

CONTENT

INTRODUCTION	6
1 ANALYSIS OF THE CURRENT SITUATION IN THE FIELD OF TRANSPORT OF MINERAL RAW MATERIALS THROUGH THE ENVIRONMENT IN THE WORLD AND IN SERBIA	9
1.1 Main characteristics of the external transport of mineral raw materials	9
1.1.1 Basic assumptions of external transport	9
1.1.2 Categories of environments through which transport is performed	11
1.2 The current situation in the field of transport of mineral raw materials through the environment in the world	13
1.2.1 Transport of energy raw materials through the environment	13
1.2.2 Transport of metallic raw materials through the environment	15
1.2.3 Transport of non – metallic raw materials through the environment	16
1.2.4 A few interesting examples of transport systems for mineral raw materials in the world	17
1.2.5 Analysis of the current trends in the field of transport through the environment in the world.....	18
1.3 The current situation in the field of transport of mineral raw materials through the environment in Serbia	19
1.3.1 Transport of energy raw materials through the environment	19
1.3.2 Transport of metallic raw materials through the environment	21
1.3.3 Transport of non – metallic raw materials through the environment	22
1.3.4 Analysis of current situation in Serbia in the field of transport thorough the environment	24
2 DEFINING RESEARCH SUBJECT.....	26
2.1 Classification of transportation systems through the environment.....	26
2.1.1 The mineral raw materials that are the subject of research	26
2.1.2 Defining basic parameters to which the research relates.....	30
2.1.3 Possible application of methods of transportation through the environment	32
2.1.4 The impact of transportation of mineral raw materials on the environment	34
2.2 Mathematical assumption for the environmental impact of the transportation of mineral raw materials	36
2.2.1 Defining the environmental impact degree of the transport of particular mineral raw materials	37
2.2.2 Determining the relations between technical parameters of the transportation through the environment and environmental parameters....	42
2.2.3 The basic principles of setting the model for solving problem	45

3 SOLUTION APPROACH AND METHODOLOGY	47
3.1 Techno – economic analysis	47
3.1.1 Specificities of the technical analysis.....	47
3.1.2 Parameters of the economic analysis.....	48
3.2 Methods of Multi – Criteria Analysis.....	50
3.2.1 Simple Additive Weight method	50
3.2.2 PROMETHEE Method.....	51
3.2.3 The ELECTRE method.....	53
4 CREATING A MODEL FOR THE SELECTION OF A TRANSPORTATION SYSTEM	57
4.1 Defining models by blocks.....	57
4.1.1 Defining the parameters of a technical block model.....	57
4.1.1.1 Defining the parameters of a technical block model for trucks	57
4.1.1.2 Defining the parameters of a technical block model for belt conveyors	60
4.1.1.3 Defining the parameters of a technical block model for pipe conveyors	64
4.1.2 Defining parameters of the economic block.....	65
4.1.2.1 Defining parameters of the economic block model for trucks.....	65
4.1.2.2 Defining parameters of economic model for belt conveyors	67
4.1.2.3 Defining parameters of the economic model for pipe conveyors	69
4.1.2.4 Calculation methodology	70
4.1.3 Defining parameters of the environmental block	70
4.2 Creating a model and software for selection of a transportation system	72
4.2.1 Defining input model values.....	72
4.2.1.1 Input values of general nature	73
4.2.1.2 Input values relating to truck transportation	74
4.2.1.3 Input values for defining an optimal variant of belt conveyor.....	75
4.2.1.4 Input values for defining an optimal variant of pipe conveyors	76
4.2.1.5 Input values for the environmental block.....	76
4.2.2 Defining the limitations	77
4.2.3 Creating an integral model	78
5 VERIFICATION OF A MODEL ON THE EXAMPLES OF MINES IN SERBIA	82
5.1 Range of current problems in the transportation	82
5.1.1 Defining input parameters for the transportation of technical stones.....	82
5.1.2 Defining input parameters for the transportation of raw material for the cement industry.....	88
5.1.3 Defining input parameters for the transportation of clay	95
5.2 The application of the model for the selected transportation systems.....	101
5.2.1 Application of the model for the transportation of technical stones	101

5.2.2	The application of the model for the transportation of raw material for the cement industry.....	105
5.2.3	The application of a model for clay transportation.....	108
5.3	Analysis of the results obtained by the application of the model	112
5.4	The application of the model for the selection of a transportation system in designing new mines	112
6	CONCLUSIONS AND RECOMMENDATIONS.....	118
	REFERENCES	121
	LIST OF FIGURES	127
	LIST OF TABLE.....	130