

Analysis by the Residual Method for Estimate Market Value of Land on the Areas with Mining Exploitation in Subsoil under Future New Building

Monika Gwozdz - Lason¹

¹ University of Bielsko-Biala; Faculty of Materials, Civil and Environmental Engineering; Institute for Building; 43-309 Bielsko-Biala, 2 Willowa St., Poland

mgwozdz@ath.bielsko.pl

Abstract. This paper attempts to answer some of the following questions: what is the main selling advantage of a plot of land on the areas with mining exploitation? which attributes influence on market value the most? and how calculate the mining influence in subsoil under future new building as market value of plot with commercial use? This focus is not accidental, as the paper sets out to prove that the subsoil load bearing capacity, as directly inferred from the local geotechnical properties with mining exploitation, considerably influences the market value of this type of real estate. Presented in this elaborate analysis and calculations, are part of the ongoing development works which aimed at suggesting a new technology and procedures for estimating the value of the land belonging to the third category geotechnical. Analysed the question was examined both in terms of the theoretical and empirical. On the basis of the analysed code calculations in residual method, numerical, statistical and econometric defined results and final conclusions. A market analysis yielded a group of subsoil stabilization costs which depend on the mining operations interaction, subsoil parameters, type of the contemplated structure, its foundations, selected stabilization method, its overall area and shape.

1. Introduction

Improved property on areas with not good mining influence for new buildings performance can lead to reduced regulatory risks, better competitive positioning, enhanced liquidity, and the potential for greater overall investment returns. By focusing on geotechnical properties of the subsoil which moves the load from the building to the ground and the negative impact of the mines operational form from the ground to the newly building investment, it's able to offer better investment performance and lane benefits through real estate fundamentals and operational excellence. In accordance to the act on real estate management and to professional standards of real estate valuers the market value of a real estate is defined as its most likely market purchase price providing that parties deal at arm's length and act rationally without any special motivations, they have a firm intention of closing the deal and are aware of circumstances influencing the price. Market purchase price providing are not acting under constraint and there has elapsed a sufficient amount of time for the real estate's market exposure, including appropriate advertising measures, and for the negotiation of terms and conditions of purchase, considering the nature of the real estate and the state of the market at the time [7]. A real estate's market value reflects, therefore, the market as of the day when the property is valued, and is equivalent to the price obtainable should a contract be signed. This paper attempts to answer the



following two questions: what is the main selling advantage of a plot of land with the mining influence under building? and which attributes materially influence its market value the most? The discussion here is limited to undeveloped land designated for commercial, service, industrial, transport or multi-apartment housing development. This focus is not accidental, as the paper sets out to prove that the load bearing capacity, as directly inferred from the local geotechnical properties, considerably influences the market value of this type of real estate on the subsoil with mining influence. Nevertheless, the role of this factor has not been included or defined in any binding regulations and is not taken into account in the market valuation of this type of land [4]. In order to account for the combination of economic, legal, technical, mining and geotechnical aspects certain necessary terms have been defined for the purpose of this paper. Construction base means a zone where properties of the ground are material factors in the design, build and operation of the planned structures. Ground base reinforcement means any methods and techniques aimed to improve the ground load-bearing capacity and constants, variables or dynamic impact of mining on the subsoil and the buildings constructed on it. Land real estate means land understood as a base for development including its constituent parts, but excluding buildings and their parts that constitute a separate object of ownership. Land survey and cartographic documentation means maps, records, reports, sketches, excerpts of maps and documents and other documents providing a basis for the definition of the land's legal status. Valuation survey means a real estate valuator's assessment of the real estate value and is regarded as an official formal document. Real estate means a portion of the Earth's surface constituting a separate object of subsoil, as well as any permanent buildings attached to the land or parts of such buildings where under specific regulations they constitute an object of ownership separate from the land.

2. Characteristics of the real property

Characteristics of the real property are then described taking into account all of its advantages and disadvantages in connection to a market analysis. The real estate valuator then selects an appropriate method and technique for the valuation to determine the market value. In the highly popular comparative approach to market valuation of undeveloped land the value is equivalent to prices obtained for similar properties actually traded on the market, [6], [7].

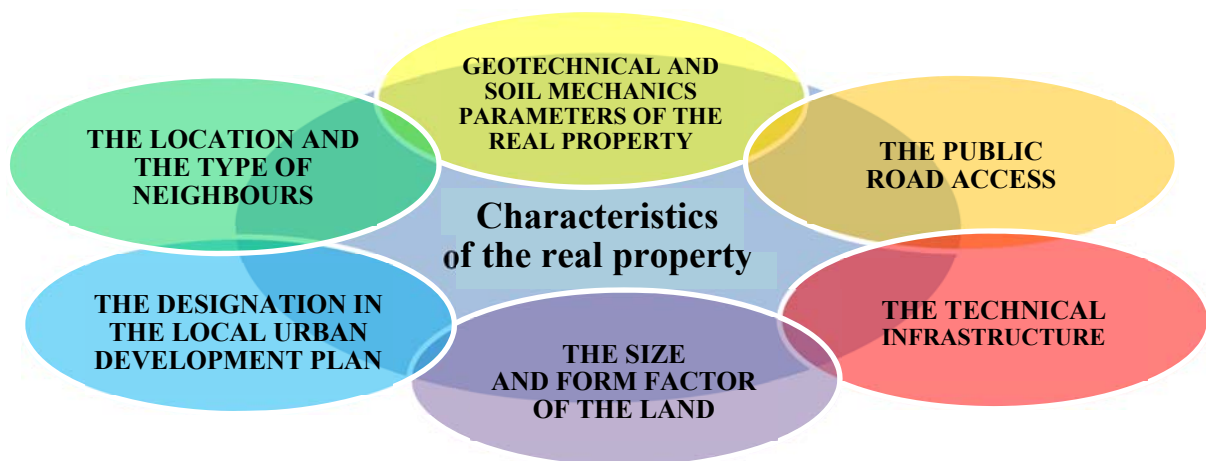


Figure 1. Typical characteristics of the real property with new geotechnical aspect

In this method of valuation, the typically compared attributes of land real estate's include the location, neighbourhood, purpose designation in the local spatial development plan, form factor, square area, availability of utilities and public road access. This paper is not concerned with farmland, woodland and land designated for leisure or detached/semidetached housing development, because the market value of such properties largely depends on different attribute types. This study looks at real estates in

areas earmarked for services, commercial, transport and industrial purposes, or in other words for large building projects. As a prime factor influencing the market value of these types of properties their location is closely followed in order by the type of neighbours and the designation in the local spatial development plan and, in succession, by public road access, technical infrastructure and the size and form factor of the land. The individual impact of each attribute on the real estate's market value largely depends on a specific purpose for which the property is purchased or leased.

Standards already exist for the estimation of the influence of environmental factors on property value, including emission of dust, chemical and radiological pollution, noise, watercourses, shallow ground water table, underlying mining activity, insolation, etc. There are also guidelines for the valuation of real estates located on top of underground natural resources and under motorways, but no guidelines are available for estimating the influence of the ground base with poor geotechnical properties, i.e. a weak base and mining influence of on the subsoil and the buildings on it placed. Therefore, it is attempted here to prove that a land real estate valuation process concerning any planned project larger than a family house must take into account local geotechnical conditions and mining risk in geotechnical engineering, as an important attribute translating into economic aspects and the price of the property [6].

Real estate appraisal, property valuation or land valuation is the practice of developing an opinion of the value of real property, usually its market value. Market value is the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arms-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently, and without compulsion. It is important to distinguish between market value and price. A price obtained for a specific property under a specific transaction may or may not represent that property's market value. The comparable method is the most common one which is used to estimate market value for example of our selected plot of land with commercial use. It's real estate appraisal term referring to properties with characteristics that are similar to a subject property whose value is being sought. This can be accomplished either by a real estate value who attempts to establish the value of a proper-ty through market analysis or using another defined method when the simplest one is impossible to do.

A market analysis is documented investigation of a market that is used to inform about the prices of different kind of real estates, about trends of price changes for different space of local markets or inform about types and number of market attributes which have influence on real estate market value. All calculation which is used to estimate market value base on market analysis data and understand how the data was derived. A large number of market analysis techniques are related to sales forecasting; others are more general techniques for analysing markets. The literature defines several areas in which market analysis is important. These include: sales forecasting, market research, and marketing strategy. A market prices of plots of land in commercial use on the outskirts of the Slask region was analysis. Average price of the 1m² plot of area for new buildings in surrounding of large slask' town which exploitation of mines – Ruda Śląska, Będzin, Sosnowiec and Mysłowice from the group of 424 transactions is 188.42 zł./m².

Using this characteristic of local market, we are able to estimate market value of land which depends on market attributes of real estate like location, neighbourhood, and square area of plot, form factor of plot, infrastructure, profiles or designation in the local spatial development plans. But use this method and analysis there is no chance to calculate the influence of geotechnical parameters of subsoil on market value of commercial land, so another way or method must be find.

3. The physical and mechanical parameters of the subsoil and Market Value of Real Estate

The physical and mechanical parameters of the subsoil and Market Value of real estate. The analysis of the main objective of this study is to define new physical and mechanical parameters of the soil which must withstand loads generated by mining operations in areas earmarked for development in

local urban development plans. Another aspect focuses on defining soil modifications required to: adequately support loads exerted by engineering structures; eliminate static and dynamic forces accompanying mining operations; and protect the newly erected structures and buildings against adverse effects of mining operations. The next step of our analysis includes developing a mathematical model for the required modifications, as well as designing and stabilizing the soil so that the standard soil assumptions for a specific building or structure would satisfy the two principal criteria (that of the ultimate limit state (ULS) and the serviceability limit state) over the structure's estimated useful life, [3]. One of the final steps of the proposed know-how includes a method for calculating the replacement value of the stabilized soil according to all applicable legal and methodological requirements. Since the replacement value affects the property market value, it must be taken into account in all of the financial analyses of the project. The proposed foundation soil attributes such as soil parameters, soil loads from the proposed construction projects, magnitude, type and duration of mining operations impact, calculation methodology, soil structure stabilization, and financial performance, which all affect the project market value – all represent a compatible information package of vital importance to a comprehensive analysis of the issue, [3], [6].

A morphological method was applied to the results of analyses and methods for eliminating mining damage: the main issue at hand was divided into sub-problems with partial solutions. This approach allowed for analysing various options and combinations of potential solutions. The final conclusions of the project produced a matrix of solutions applicable to solving the mining damage problem.

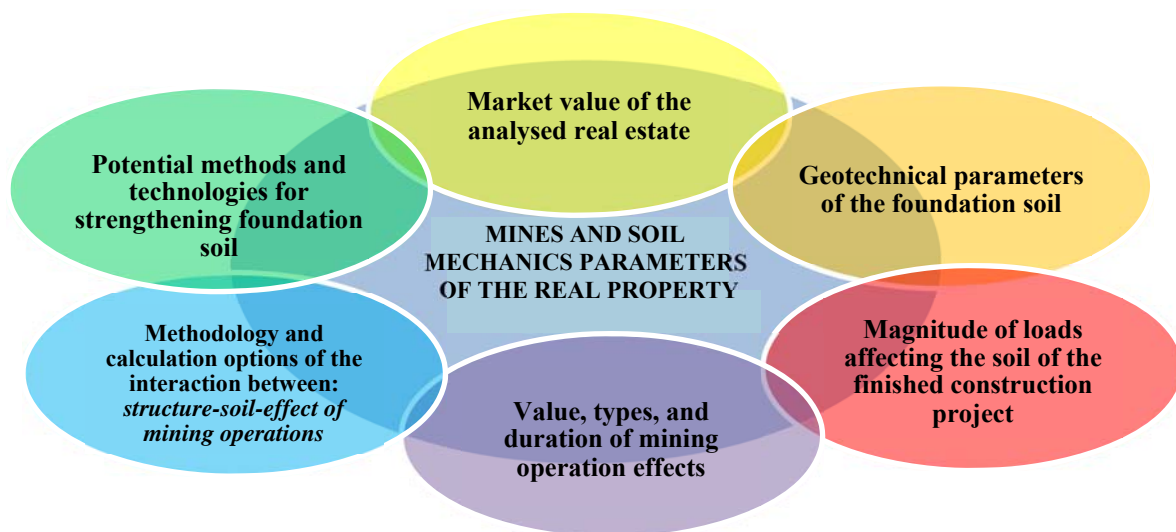


Figure 2. Variables affecting the selection of the best configuration for minimizing adverse mining operations impact on future urban sites, according to the local urban development plan

The physical and mechanical attributes of land include quality of fertility which in this case have subsoil's bearing capacity meaning and corresponding to external loads from construction like shopping centre, schools, roads, sky-scrappers, office blocks, hotels, and cinema, etc. Except it, another important factors which have a big influence on market value of this kind of real estate is adverse mining operations impact on future urban sites as well as typical attributes of land are location, patterns of land, neighbourhood of big streets or prestige zone, etc. The load bearing capacity, reflecting the local geotechnical properties of the ground, ought to be included in the property valuation process as an attribute having an influence on the value and as a comparative feature. To this end, real estate valuers should use field and laboratory testing-based geotechnical documentation facilitating a right choice of a structure's foundation and its detailed construction. Usually a land market assessment system is based upon data related to land attributes [6]. A path of proceedings to

estimate market value presented in this article can be used for land with mining exploitation use in manufacturing, commercial and government, that which will be belong to government because of expropriation on public purpose like for example land under new speedway, way.

4. The mine exploitation as forces affecting the construction site under analysis

Locating, expansion or reconstruction of mining operations in the site exactly under the analysed spot represent a key source of subsoil deformations and interactions both determined and undetermined, direct and indirect. The mining and geological condition of the investigated sites is mainly tied to coal extraction, both current and future, and to worked-out underground spaces which also interact with the subsoil [3], [6]. Such interactions may combine and – in some random cases – may lead to dangerous load combinations which exceed permissible calculated values; a fact easily tested in real life. Design analyses use the laws of mechanics to describe the rock mass stresses and deformations. The anticipated, theoretically most likely overall effect of mining interactions with the area earmarked for development has been determined based on basic mean parameters, such as subsidence, tilt, curvature, or strain. Depends on different reinforcement technology and methods we try to find the best numerical model of subsoil which will be helpful to designed appropriate loadbearing capacity and estimate the time and the cost that should be spend by investor before starting to build the construction over the ground. Based on generally accepted principles it presents numerical modelling patterns of subsoil with mining operations impact by different kind of methods and technology especially by grouting technologies for structural remediation works are not suitable or the lifting of structures is required. That method fills this gap within the range of grouting techniques [6]. Together with newly developed instrumentation and monitoring technologies as well as special sensors it is possible to lift structures by several decimetres in a controlled manner. In this process fractures are created in the soil which are filled with hardening grout. Every soil formation can be improved by multiple rounds of grouting and controlled lifting can be induced.

The paper constitutes an attempt to summaries and generalise earlier research which involved FEM numeric procedures and utilised an elastic-plastic model of a ground medium. The main assumption for the adopted numerical model was made of using continuum medium and by accepting the Drucker–Prager (PD), the Mohr–Coulomb (MC and MCM), the Cam–Clay (CC and MCC) and, elastic–plastic character of materials and we accepted a plane strain model. The computer program which offers an attractive alternative to traditional approaches to geotechnical problems was used to solve the all steps of main task [2], [3], [9], [10]. The results presented in this paper give us the opportunity to solve, a very important problem using the three-zonal material model of the reinforced subsoil with mining operations impact in FEM. The database about the subsoil reinforced system which are strong enough for initial assumption will be included information not only about reinforced technology and numerical model use for calculations but time which is necessary to make this work, and the approximately cost as well [1]. All of this information give estimators possibility to calculate market value of plot use the residual method which base of land market value and take into consideration the cost of reinforced the mining subsoil by comparison with market value of land in good geotechnical condition and economical aspect.

5. The residual method for estimate Market Value of land on the areas with mining exploitation

There are several types and definitions of value sought by a real estate appraisal. Some of the most common are market value – the price at which an asset would trade in a competitive Walrasian auction setting. Market Value is usually interchangeable with Open Market Value or Fair Value. International Valuation Standards (IVS) define Market Value as the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arms-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently, and without compulsion. A very important aspect here is the actions informed that is such that clearly identify all risks that can occur on this property under development. All information about the impacts of mines and about the cost of what you will pay at the time of object construction engineering safely

and without risk of damage to mining for new buildings. It is important to distinguish between Market Value and Price. A price obtained for a specific property under a specific transaction may or may not represent that property's market value: special considerations may have been present, such as a special relationship between the buyer and the seller, or else the transaction may have been part of a larger set of transactions in which the parties had engaged. There are three general groups of methodologies for determining value. These are usually referred to as the "three approaches to value" which are generally independent of each other: the cost approach, the sales comparison approach and the income approach. However, the recent trend of the business tends to be clinging to the scientific methodology of appraisal which lies on the foundation of quantitative-data, risk and geographical based approaches. Pagourtzi et al. have provided a review on the methods used in the industry by comparison between conventional approaches and advanced ones. The appraiser using three approaches will determine which one or more of these approaches may be applicable, based on the scope of work determination, and from that develop an appraisal analysis. Costs, income, and sales vary widely from one situation to the next, and particular importance is given to the specific characteristics of the subject [7]. In this case, specifying the value of land to appropriate under development is defined as combinations of the two approaches – the comparative approach which analyzes and calculates all the typical attributes that affect the market value of the land and the cost approach, where specifies the risk and cost of security for the subsoil from the adverse impacts of mine in the areas. This is known as the method of residue because the scope of the necessary work which due to perform and complete for your real estate is known for assumptions that are compatible with the intended purpose of the plot in the local land development plan. Residual method allows to estimate the maximum value, which the potential investor may pay for the real estate in its present condition in connection with the investment project envisaged for implementation. When the investor wants to buy a plot of commercial use it's obviously that want to build commercial engineering structure on this ground. [5], [8], [9], [10]

Residual method is implemented when determining the value of real estate which can be subject to development, expansion, modernization or other improvements. In our case real estate which is a plot of land must be reinforced to be used like subsoil under big commercial investments. The value of the property can be specified solely for the land, for the land with its components before the improvements or for the land components separately. It is used in analysing and preparing development projects for real estates. These situations usually require determining the value of individual components of the real estate.

6. Conclusions

Information about time and cost that investor need to start build some-thing on the plot of land may be used for estimate real market value of plot of land with commercial use because only in the case when the cost of reinforced works is known the residual method of estimate market value can be used. So the residual method is the most appropriate tool to estimate the value of an undeveloped land real estate taking into account the influence of its load-bearing capacity on the market value. More and more construction projects begin with analysing the zero stage of CMR Project Management, or the first step in the Critical Path Method (CPM) [4], [8], [10]. The availability of a wide variety of solutions from which to choose is of key importance for optimal management. To choose the ideal option, however, one needs to possess full knowledge of all the potential aspects and selection criteria. A comprehensive set of attributes of any real estate intended for development allows one to pursue one's outlined goals in an informed, effective manner, taking into account any natural disasters that may potentially take place in the area, which would undoubtedly affect any property purchase decisions.

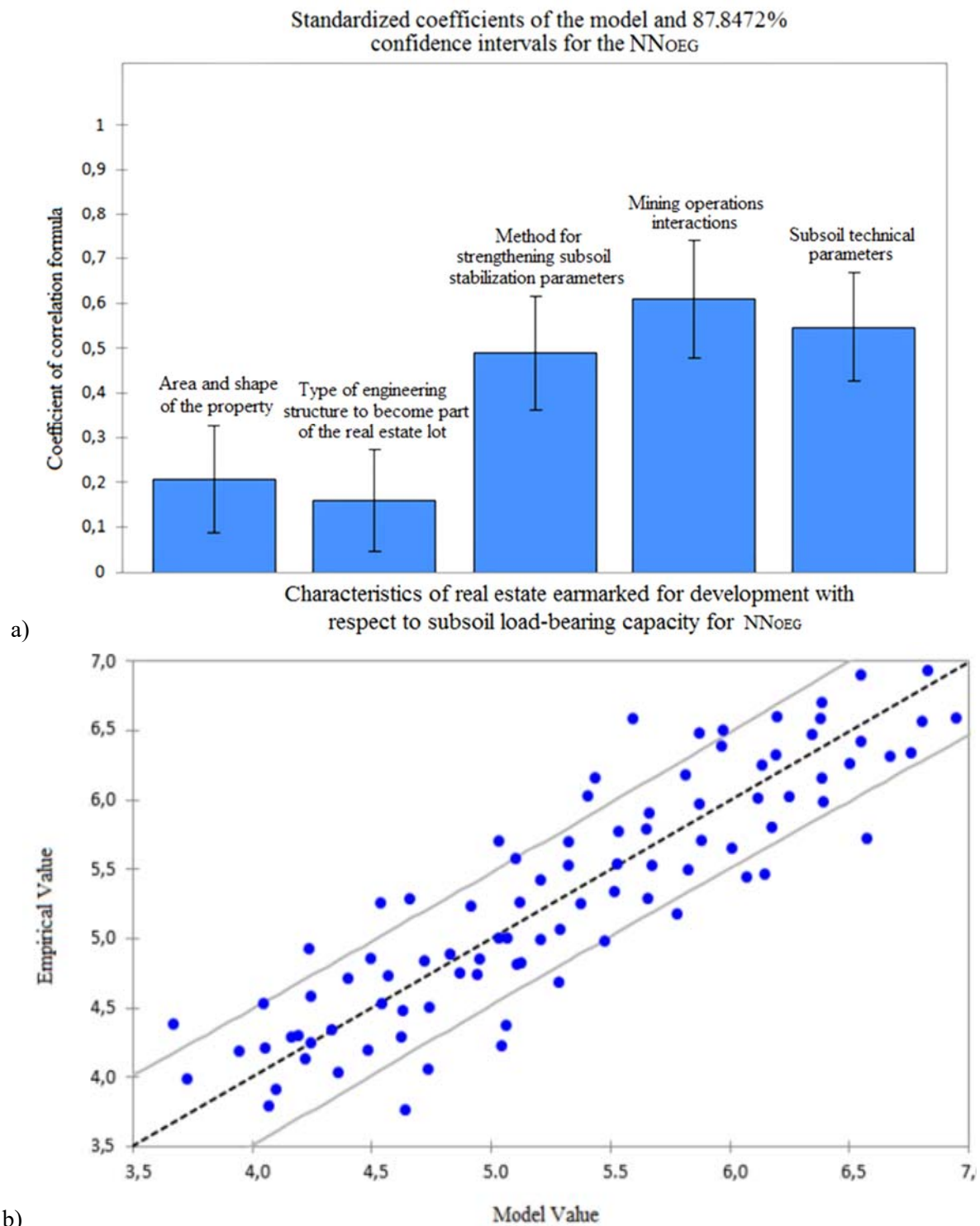


Figure 3 a), b) Statistical analysis – ANOVA value model for the residual method with characteristics of real estate earmarked for development with respect to subsoil load-bearing capacity

With the prerogative to protect human life and assets against natural disasters, as well as the need to realistically estimate the costs and time frame of a commercial investment project located in an area subject to mining operations interactions, one should first attempt to find out as much as feasible about

the subsoil structure, automatically assumed to be classified in geotechnical category III [3]. According to Art. 4 section 1, with reference to immovable property, 'market value' is defined as the estimated price for which the property may be sold by a willing seller to a willing buyer in an arm's-length transaction taking place on the date of valuation, provided that both parties have acted knowledgeably, prudently, and without coercion. A residual approach and method are applied to estimate the stabilization costs of the property in an area earmarked for development. The property value is calculated as the difference between its value following subsoil stabilization and the amount of average stabilization costs, including the investor's profit earned on comparable real estate on the market. The market value calculated using this method (WR) is equal to the difference between (WK), or the value of the already stabilized property, and the amount (KR) of the market costs incurred for its development or stabilization and (ZI), that means investor's profit earned on comparable projects in the market. The value of properties in areas exposed to mining interactions must not be compared to the value of other properties in the same location, intended for the same use in the urban development plan, having the same area, shape, comparable neighbourhood and technical infrastructure since - considering the provisions of the EU regulation - a well-informed buyer knows very well the amount of additional costs required to make the property useable according to its planned use. The Critical Path Method - CPM analysis shows what must be modernized and why, as well as the associated cost. Thus, the other condition for the residual approach will have been met [4]. The components of the adopted approaches take market indicators into account. Therefore, in order to determine the stabilization costs of the property in question, the cost method was combined with the replacement cost method using the index method technique. A market analysis yielded a group of subsoil stabilization costs which depend on the mining operations interaction, subsoil parameters, type of the contemplated structure, its foundations, selected stabilization method, its overall area and shape.

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