

## ASPECTS OF COST-ESTIMATE FOR CONSTRUCTION WORK IN LISTED BUILDINGS

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**Key words:** listed buildings, renovation work, owner/client cost estimate, public contracts.

### Abstract

The paper discusses the aspects of estimating costs of construction work in historic buildings. An analysis of the unit prices for renovation and refitting an old building found in market available price lists has been completed. The results were compared with the prices attained through a detailed cost estimate. It has been demonstrated that at present the limited accessibility to price lists containing unit prices for redecoration work in historic buildings is a serious obstacle to estimating costs of such type of building work, as a result of which cost estimates must be performed several times using the detailed unit method.

## PROBLEMATYKA KOSZTORYSOWANIA ROBÓT BUDOWLANYCH W OBIEKTACH ZABYTKOWYCH

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**Słowa kluczowe:** obiekty zabytkowe, roboty remontowe, kosztorys inwestorski, zamówienia publiczne.

### Abstrakt

W pracy przedstawiono problematykę związaną z kosztorysowaniem robót budowlanych w obiektach zabytkowych. Przeprowadzono analizę dostępnych na rynku cenników cen jednostkowych robót remontowych w porównaniu z cenami wyliczonymi w kalkulacji szczegółowej. Wykazano, że poważnym problemem kosztorysowania tego rodzaju robót jest ograniczony zakres dostępnych na rynku cenników cen jednostkowych robót remontowych w obiektach zabytkowych, co powoduje wielokrotną konieczność dokonywania kalkulacji ceny jednostkowej metodą szczegółową.

## **Introduction**

Construction work in listed historic buildings requires a customized approach to the issues connected with conservation research, design making and cost estimate. The technical condition of such buildings often necessitates complex restoration so as to revive their former splendour. Prolonged lack of ongoing maintenance repairs or redecoration work in historic buildings often leads to extensive damage of their structural and decorative components. When many elements of an old building are worn out, the whole construction poses a threat to its users and other persons. In addition, the aesthetic value of the building suffers too.

### **Construction work in historic buildings**

The most common types of renovation work in historic buildings include:

- drying up damp cellars,
- redecoration of stairwells,
- redecoration of wall elevation,
- roof renovation,
- replacement of old fittings.

Each construction activity planned in a historic building needs to be assessed and approved of by the Conservation Officer. The scope of the work as well as the materials to use are agreed upon separately for each historic construction. Many solutions are unique and the materials to be used are unavailable on the Polish market. All this creates big problems while working out a detailed cost estimate. A cost estimator must complete a customized detailed cost estimate as well as suggest alternative material and technology solutions. The labour and material outlay norms in the published catalogues of in-kind outlays do not reflect the actual costs of restoration work.

### **Methods for cost estimating**

Cost estimate methods are defined by the ways of cost estimating building work. They are specified in relevant legal regulations or in model case studies.

The current laws on cost estimating construction work contain regulations which are binding only to those owners/clients who act in accordance with the Act of 29<sup>th</sup> January 2004, the Act on Public Contracts (Journal of Laws no 223, item 1655 and later amendments). Public investors should possess an owner/client cost estimate drawn up in compliance with the executive acts

passed on the basis of the Law on Public Contracts, i.e. the Ordinance of the Minister for Infrastructure of 18<sup>th</sup> May 2004, on determination of cost estimate methods and basic information for elaborating an owner/client cost estimate, calculation of planned costs of designing work and planned costs of construction work as defined in the functional and services programme (Journal of Laws No 130, item 1389) and the Ordinance of the Minister for Infrastructure of 2<sup>nd</sup> September 2004, on detailed scope and form of design documentation, technical specification of completing and commissioning construction work, and the functional and services programme (Journal of Laws No 202, item 2072). With respect to other investors, there are no binding legal regulations which enforce and specify cost estimating. Most cost estimates are worked out on the basis of the now invalid Ordinance of the Minister for Regional Development and Civil Engineering of 13<sup>th</sup> July 2001 on cost estimate methods for construction projects (Journal of Laws No 80, item 876) or according to published materials, for example “Polish standards for cost estimates”, prepared and published by the Association of Construction Industry Cost Estimators.

Following the above guidelines and the binding legal regulations in Poland, there are two cost estimate methods:

- detailed cost estimate,
- simplified cost estimate.

The choice of a cost estimate method depends on the type of a cost estimate and its purpose as well as the source of financing the building project. The way of performing an owner/client cost estimate, as required for public contracts, is legally regulated. The choice of a cost-estimate method is made by the contracting party and the contractor while negotiating the terms of the contract, when the scope and complexity of the construction work is taken into consideration alongside repeatability of certain jobs as well as availability of information on construction work prices, etc.

The generally applicable basis for making detailed cost estimates for building work in listed historic buildings consists of in-kind outlays, cited in In-kind Outlays Catalogues (in Polish, Katalogi Nakładów Rzeczowych, KNR) or Temporary Branch Catalogues of Outlays in Historic Conservation Work (in Polish, Tymczasowe Zakładowe Katalogi Nakładów Budownictwa Konserwatorskiego, TZKBNK). In turn, simplified cost estimating is based on the published price lists or unit prices for construction work available on the building industry market.

The detailed cost estimate method relies on determination of a cost-estimate value  $W_k$  by estimating the direct costs for all takeoff items and adding respective indirect costs, profit and VAT.

The indirect costs and profit can be estimated for the whole building or relative to every production unit. This in mind, the work cost-estimated value  $W_k$  is calculated from the formula:

$$W_k = \sum_i (L_i \cdot n \cdot c) + K_p + Z + P_V \quad (1)$$

or

$$W_k = \sum_i L_i \cdot (n \cdot c + K_{pj} + Z_j) + P_V \quad (2)$$

where:

- $L_i$  – number of takeoff units of the activity designated number  $i$ ,
- $n$  – unit in-kind outlays of:  $n_r$  – labour,  $n_m$  – materials,  $n_s$  – equipment labour,
- $c$  – prices of production factors:  $C_r$  – labour rate,  $C_m$  – price of material purchase,  $C_s$  – price of equipment work,
- $n \cdot c$  – direct costs of a takeoff unit, calculated from the formula:

$$n \cdot c = (\sum n_r \cdot C_r + \sum n_m \cdot C_m + \sum n_s \cdot C_s) \quad (3)$$

where:

- $K_p$  – indirect costs for the whole range of the cost-estimated work,
- $Z$  – rofit for the whole project,
- $K_{pj}$  – indirect costs per takeoff unit,
- $Z_j$  – profit per takeoff unit,
- $P_v$  – value Added Tax (VAT).

Calculating the cost-estimated value from formula (1) means calculating direct costs of construction work activities and adding indirect costs, profit and VAT. When formula (2) is used, for each takeoff item, a unit price is calculated that includes direct costs, indirect costs and profit. Afterwards, the achieved value is multiplied by the number of the construction operations. When the values of all the operations are summed up, a VAT tax is added. The takeoff price for the calculations ( $C_j$ ) (unit price) in formula (2) can also be written as:

$$C_j = R_j + M_j + S_j + K_{pj} + Z_j \quad (4)$$

where:

- $R_j$  – cost-estimate value of labour per takeoff unit,
- $M_j$  – cost-estimate value of materials per takeoff unit,
- $S_j$  – cost-estimate value of equipment work per takeoff unit, the remaining designations as in formula (2).

The direct cost breakdown elements: labour  $R_j$ , materials  $M_j$  and equipment work  $S_j$  are calculated from formula (3).

The simplified calculation means calculating the cost-estimated value of the construction operations as a sum of the multiplication products of takeoff units and their unit prices, with the VAT added afterwards.

According to this method, the cost-estimated value of construction work is:

$$C_k = \sum_i L_i \cdot C_j + P_v \quad (5)$$

where:

$C_k$  – cost-estimate price,

$L_i$  – number of takeoff units for a construction operation or element number  $i$ ,

$C_j$  – unit prices for determined takeoff units,

$P_v$  – Value Added Tax (VAT).

The unit price  $C_j$  includes all calculation components of construction activities according to formula (4).

The simplified calculation method is applicable when the cost estimator has lists of unit prices for construction operations. Such sets of prices can be created by building industry companies for their own purposes or by owners/clients based on former contracts. Information on unit prices can also be obtained from tender bids and negotiations carried out when construction projects are commissioned, or found in specialist publications issued by institutions and firms which deal professionally with registration and publication of prices in the building industry.

Clients who open a public bid are obliged to have an owner/client cost-estimate. Such an estimate is used for determination of an estimated value of the planned building activities and for analysis and comparison of the offerers' estimates. The owner/client cost estimate is prepared with the detailed methods unless there are no grounds for using this method, in which case a simplified calculation method is used.

However, it is rather difficult to prepare a cost estimate for building work in a historic building based on the simplified method, using ready-made databases of unit prices, due to the limited range of published prices for a variety of construction work types. Besides, a client cost estimate for historic buildings is based on the design documentation, which imposes certain recommendations concerning the materials and technical solutions which will approximate the original ones. This means that cost estimators must adapt tailor-made calculation of labour and material consumption. Most often, such

Table 1  
An example of a table of prices containing unit prices for renovation work in listed buildings

No	Statistical classification code	Job specification	Measure unit	Unit price ( $C_j$ ) of work				Change in %		
				$C_j$ min.	$C_j$ max.	$C_j$ mean	$C_{jupbud}$	including materials $M_{nj}$	1 <sup>st</sup> quarter 2009	4 <sup>th</sup> quarter 2008
1	2	3	4	5	6	7	8	9	10	11
TZKNBK, part 15, Painting jobs										
Chapter 01 Plaster painting – code CPV 45442100-8										
1	0101-0110	Limewhiting of brick, stone or scored surfaces	m <sup>2</sup>	2.95	4.86	<b>3.50</b>	3.84	1.01	-2.0	-1.1
2	0101-0120	As above, but twice	m <sup>2</sup>	4.92	8.22	<b>5.88</b>	6.45	1.51	-1.8	-1.0
3	0102-0210	Limewhiting of previously soap grounded surfaces- once	m <sup>2</sup>	4.02	6.77	<b>4.81</b>	5.27	1.07	-2.0	-1.2
4	0102-0220	As above, but twice	m <sup>2</sup>	6.25	10.59	<b>7.51</b>	8.25	1.58	-1.8	-1.2
5	0103-0310	Limewhiting of plastered surfaces with adding colour and groundin – once	m <sup>2</sup>	5.06	8.65	<b>6.09</b>	6.69	1.11	-2.1	-1.3
6	0103-0330	As above, but twice	m <sup>2</sup>	6.28	11.59	<b>8.20</b>	9.01	1.65	-1.9	-1.2
7	0104-0410	Soap grounding of plastered walls	m <sup>2</sup>	4.60	8.33	<b>5.68</b>	6.23	0.06	-2.2	-1.4
8	0105-0510	Painting elevation walls with so-called Swedish lime – once	m <sup>2</sup>	6.12	10.58	<b>7.42</b>	8.15	1.18	-2.0	-1.3
9	0105-0520	As above, but twice	m <sup>2</sup>	8.81	14.98	<b>10.61</b>	11.66	2.19	-1.9	-1.2
10	0106-0610	Painting previously colour grounded elevation walls with casein paint – once	m <sup>2</sup>	12.51	22.20	<b>15.57</b>	17.11	2.48	-1.6	-1.6
11	1007-0710	Painting with “Swedish paint” of grounded drawn profiles max. length 5 cm	m <sup>2</sup>	21.76	38.81	<b>26.69</b>	29.33	1.43	-2.1	-1.5
12	0107-0720	As above, but length 5 to 10 cm	m <sup>2</sup>	18.06	32.54	<b>22.21</b>	24.40	1.01	-2.2	-1.4
13	0107-0730	As above, but length 10 to 20 cm	m <sup>2</sup>	13.00	23.36	<b>15.98</b>	17.56	1.01	-2.1	-1.4
14	0107-0740	As above, but length over 20 cm	m <sup>2</sup>	10.99	19.69	<b>13.49</b>	14.82	1.01	-2.0	-1.3
15	0108-0810	As above, but of simple ornamental plaster moulding	m <sup>2</sup>	9.09	16.26	<b>11.16</b>	12.27	1.17	-1.8	-1.2

Source: Bulletin of Prices for Renovation and Construction Work in Listed Buildings, 3<sup>rd</sup> quarter of 2009; published by OWEOB Promocja Sp. z o.o. Warszawa.

a cost estimate is produced on the basis of published sets of norms and catalogues of in-kind outlays, taking into account the applied material solutions. In practice, it is not uncommon to consult companies which specialise in restoration and renovation of listed buildings.

The example of a price database shown in Tab. 1 is produced by firms which monitor price-creating factors on the building industry market and drawn up by the detailed calculation of unit prices (formula 4) according to the TKZKNK catalogues.

Below we present a cost-estimate of grounding 100 m<sup>2</sup> of walls in a listed building, calculated with the detailed method according to the KNR catalogues and the same estimation shown as a simplified position, using the value of unit price calculated with the detailed method (Tab. 3).

Table 2  
Sample detailed calculation of wall grounding in a listed building

No	Base	Specification	Measure unit	Outlays	Unit cost	R	M	S
1	45442100-8	Wall surface grounding – detailed calculation						
1	KNR 10-01 1305-04 analogy	Grounding walls with the grounding preparation TAGOSIL G (once) quantity survey = 100 m <sup>2</sup>	m <sup>2</sup>	22.0000				
1*		--R-- labour 0.22w-h/m <sup>2</sup> · 16,52PLN/w-h	w-h	33.0000	3.634	363.44		
2*		--M-- TAGOSIL G – grounding agent and diluent for silicate paints and plasters 0.33 dm <sup>3</sup> /m <sup>2</sup> · 22.14 PLN/dm <sup>3</sup>	dm <sup>3</sup>	33.0000	7.306		730.62	
3*		Additional materials 2% of M	%	2.0000	0.146		14.61	
<b>Total direct costs:</b>						363.44	745.23	
<b>Unit price:</b>						6.860	7.452	0.00

Source: Norma Pro, Athenasoft.

Table 3  
Sample simplified calculation of wall grounding in a listed building

No	Base	Specification	Measure unit	Takeoff	Unit price	Value
1.	45442100-8	Wall surface grounding – detailed calculation				
1 d.1	KNR 19-01 1305-04 analogy	Wall surface grounding with TAGOSIL G (once)	m <sup>2</sup>	100.000	14.31	1431.00

Source: Norma Pro, Athenasoft.

The cost estimate of this building activity – wall grounding – using the preparation suggested by the Conservation Officer is largely divergent from the cost-estimated value calculated according to a unit price found in one of the generally available price lists for renovation work in listed buildings (Tab. 4).

Table 4  
Comparison of an item prepared according to the norms of R, M and S consumption, with a simplified item calculated according to a published bulletin of prices of renovation work in listed buildings

No	Base	Specification	Measure unit	Takeoff	Unit price	Value
1	45442100-8	Wall surface grounding – detailed calculation				
1 d.1	KNR 19-01 1305-04 analogy	Wall grounding with TAGOSIL G (once)	m <sup>2</sup>	100.000	14.31	1431.00
2	45442100-8	Wall surface grounding – simplified calculation				
2 d.2	BRR 3/2009	Plaster painting – soap grounding of plastered walls	m <sup>2</sup>	100.000	5.68	568.00

Source: Norma Pro, Athenasoft.

The cost of grounding walls calculated from the price list is just about 40% of the cost of grounding with the preparation recommended by the Conservation Officer (Fig. 1). This means that in practice it is impossible to produce a reliable cost estimate for renovation work in a listed building relying solely on unit prices in available published sources.

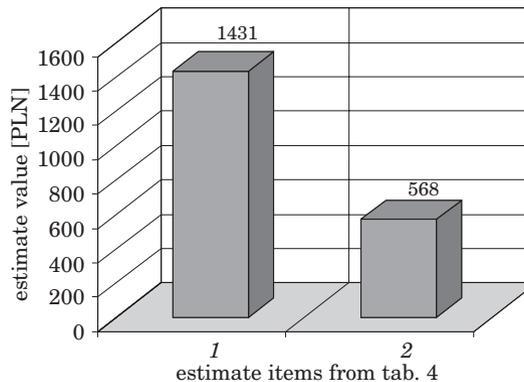


Fig. 1. Comparison of items from tab. 4. 1 – calculation item 1; 2 – calculation item 2  
Source: Own elaboration.

## Conclusion

Most of cost estimates for construction work in listed buildings are drawn up using the detailed method, based on the existing database of price catalogues, taking into consideration a whole variety of material and technological solutions. The fact that clients acting under the Act on Public Contracts must possess an owner/client cost estimate produced with the simplified method means that a detailed calculation of unit prices must be completed. The scope of construction activities and materials to be used suggested by an authorized conservation officer obliges the cost estimator to perform a customized analysis of labour consumption and cost of used materials.

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