THE UNPREDICTABLE COSTS PART OF CONSTRUCTION

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ABSTRACT

Nowadays, there are no surprise occurring increasing unplanned costs or unpredictable costs incurred during construction. Possible causes of are usually caused by inadequate preparation of project documentation at the stage before realization construction work, because often lies importance, especially for the lowest price of the project and in the choice of the designer. Poorly finished project is one of the reasons for increasing costs to remove the problems of works. The problems may be caused e.g. improper design of foundations for the given conditions of the construction site or you can not use the material, and it is necessary to replace the more expensive material if necessary or time-consuming process with other materials. These changes may cause unpredictable cost of works.

Key words: *coefficient, construction site equipment, unpredictable costs*

1 INTRODUCTION

At present construction regarding the calculated costs and pricing in terms of legal measures will apply to arrangements and price controls following the pricing rules:

• Basic rule for the negotiation and price regulation is Slovak National Council Act no. 18/1996 on prices of 14th November 1995 (hereinafter the Prices Act), as modified. For the construction industry is a major amendment to the Act. no. 520/2006, under which, inter alia, repealing §7 - The cost-plus pricing,

• Decree no. 87 Slovak Ministry of Finance on 12th March 1996, implementing the Act on prices. In connection with the above amendment to the law on prices and also it regulates the performance amended by Decree no. 536/2003,

• Regulatory Notification of the Ministry of Finance. For the regulation of prices in construction is an important measure of 9th December 2003 No.01/R/2003 (including supplementary measure No.02/R/2003). With effect from 1st January 2004 in building true "full price liberalization", but it is necessary to proceed in negotiating prices in accordance with applicable public procurement law.

Costs of construction site equipment are rated among secondary budgetary costs (VRN), which constitute indirect costs due to construction works such as buildings equipment, need water and electricity to the site, and others. These costs in the procurement of these are not listed as VRN, but they need to be included in the calculation to bid. The bidder must include these costs in its offer and by counting the basic budgetary costs (ZRN). VRN inclusion in its offer is conditioned only by mutual agreement between the investor and the contractor, as no Community legislation does not require it.

Quarterly analysis of the Slovak construction Q3/2015 issued by CEEC Research, Ltd. It states that:

> *"According to three of the ten directors of construction companies, a deterioration of quality of training buildings by public investors. One of the problems is mostly below average quality project documentation (Fig.1). Change of the project was to be implemented in almost four out of ten buildings, causing increase construction costs on average up to 16% (previous year 15%)." [1]*

It is therefore necessary to consider the proposal itself already in the reserve in the budget. Since the information available up to 8% of companies often extend beyond its internal guidelines, to win contracts. Almost half (49%) of companies ignore risk management rarely or exceptionally. Crossing the directive confirms in particular of large companies, in 79% of cases. [2] A similar situation was in

Czech Republic in 2015, when the total increase construction costs up to 18% (Fig. 2). [3] Design changes can lead to changes in the construction period, eventually suspension of construction or other adverse events that may increase the cost of construction. These circumstances have an impact on objects construction site equipment and such that all these objects need to have leased a longer period than originally planned and it is necessary to pay wages and other guard on duty. For these situations it has been designed coefficient of unpredictable costs *k*, with which the author considers in its evaluation of the costs of construction site equipment in model.

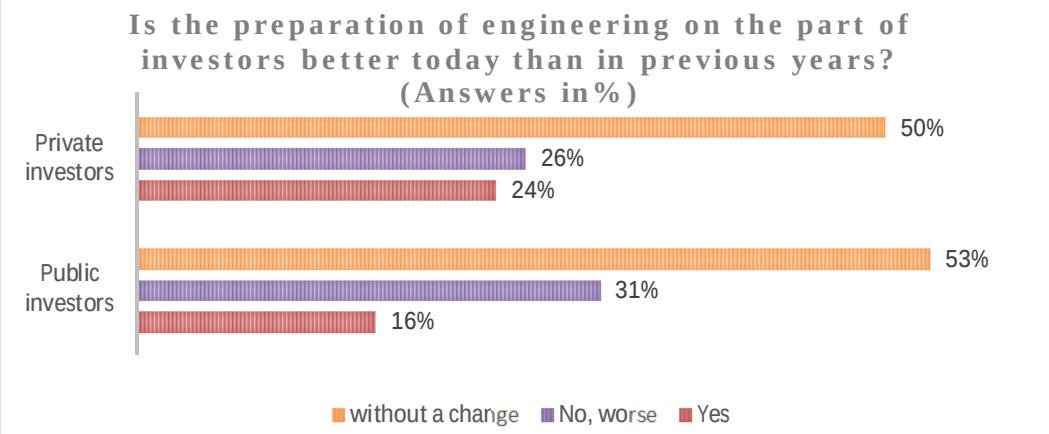

Figure 1 Guest preparation *of* construction by investors in Slovak [1]

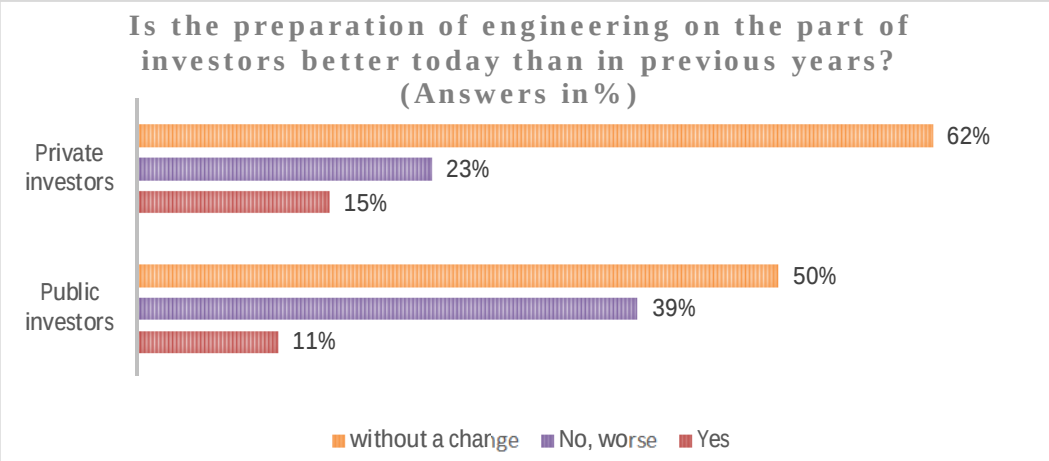

Figure 2 Guest preparation of construction by investors in Czech Republic [3]

2 METHODOLOGY OF WORK

2.1 Coefficient of unpredictable costs

The model designation appears to coefficient of unpredictable costs *k*. Offsetting coefficient *k* to the model is due to the so-called security reserves in the budget for the building site equipment. One of the causes can be adverse weather conditions, which incidentally extended construction period and this involves increased funding. The financial resources are insufficient cover construction of the investor if necessary. misunderstandings between the investor and the contractor resulting in the suspension of construction. Here it is whether the building site kept on the site and you will have to pay rent for the buildings if necessary. the construction site and take you after the resumption of construction of these objects re-energize the site. Climatic conditions are adverse weather conditions that prevent the continuation of the construction as a few weeks of rain or frost that slow down the construction of works. If not considering a coefficient of unpredictable costs is very likely that it may happen that the remaining funds will be used otherwise the building and, if necessary, it will be necessary to find

solutions to cover claims. Coefficient *k* represents funds that can be used for example in the construction of the extension of the payment of rent for residential units for employees that have been planned for a shorter period during construction. It is also possible for these funds to pay for the services of guards on site. The coefficient will form a premium to the calculated cost of construction equipment. Thus, a calculated cost is multiplied by the coefficient *k*, and it is necessary to take into account the so-called. indicative rate for the cost of equipment, which are assigned to all types of buildings. Form over the basic budgetary costs (ZRN). It is appropriate to compare these two values. If the cost of construction equipment by using the coefficient *k* to be larger than using the indicative rate is appropriate to find an optimal solution design site equipment, as this should be one of the factors which indicates that the proposal is not in terms of time and cost-effective prices. Indicative rates are purely indicative calculated cost of site equipment, when not available implementation project if necessary project for building permission. [4] In Table 1 are given as an example orientation towards Cenekon rate database. On the market there are even two databases, and so by Odis and Systematic. When using individual calculation, it is necessary implementation project site equipment, which is necessary to know how many of the social and sanitary containers will be and what time and what track is designed in site communication etc.

No.	KS (department JKSO)	Name	Rate in %
1.	1ex, 2ex, (801) 1ex (802)	Building civil construction (except halls) Civil construction halls	2.4
2.	1ex (803)	Buildings for housing	1.9
3.	12ex, 22ex, 23ex (811) 1ex, 2ex, (812) 23ex (813) 1ex, 2ex, (814) 1ex, 2ex (815)	Halls for production and services Buildings for production and services Towers, chimneys Tanks and tank sewage treatment and other underground tanks Special objects underground	3.7
4.	2141 (821)	Bridges	3.4
5.	21ex (822) 230, 241, 242 (823) 21ex (824) 2ex (825) 1ex, 2ex (827) 1ex, 2ex (827)	Ground communications, airport, except for field and forest roads Areas and landscaping, among subgroups 25-28 Rail tracks Objects underground, except mining and groups 8 Pipework in remote and branch Power management. and extended runway	2.8
6.	2ex (831)	Hydro melioration	0.5
7.	2ex (832) 2ex (833)	Dams and objects to streams Tank flows flow adjustments, channels	3.4
8.	45 (928)	Repair and maintenance nature	0.5

Tab. 1 Orientations rate database Cenekon [5]

2.2 Research of the construction market

For optimum determination coefficient was carried out construction market survey and were interviewed construction companies that the costs of construction equipment experienced quite often especially when processing bids for investors if necessary. general contractors. Therefore, they need as much information for quotation regarding the equipment, if necessary on site. For the survey were interviewed firms that were specified conditions to which object they have to determine the amount of

unforeseen expenses in percentage to actually meet and need to be addressed (Tab. 2). Since many companies were approached while information is available only from 6 companies because many of them were willing to provide in respect of costs and calculated any information. For this reason, the coefficient in the model of cost assessment site equipment can be different over time, as is the authors of this data as possible to clarify the reality.

	Unpredictable costs						***Evaluation***			
	firm 1	firm 2	firm 3	firm 4	firm 5	firm 6	***Median***	***MAX***	***MIN***	***Geometric mean***
k	7%	5%	8%	6.5%	10%	13%	7.50%	13%	5%	7.86%

Tab. 2 The obtained values from the research of the construction market

3 RESULTS AND DISCUSSION

3.1 Verification of the data obtained of extremes

Before the inclusion of a specific coefficient was necessary to verify a set of collected data, whether it is possible to count all the values and set them using the geometric mean ratio. Since the greater number of data, it is possible that it will be necessary to proceed to the exclusion of minimum or maximum values if necessary both the data set and then subsequently by the geometric mean ratio determined. These values tend to distort the final result. To verify the exclusion of extremes file was used Grubbs and Dixon test.

Grubbs test forms the basis of the calculated test criteria in the data file that correspond to the Gaussian normal distribution observed random variables. The values correspond to the Gaussian normal distribution, we have verified and shown on the fig. 3.

Test criteria [6]

$$D_n = sup|F_n(x) - \Phi(x)|$$

The calculation process was conducted and the alignment of the sample to the council upward variance, followed by determining the arithmetic mean $\bar{x}$ selection and standard deviation of all values from the file. These data are shown in Table 3. Was determined by the null hypothesis H_0: x_{max} (x_{min}) is not an outlier: x_{max} - x_{n-1} = 0 i.e. between the last and penultimate variation value in a row is not statistically significant difference. Compared to the null hypothesis is established alternative hypothesis H_1: x_{max} (x_{min}) is an outlier: x_{max} - $x_{n-1} \neq 0$ e.g. between the last and penultimate variation value in a row is a statistical significant difference.

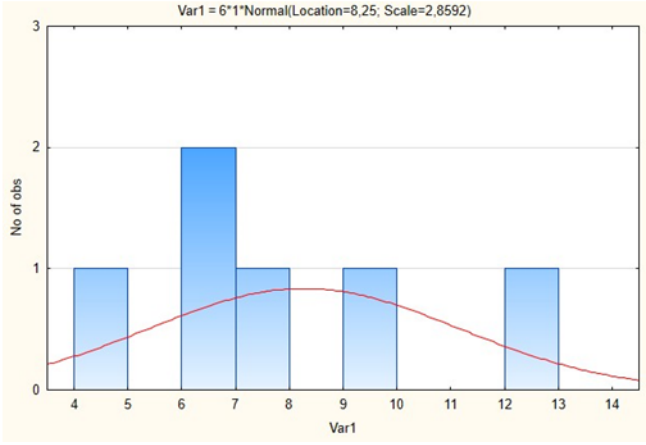

Figure 3 Normal probability distribution for the coefficient *k*

Variation council	x_1=5	x_2=6.5	x_3 =7	x_4 =8	x_5 =10	x_6 =13
The arithmetic mean of $\bar{x}$ file	**8.25**					
Experimental standard deviation *s*	**2.86**					
The level of significance α	**0.05**					

Tab. 3 Determination of the basic parameters for Grubbs test

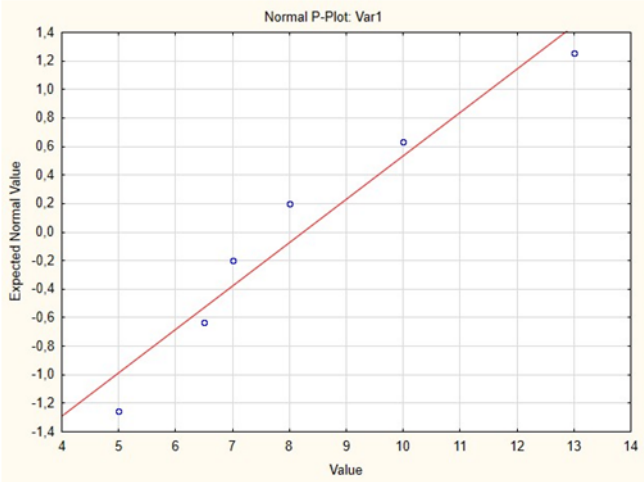

Figure 4 The probability of a normal distribution for the coefficient *k*

The next step was to calculate the test criterion for the first if necessary last value variance council. [7]

$$T_1 = \frac{\bar{x} - x_1}{s} = \frac{8.25 - 5}{2.86} = \mathbf{1.14} \qquad T_6 = \frac{x_6 - \bar{x}}{s} = \frac{13 - 8.25}{2.86} = \mathbf{1.66}$$

This calculation is compared to the tabulated critical value for the respective *n*-sample and the level of significance α. Table values for T_{crit} is 1.996. If $T_{1\,(n,\,\alpha)} > T_{crit}$ first respectively. Last Exclude from file and then calculates a new average $\bar{x}$ and standard deviation *s* without this extreme value. If $T_{1(n,\,\alpha)} < T_{crit}$ first respectively. Last value of the variation lines includes a file and can not exclude it.

$$T_{1(6;0.05)} = 1.14 < T_{krit} = 1.996 \qquad T_{6(6;0.05)} = 1.66 < T_{krit} = 1.996$$

The comparison shows that the values do not form extrema of the group and their elimination is not possible.

Dixon test is also based on testing criteria and is suitable for a set with a small number of values. For the calculation of the test criteria is used the variation range of the file. [7]

$$R = x_{max} - x_{min} = 13 - 5 = \mathbf{8}$$

The first step in creating an ordered calculates variance council and continue the calculation for the first test criteria respectively council last value. The arrangement of the variation of the council is set out in Table 3. The test criteria are as follows

$$Q_1 = \frac{x_2 - x_1}{R} = \frac{6.5 - 5}{8} = \mathbf{0.1875}$$

$$Q_a = \frac{x_a - x_{a-1}}{R} \rightarrow Q_6 = \frac{x_6 - x_5}{R} = \frac{13 - 10}{8} = \mathbf{0.375}$$

The calculated values were compared to the tables for the corresponding n-sample and α chosen for Dixon test. Table values for Q_{krit} is 0.56. If $Q_{1(n)} > Q_{krit}$ first respectively. Last Exclude from file. If $Q_{1(n)} < Q_{krit}$ first respectively. Last value of the variation lines includes a file and can not exclude it.

$$Q_{1(6)} = 0.1875 < Q_{krit} = 0.56 \qquad Q_{6(6)} = 0.375 < Q_{krit} = 0.56$$

From the foregoing comparison it shows that, according to Dixon test the values of a set can not be excluded.

4 CONCLUSION

After processing Dixon and Grubbs test was clearly verified that the data set is not any outlier that would have a big or small way influenced the coefficient unpredictable costs. The first step was to verify the normal distribution. The verification method by using multiple information value and the exclusion of minimum and maximum values is not necessary, as there is a value that is unlikely. The size of the coefficient is based on the geometric mean and stood at 0.0786 is 7.86%. The resulting coefficient k is 1.0786. If database is the data collected, this ratio may be adjusted because of objectification, and will also be before the inclusion of new data verification conducted by the above-mentioned tests.

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