Challenges in the Preparation of Budgets with Statements of Estimates

Silvia Ďubek[1], Marek Ďubek[2]

[1] Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Institute for Forensic Engineering, Radlinského street 11, 810 05 Bratislava, Slovakia; silvia.dubek@stuba.sk
[2] Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Institute for Forensic Engineering, Radlinského street 11, 810 05 Bratislava, Slovakia; marek.dubek@stuba.sk
* Correspondence: silvia.dubek@stuba.sk

Abstract
In Slovakia, market prices have been applied for several years, while regulated prices have lost their validity. Each contractor has the right to offer any price for the work, which should cover the costs of implementation, including labour, overheads and profit. A key step in the bid preparation process is the preparation of a budget with a bill of quantities, which requires a detailed study of the project documentation and all relevant documents. However, this process cannot always be carried out consistently due to time constraints, leading to the preparation of 'quick' budgets in order to meet the deadlines for the submission of the quotation. In practice, therefore, we encounter a variety of forms of budget submissions, often reflecting compromises between time and quality of workmanship.

Keywords
statement of measurements, budget, calculation

Abstrakt
Na Slovensku sa už niekoľko rokov uplatňujú trhové ceny, pričom regulované ceny stratili platnosť. Každý zhotoviteľ má právo ponúknuť ľubovoľnú cenu za prácu, ktorá by mala pokrývať náklady na realizáciu, vrátane mzdových, režijných nákladov a zisku. Kľúčovým krokom v procese prípravy ponuky je vypracovanie rozpočtu s výkazom výmer, ktoré si vyžaduje podrobné preštudovanie projektovej dokumentácie a všetkých relevantných podkladov. Z časového hľadiska však nie je vždy možné tento proces dôsledne realizovať, čo vedie k vypracovaniu tzv. „rýchlych“ rozpočtov s cieľom dodržať termíny na predloženie cenovej ponuky. V praxi sa preto stretávame s rôznorodými formami predkladaných rozpočtov, ktoré často odrážajú kompromisy medzi časovou náročnosťou a kvalitou spracovania..

Kľúčové slová
výkaz výmer, rozpočet, kalkulácia

1. Introduction

When creating the budget, it is still true that the more detailed (better) the project documentation is, the better (more accurate) the budget with the bill of quantities will be. This implies that the budgeter will not have to substitute the work of the designer. It often happens that the budgeter has to make up (complete) things for the designer that are either not included or are only partially included. The budgeter can also be said to be a technologist for individual processes (activities) and must know the process of implementation. If some details are missing in the project documentation, the budgeter

has two options: either to contact the designer and let him finish it or to put in the budget only general items that should cover the work with the unit of measure (kpl.). Which in reality may not be true. The construction budget is a preliminary price estimate. Preliminary costing is for the sake of processing in the pre-construction phase of the construction work. In this situation, the contractor should have prepared a bid budget for the purpose of calculating the bid price with which he is bidding for the contract. If agreed by the investor, it becomes the basis for agreeing the contract price. The budget would form an annex to the works contract and would define what is to be implemented, from what material, in what quantity and at what price (Ellinger, 2013). The most important function of the bill of quantities is to describe the construction object so that both parties, the investor and the contractor, have the same idea of the future construction work. The bill of quantities is used to document the physical extent (area) of each budget item. It is the actual calculation of the quantities given for each budget item. Thus, it is not only the indication of the total area of a given budget item, but also the documentation of its calculation. The order of the items in the bill of quantities corresponds to the order of the items in the budget (Čavojský & Ellingerová, 2021).
From the design for the building permit, it is possible to read the number of elements and structures, but it is not possible to determine their type and type, which affects the price of individual structures and elements, and therefore the total cost of the work (Čavojský, 2012).

2. Statement of measurements

Before the budget is prepared, it is necessary to draw up a bill of quantities, which is an unambiguous description and quantification of the construction object expressed by a set of items of descriptions of construction works and supplies, indicating the units of measurement and their quantity. The basic function of the bill of quantities is to describe the construction object so that both parties have the same and unambiguous idea of it. As mentioned above, the budgeter must study the project for which he is to draw up a budget. It is therefore essential that he or she is familiar not only with the building in question, but also with its location, site conditions, communications and all the relevant facts in general. He has to take into account all the site requirements - surveys (hydrogeological, geological, archaeological, ...).
The budget contains a list of the items of work for the building structures, materials, works (installation). It can be processed by various programs available on the market e.g. Cenkros 4, Odis and others. The investor can be provided with this budget priced at indicative guide prices to give an idea of the estimated value of the contract. And then as a blind budget (without prices), which will later be priced by the contractor. The method of measurement is also an important factor in the preparation of the bill of quantities. Taking into account what belongs to the measurements and what does not. (Cenekon, Inc., 2024) Because if a database from one creator is used, the individual measurement principles may not be the same for the other. Alternatively, one database has one item per activity as one item that includes everything and in the other more items are needed for valuation. This always needs to be studied. And of course, there are exceptions when some things (measurements) are not deducted and other times they are. The classification of items in the budget is by means of the Grading of Works and Structures (TSKP) or the Grading of Structural Works (TSP). Mostly in practice, the TSKP is used, although this classification is not currently valid.
The budgeter shall transfer the works and materials from the design documents to the bill of quantities and quantify them according to the method of measurement. The budgeter must have an important knowledge of the technological processes, interrelationships in the context of the specific construction, the construction site, the contractual conditions. Since the preparation of the quotation is the basis for the conclusion of the works contract, but also for the planning of the works, the budget with the bill of quantities can of course form the basis for the schedule (time schedule). The bill of quantities is required in the public procurement procedure and through it the tenderers have the same information.

3. Methods of processing the statement of estimates

Errors most often occur in the method of processing the statement of quantities. Consequently, the valuation according to this statement is imperfect (poor quality). After correctness, every budgeter should study the supporting documents (project documentation, work contract, wider construction site relations, etc.) before valuing the blind budget. After this, he should be able to check whether the given statement of quantities is correctly prepared or contains all activities. But this is not always possible in practice due to time constraints and the submission of multiple price offers within a week (month). The most common errors in the bill of quantities are:

- insufficient supporting documents (project documentation),
- short time to study the supporting documents,
- inaccurate quantities in the project drawings,
- errors in reading the drawings,
- incorrect or missing dimensions,
- incorrect calculations or omission of auxiliary structures,
- insufficient information in the item description - information on how the quantity was calculated is missing,
- incorrect items listed (from another construction, but where a different technological process was used),
- the project was changed, but the bill of quantities was not subsequently adjusted,
- absence or duplication of items,
- missing temporary building structures: formwork, reinforcement, fences, cranes, support systems, etc.

As an example, it is possible to show frequently occurring forms of budget for one and the same item (activity). The first image (Fig. 1) shows a processed bill for the manufacture of trellis on the balconies of an apartment building. Where it is processed with 3 items including the transfer of materials. While it is processed with a separate item for assembly and a separate one for material. From this method it is possible to deduce what all could be included in the items.

	D	PSV	Práce a dodávky PSV				126 182,765
	D	763	Konštrukcie - drevostavby				126 182,765
1	K	763792101.S	Montáž ostatných dielcov líšt, lát, s prierezovou plochou do 25 cm2	m	9 970,080	0,730	7 278,158
2	*M*	*283190001300.S*	*Doska terasová drevoplastová kompozitná, šxhrxl 150x24x4000 mm*	*m*	*9 970,080*	*11,784*	*117 487,423*
3	K	998763101.S	Presun hmôt pre drevostavby v objektoch výšky do 12 m	t	27,916	50,766	1 417,184

Figure 1. Example of processing a statement of estimates with an itemized budget

In the second picture (Fig. 2), the statement is processed with one complete item and with a total price. This method is often chosen when the project is not complete and the budgeter cannot precisely define all the work and materials for the construction. Or when there is not much time to process the statement of quantities. There is nothing illegal in this processing, but for the contractor, when he has to price it according to the above description and unit of measurement, he does not know what his

price should include. It may happen that he gives a "good" price and manages to realize it for that price if the investor chooses him. But it may happen that he overestimates his offer, so he may not be competitive.

	D	PSV	Práce a dodávky PSV				150 000,000
	D	763	Konštrukcie - drevostavby				150 000,000
1	K	763792101.S	Montáž a dodávka materiálu na treláž balkónov	kpl.	1,000	150 000,000	150 000,000

Figure 2. Example of processing a complete measurement report

To clarify what kind of construction it is, see the pictures below. It is a construction made of WPC profiles on the balconies of an apartment building. It is not a straight construction, but also contains arches that need to be made directly on site. And this was apparently not included in the examples either. In pictures no. 1 and 2 there were reports of measurements, which were not immediately obvious that they had their pitfalls. The first example item no. 1 used from the Cenkros 4 program also with a unit price. This is a common method, but you should always remember that if you want to price an atypical construction, you also need to calculate the items from the database individually.

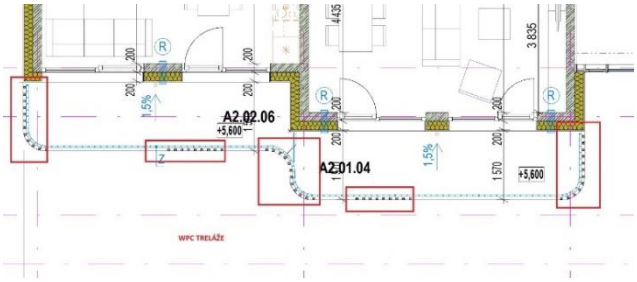

Figure 3. View and floor plan of the building with the location of the WPC trellis marked

According to the price analysis, the item in the database only includes the work of a construction carpenter and no auxiliary material for attaching the structure, including a bracket for attaching the trellis (Fig. 4). This material was not described in the project documentation. It was only possible to deduce from the visualization that a bracket for fastening the structure is required for assembly.

Rozbor ceny

Položka	763792101.S	Montáž ostatných dielcov líšt, lát, s prierezovou plochou do 25 cm2	
TOV	000	TOV 000	MJ m

H	Priamy materiál				0,00
NC	z toho nákupná cena				0,00
D	z toho doprava				0,00
M	Mzdové náklady				0,40
P	z toho priame mzdy + doplnkové mzdy				0,29
O	odvody	36,2 % z miezd			0,11
S	Stroje				0,00
T	Ostatné priame náklady				0,00
SUB	Poddodávky				0,00
PSN	**Priame spracovacie náklady**	**[M] + [S] + [T]**			**0,40**
	Priame náklady	**[H] + [SUB] + [PSN] + [NK]**			**0,40**
R1	Výrobná réžia	40,00 % z [P]+[O]			0,16
R2	Správna réžia	20,00 % z [P]+[O]			0,08
R3		0,00 % z []			0,00
	Nepriame náklady	**[R1] + [R2] + [R3]**			**0,24**
	Náklady celkom	**[H] + [SUB] + [PSN] + [R1] + [R2] + [R3] + [NK]**			**0,63**
Z	Zisk	15,00 % z [P]+[O]+[S]+[T]+[R1]+[R2]			0,10
R4		0,00 % z []			0,00
NK	Nekalkulované náklady				0,00
	Celkom	**[H] + [SUB] + [PSN] až [NK]**			**0,73**
	Jednotková cena				0,73
	Hmotnosť				0,00000
	Normohodiny				0,034

P.Č.	T	Kód položky	Názov položky	MJ	Množstvo	Jednotková cena	Celkom	NC cena	NC cena celkom	Doprava	Doprava celkom
1	P	7115001-T-2	Stavebný tesár	Nh	0,03400	7,42	0,25				
			Mzdy				**0,25**				

Figure 4. Price analysis of the item "Assembly of other parts of moldings, battens with a cross-sectional area of up to 25cm2"(Cenkros 4, 2024)

When calculating the unit price, a calculation formula should be followed to cover all costs, whether direct or indirect, and profit (Fig. 5).

VN – Own costs						**Z - profit**
PN – Own costs				**RN – Indirect overhead costs**		**Z**
H	**M**	**S**	**O**	**RV**	**RS**	**Z**
H	**PSN**			**HR**		
H	**SNV**				**RS**	**Z**
H	**SN**					**Z**
Price excluding VAT						

Figure 5. Unit price calculation formula (Cenekon, a.s., 2024)

H – direct material costs
M – direct wage costs
S- costs of operating construction resources and equipment
O – other direct costs
RV – production overhead
RS – administrative overhead
Z – profit
PSN – direct processing costs
SNV – production processing costs
SN - processing costs
HR – gross margin
VAT – value added tax

4. Solution to the assessment report

One possible solution to the above example is to process it with an individual calculation, since it is an atypical construction and such items are not found in the database. The individual calculation included fasteners such as chemical anchors, screws, as well as other professions, so that the construction could be implemented. The more detailed information with the specification was requested from the designer. And it can be stated that the unit price of 0.73 €/m did not cover the costs of assembling the structure. The individual calculation shows the unit price as high as 16.55 €/m (Fig. 6). Which is much more than was in the budget.

Rozbor ceny

Položka	763792101.S	Montáž ostatných dielcov líšt, lát, s prierezovou plochou do 25 cm2	
TOV	000	TOV 000	MJ m

H	Priamy materiál			10,38
NC	z toho nákupná cena			10,33
D	z toho doprava			0,04
M	Mzdové náklady			5,65
P	z toho priame mzdy + doplnkové mzdy			4,17
O	odvody	% z miezd		1,47
S	Stroje			0,00
T	Ostatné priame náklady			0,00
SUB	Poddodávky			0,00
PSN	**Priame spracovacie náklady**	**[M] + [S] + [T]**		**5,65**
	Priame náklady	**[H] + [SUB] + [PSN] + [NK]**		**16,02**
R1				0,25
R2				0,13
R3				0,00
	Nepriame náklady	**[R1] + [R2] + [R3]**		**0,38**
	Náklady celkom	**[H] + [SUB] + [PSN] + [R1] + [R2] + [R3] + [NK]**		**16,40**
Z	Zisk			0,15
R4				0,00
NK	Nekalkulované náklady			0,00
	Celkom	**[H] + [SUB] + [PSN] až [NK]**		**16,55**
	Jednotková cena			**16,55**
	Hmotnosť			0,00072
	Normohodiny			0,554

P.Č.	T	Kód položky	Názov položky	MJ	Množstvo	Jednotková cena	Celkom	NC cena	NC cena celkom	Doprava	Doprava celkom
1	M	1111	Nosná konzola (montážny profil k systému)	ks	0,30000	9,56	2,87	9,56	2,87	0,00	0,00
2	M	245990000200.S	Kapsula chemická M16x125, kotevná technika do betónu, 100 ks v balení	bal	0,01000	451,42	4,51	448,00	4,48	3,42	0,03
3	M	309500000200.S	Skrutka kombi M 8x60 mm	ks	2,00000	0,15	0,30	0,15	0,30	0,00	0,00
4	M	311990006900.S	Kotevná skrutka M24x210/54 žiarovo pozinkovaná, 100 ks v balení	bal	0,01000	256,00	2,56	255,58	2,56	0,42	0,00
5	M	312110000700.S	Elektróda zváracia E-R 117 D 4 mm x dĺ. 350 mm nelegovaná s rutilovým a kyslým obalom	tks	0,00010	246,30	0,02	241,00	0,02	5,30	0,00
6	M	546320000600.S	Nábojka pre VS trel. pr. tempo R 9 mm st. 5 červená	tks	0,00099	105,40	0,10	105,00	0,10	0,40	0,00
			Materiály				**10,38**				
8	P	7115001-T-2	Stavebný tesár	Nh	0,05400	7,42	0,40				
9	P	7222005-T-2	Stavebný zámočník	Nh	0,50000	7,42	3,71				
			Mzdy				**4,11**				

Figure 6. Price analysis of the item "Assembly of other parts of battens, laths with a cross-sectional area of up to 25cm2" in the form of individual calculation (Cenekon, a.s., 2024)

Individual calculation is the most accurate form of calculation of structures. Suitable for atypical structures. The difference is mainly seen in the result for the structure as a whole (Fig. 7). It is about 125% higher than the original in Fig. 1. It is also higher than the example in Fig. 2 by about 89%.

	D	PSV	Práce a dodávky PSV				284 283,241
	D	763	Konštrukcie - drevostavby				284 283,241
1	K	763792101.S	Montáž ostatných dielcov líšt, lát, s prierezovou plochou do 25 cm2	m	9 970,080	16,551	165 014,794
2	*M*	*283190001300.S*	*Doska terasová drevoplastová kompozitná, šxhrxl 150x24x4000 mm*	*m*	*9 970,080*	*11,784*	*117 487,423*
3	K	998763101.S	Presun hmôt pre drevostavby v objektoch výšky do 12 m	t	35,083	50,766	1 781,024

Figure 7. Example of processing a statement of measurements in the form of individual calculation (Cenekon, a.s., 2024)

According to one case, the contractor would be in loss by €161,100.48 excluding VAT and in the other case by €134,283.24 € excluding VAT. These amounts are not negligible and can also be liquidating for the contractors. Of course, it depends on what kind of contract for the work they have concluded with the investor and whether there is room for an increase by actual costs.

5. Conclusions

In the construction industry, a budget with a bill of quantities plays a key role, which often also serves as an annex to a contract for work. In disputes between the investor and the contractor, the budget is usually the first basis for review, with both parties having the right to defend or comment on its

content. However, the bill of quantities is a demanding part, especially in terms of its processing and control. Factors such as time and the professional experience of the budgeter are decisive for the quality of the preparation of the bill of quantities. Input documents, especially project documentation, play an equally important role. Modern technologies such as BIM (Building Information Modelling) allow for efficient acquisition of quantities, but the correct choice of items and units of measurement for specific structures remains a critical task. At the same time, it is necessary to take into account whether it is a "traditional" structure or an atypical solution that requires increased attention. Incorrect processing of these aspects can lead to significant differences between the bid and final (realization) price.

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