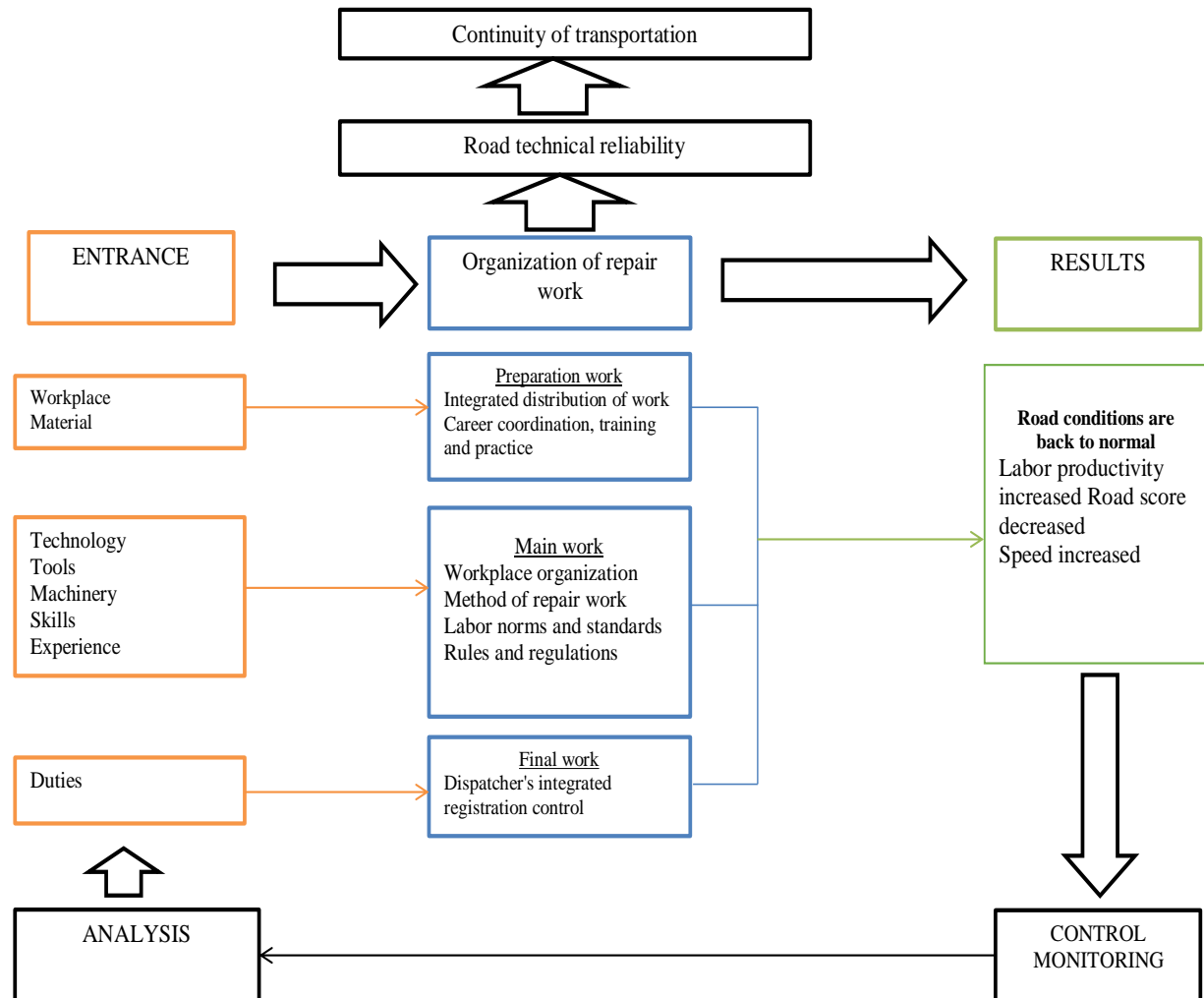
5. To improve HSE and technology discipline - In the organizing activities, work necessary for work safety and hygiene regulations, instructions, technology cards, and technological processes will be developed and presented to supervisors and employees, and necessary work will be carried out.

6. Integrated registration and control - In the framework of labor organization, work performance, results, and reports will be registered with each document and a process map will be developed. In the process map, the parties involved in the labor organization activities and the coordination of work between them, work progress, performance, and control measures will be developed in the form of a schematic diagram.

The conditions for the continuous continuation of railway transport are formed as a result of the combined work of multi-functional organizations. Ensuring the normal reliability and safety of the basic structure is the most important to ensure the continuous operation of the transport. Therefore, the most important problem of the basic structure is to organize the repair work correctly and optimally to ensure the technical reliability of the road. The inputs to repair work include jobs, materials, tools, technology, machinery, skills, experience, and tasks.

When organizing repair work, it is divided into 3 main parts. It includes preparatory, main, and final works. The results of the organization of repair work are measured by increasing labor productivity, reducing road marks, improving evaluation, and increasing the number of trains.

### Organizational model of repair work



*Pcture 6. Repair work organization model*

In order to organize repair work using the above model and increase its efficiency, the following measures should be taken in advance.

### Conclusion

1. It is determined which parts and departments of the road class need to start the organization of repair work as soon as possible. It is necessary to select and improve the parts, workshops, and workplaces that are malfunctioning in the operation of the organization

responsible for maintenance work. This will create conditions for producing results in a short time.

2. To conduct research and analysis to improve the organization of repair work, to calculate the efficiency, a working group consisting of professional workers has been appointed and collected relevant information and data. and provided the conditions for the implementation of methodological recommendations for the development of research work with the participation of professional organizations.

3. A program has been prepared that clearly reflects the directions, duties, and division of work of the work group that will organize the repair work.

4. The technology, tools, machinery, skills and experience of workers to be used in the organization of repair work

needs have been fully determined by research.

Based on the completion of the above preparatory work, conditions will be met for testing the organization of repair work at workplaces, road classes, and sections.

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