

Janka GOMBITOVÁ,<sup>1</sup> Janka ŠESTÁKOVÁ<sup>2</sup>

## PERSPECTIVE METHODS FOR PROCESSING OF TECHNOLOGIES FOR MODERNISATION OF CORRIDOR RAILWAYS

**Summary.** The modernisation works on the railways are required by qualitative improvement of the traffic network of the Slovak Republic. Development of the modernisation works is advisable to plan, realize and check by the job descriptions. Localization, structure and organization are important for design of systems. The systems are processed for the job descriptions from aspect of using of computer equipment. The automation of the job description design includes manipulation with the input data for effectiveness of the modernisation works. The result is displayed in output data. The output data influence the format of the job description and the organisation of works too.

## PRZYSZŁOŚCIOWE METODY OPRACOWANIA TECHNOLOGII MODERNIZACJI KORYTARZY KOLEJOWYCH

**Streszczenie.** Modernizacja dróg kolejowych wynika z potrzeby zapewnienia wysokiego standardu technicznego sieci transportowej Republiki Słowacji. Przebieg prac modernizacyjnych wygodnie jest planować, realizować i kontrolować za pomocą procesów technologicznych tych prac. Automatyzacja projektu procesu technologicznego dla zapewnienia efektywności prac modernizacyjnych obejmuje opracowanie wstępnych danych i wyników, które mają znaczny wpływ nie tylko na kształt procesu technologicznego, ale również na organizację modernizacji.

### 1. INTRODUCTION

The traffic network of Slovak Republic is integrated to European traffic area. The incorporation of the network necessitates the realization of the modernisation works. The works will be on the line sections, on the railway stations and on the other railway traffic equipments. The parameters of modernised railway lines and relevant railway stations (within the frame of the international corridors) will be suitable for international agreements AGC and AGTC. The agreements regulate technical parameters of railways.

Effect of modernisation is reconstructed railway with described technical parameters. This effect is available with expected precise realisation of works complex on several parts of railway body and on railway substructure building units.

<sup>1</sup> Doc. Ing. Janka Gombitová, CSc., Department of Railway Engineering and Track Economy and Management, Faculty of Civil Engineering, University of Žilina, Komenského 52, SK – 010 26 Žilina, Slovak Republic, phone: 00421 41 76 348 18, e – mail: gombit@fstav.utc.sk

<sup>2</sup> Ing. Janka Šestáková, e – mail: janase@fstav.utc.sk

The choice of useful materials and mechanisms and succession of working operation ensures quality result of modernisation works – it means high technical parameters of rail way and low costs on next maintenance activity.

## 2. SYSTEMS AND METHODS FOR DESIGNING OF JOB DESCRIPTIONS

The question of designing of job description for modernisation works on rail way relates with broad scale of tasks. These are represented by entering input information and by expected output data. The structure of input data is in the figure 1.

The location structure of modernised elements is in the figure 2. This structure classifies elements of railway on the part of location in railway body. Automatization of the job descriptions design is applied for works on construction of permanent way, railway subgrade and partly on water drainage units.

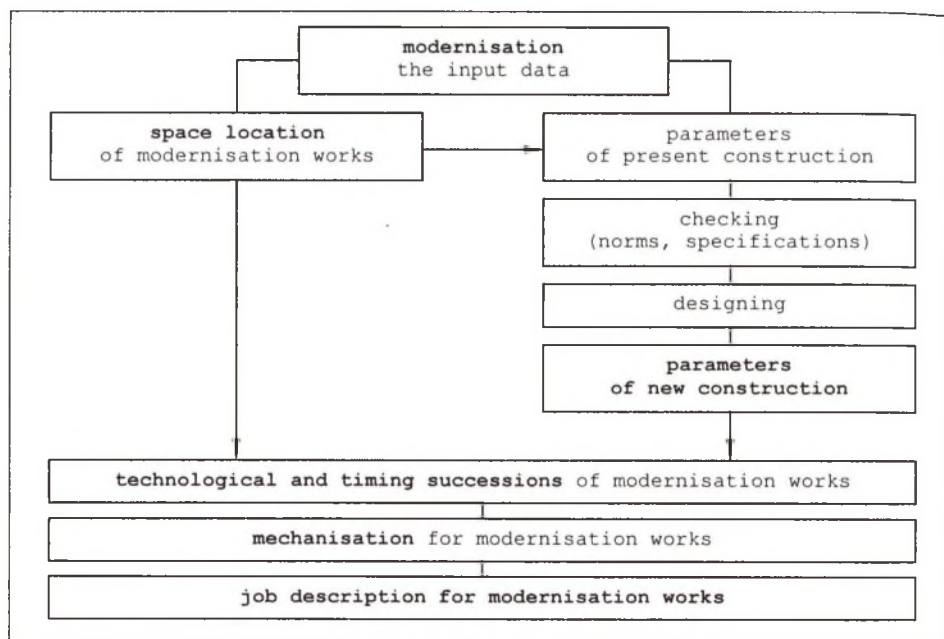


Fig. 1. Modernisation of railway lines and stations – input data structure

Rys. 1. Modernizacja linii i stacji kolejowych – struktura danych wejściowych

It is important to make provision for location modernisation works in railway body and location modernisation works in space. The location in space is divided into three categories:

- 1. point,
- 2. object,
- 3. line.

Two systems were worked for models of job descriptions design:

- system „Modernisation of switch“,
- system „Modernisation of track“,

The systems are divided into subsystems, which are characterised by the model of the railway

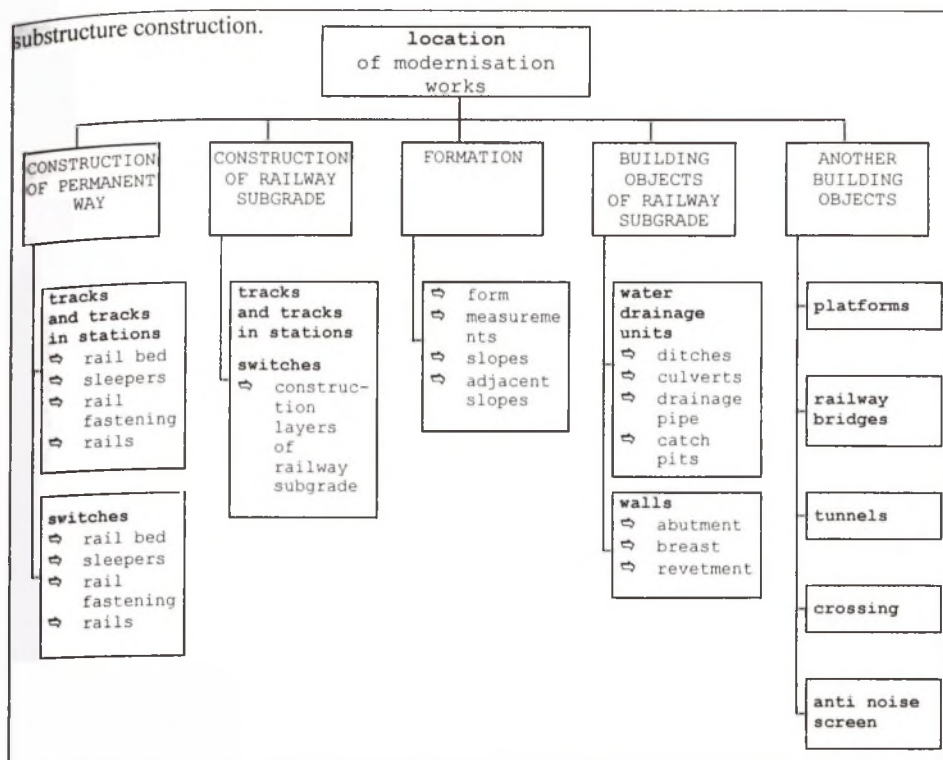


Fig. 2. Structure of location of modernisation works

Rys. 2. Struktura lokalizacji modernizowanych prac

The systems are divided into subsystems, which are characterised by the model of the railway substructure construction.

The result of design of job description in the system “**Modernisation of switch**” is the job description model, which is destined for automatized designing of job description of switch or switches in-group modernisation. There is used a base of the technologies of **switch renovation with a track grid removal**.

The objects space location of the modernisation works on switch takes cumulating of mechanisms, materials and workers in relatively small area. Old removed and new inbuilt material is in several steps continuously transported to and from this area. Therefore it is important to avoid the work activities and transport streams crossing.

The result of design of job description in the system „**Modernisation of track**“ is the job description model, which is destined for automation designing of job description of railway station track or track modernisation. There is used base of technologies of reconstruction of railway subgrade of track. It is possible to realise this technology in two ways:

- with **track grid removal**,
- without **track grid removal**.

Position of mechanisms in time and space is important for the line space location of modernisation works on track. The materials quantity requires a solid plan for number

and work performance of materials transport mechanisms. These parameters depend on the work performances of main mechanisms in mechanical configurations.

General model of the job descriptions of modernisation works was worked for design automation and results variability. This one describes the job descriptions for systems ("Modernisation of switch", "Modernisation of track") from mathematical point of view. Work with information in model (fig. 3) respects all task combinations, which are entered by boundary conditions from input data.

Mathematical model of design of the job description of the modernisation works is possible to characterize as a special case of linear programming – assignment task. The task with abides of time planning principles makes a base for successful design of the job description with effectively utilisation of mechanisms capacity.

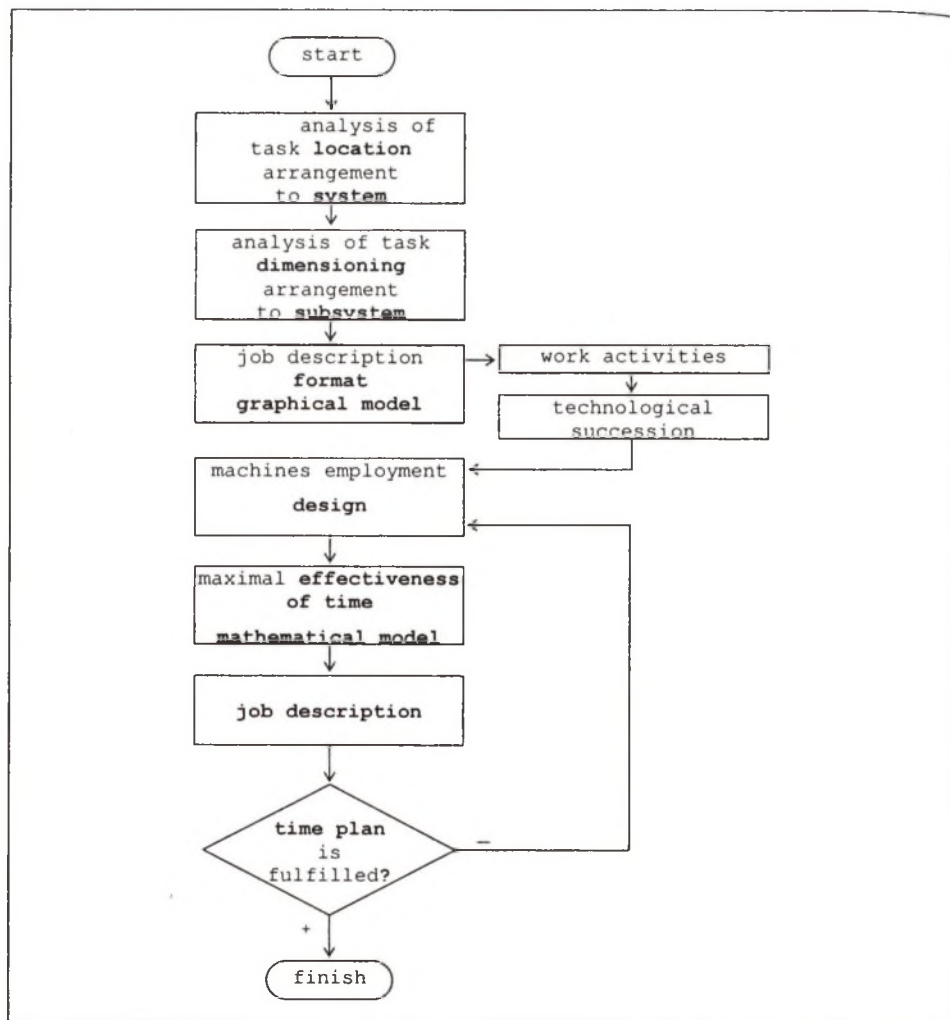


Fig. 3. General process of work with data

Rys. 3. Ogólny proces postępowania z danymi



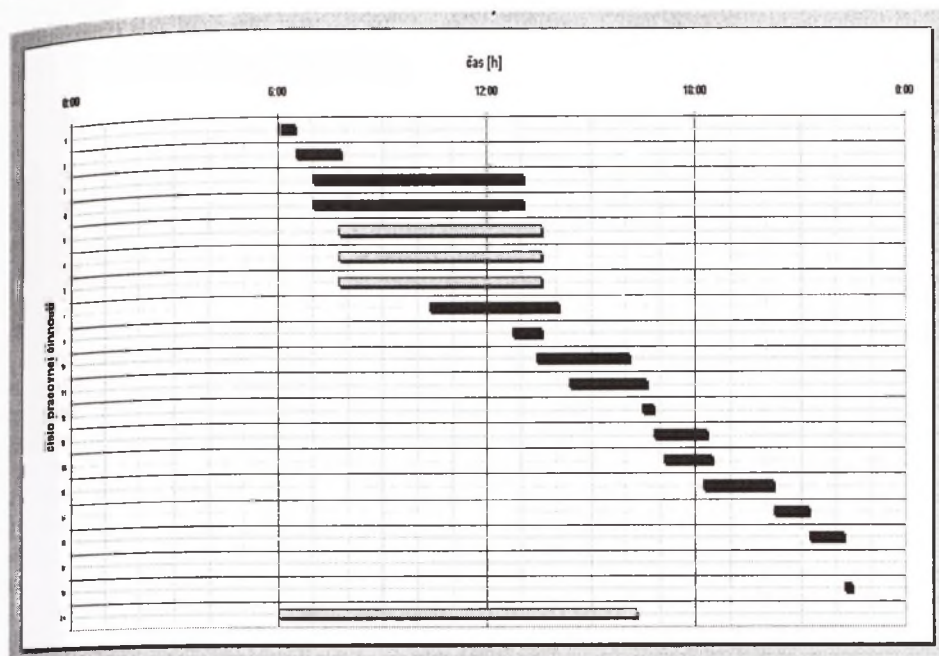


Fig. 4. Final graphical job description for system „Modernisation of switch“  
Rys. 4. Końcowe wykresy w systemie „Modernisation of switch“

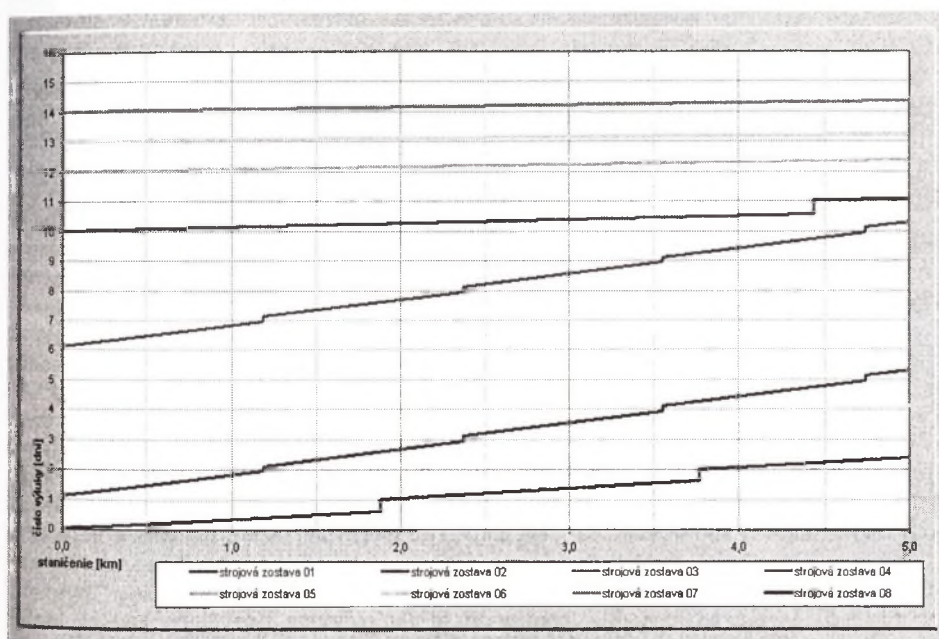


Fig. 5. Final graphical job description for system „Modernisation of track“  
Rys. 5. Końcowe wykresy w systemie „Modernisation of track“

The computer program is created for designing sample graphical job descriptions on the base of the minimisation costs task solution. Software Microsoft® EXCEL 2000 was used for an automation and a flexibility of designing. The software is used for the process of input data entering, for the realisation of related calculations and for the graphical job description drawing.

**Five phases of design** are the ground of program for job description design in system "Modernisation of switch". This one is elaborated in five sheets of program (vstupy, objemy, mechanizmy, doby, technologický postup (fig. 4)). **Six phases of design** are the ground of program for job description design in system "Modernisation of track". This one is elaborated in six sheets of program (vstupy, objemy, mechanizmy, doby, staničenie, technologický postup (fig. 5)). The user is being asked to enter information needed for correctly program function in all sheets.

The specifications are considered in process of design and creating of the job description of the modernisation works. The specifications result from the model of railway subgrade construction of modernised railway line. These one are resolved in the technological succession of the working operations and in useful mechanisms definition (for several working operations is created catalogue of mechanisms). Object of solution – minimisation of time of the modernisation works – is abided by assignment of chosen mechanism to working operation by respecting the condition of the effectiveness of time.

After comparison the calculated and allowable time it is advised to finish the design (if the calculated time is less than allowable time) or it is advised to continue (if the allowable time is less than the calculated time). It is possible to do the correction by the change of working capacity of mechanisms – by employment of mechanisms with higher working capacity or employment of more mechanisms.

### 3. CONCLUSION

The automation of the modernisation works in railway building realisation needs organisational and timing coordination. The coordination is recognized in design, plan and in realisation of modernisation works. Job description is a result of complying with complicated boundary conditions. Computer program was created for half – automated design with the base of available software. Results of the program are: the graphical job description and summary of the main information about the modernisation.

### Abstract

Infrastructure development in the Slovak Republic required advanced demands on railway net quality. The selected part of lines in the net of the Slovak Railways (ŽSR) are integrated to the international corridors. The reconstruction works are done on the track sections and on railway stations and other building units for railway traffic too. Effect of the modernisation is reconstructed railway with described technical parameters. This effect is available with expected precise realisation of works complex on several parts of railway body and on railway substructure building units. The specifications are considered in process of design and creating of the job description of the modernisation works. The specifications result from the model of railway subgrade construction of modernised railway line. These one are resolved in the technological succession of the working operations and in useful mechanisms definition. Object of solution – minimisation of time of the modernisation works – is abided by assignment of chosen mechanism to working operation by respecting the condition of the effectiveness of time.