

ANALYSIS OF THE DEVELOPMENT OF PRICES OF CONSTRUCTION PROJECTS AND MATERIALS IN THE TERRITORY OF THE SLOVAK REPUBLIC

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Abstract

In recent years, the global economy has developed unpredictably. This unpredictable and unstable development has also affected the construction industry, not only in the territory of the Slovak Republic, but all over the world. This unexpected development of the market, which has caused an increase in the prices of building materials and construction work, has also caused complications, and the slowing down and subsequent extension of construction time. The relevant authorities have tried to compensate for the impact by implementing certain remedial measures.

Keywords

Price, construction work, market development, analysis, measures

1 INTRODUCTION

Every year, the prices of building materials and construction work change either in an upwards or downwards direction based on standard inflation. The size and direction of this change are unpredictable and depend on several factors. These price changes have a colossal impact on the total costs associated with construction project. They affect the size of the investment, the total cost of the contractor as well as the final profit. The types and amounts of materials used can also significantly affect the price of construction project. For example, an increase in the price of concrete will have a more significant effect on the total price of construction project when building a massive reinforced concrete engineering structure than when a building such as a house or industrial hall is to be constructed.

Issues related to inflation, the rising prices of construction materials and work, the lack of materials and workers, and other factors have an impact on all those involved in the construction process - investors, implementers, subcontractors, the manufacturers of construction materials and also the users of the final product. The aim of this article is to describe and analyze the development of the price of construction work and materials, and to describe the methodological guidelines provided by the authorities for the remediation of the current situation, and their effect within the Slovak construction sector.

The article deals with the unexpected development of prices in the construction industry on the territory of the Slovak Republic from 2021 to the present. The research is based on collected data that map the development within the entire republic and are available on the portal datacube.statistics.sk. At the beginning, there is an analysis of the development for the mentioned period, followed by a summary of the individual methodological instructions. The article describes their validity, impact assessment and goals, and also provides an overall evaluation of these compensatory measures. For a better overall picture, the article also describes the unexpected development of the prices of the most commonly used building materials. From the analysis and the overall development of the construction sector, it can be expected that prices will continue to grow in the coming years.

2 DESCRIPTION OF THE CURRENT SITUATION

The main source for the analysis of the development of the price of construction projects ~~work~~ was the web portal datacube.statistics.sk, which falls under the Statistical Office of the Slovak Republic, which is the central authority of the state administration of the Slovak Republic in the field of statistics [1]. In this way, the objectivity and scientific value of the article was ensured. Based on the data published by the Statistical Office of the Slovak Republic, it is possible to clearly observe how the price index of construction work and materials has grown every year [2]. During 2021, there were unexpected events that affected the whole world – the coronavirus pandemic

and the escalation of the military conflict in Ukraine. These and other events had a negative impact on the prices of construction works and materials, which consequently became more expensive. The events mentioned above are partially covered by the measures and methodological instructions issued by the Office for Public Procurement (ÚVO) [3] and the Ministry of Transport of the Slovak Republic (MDRSR) [4], [5]. The price increase can also be observed on the basis of the commercial database CENEKON [5] (ODIS, KALKULUS), which covers the price of items – building materials, labor and other inputs – in such a manner that the calculated price of each item is as current as possible and adequately represents the market value of the item. The media and news servers have also described the increase in prices in the construction industry, evaluating the increase in prices of either labor or materials [6], [7], [8], [9]. This progression is clearly visible from Fig. 1. Manufacturers who try to be transparent have also stated the need to raise the prices of construction products, because the input raw materials necessary for production are more expensive [10].

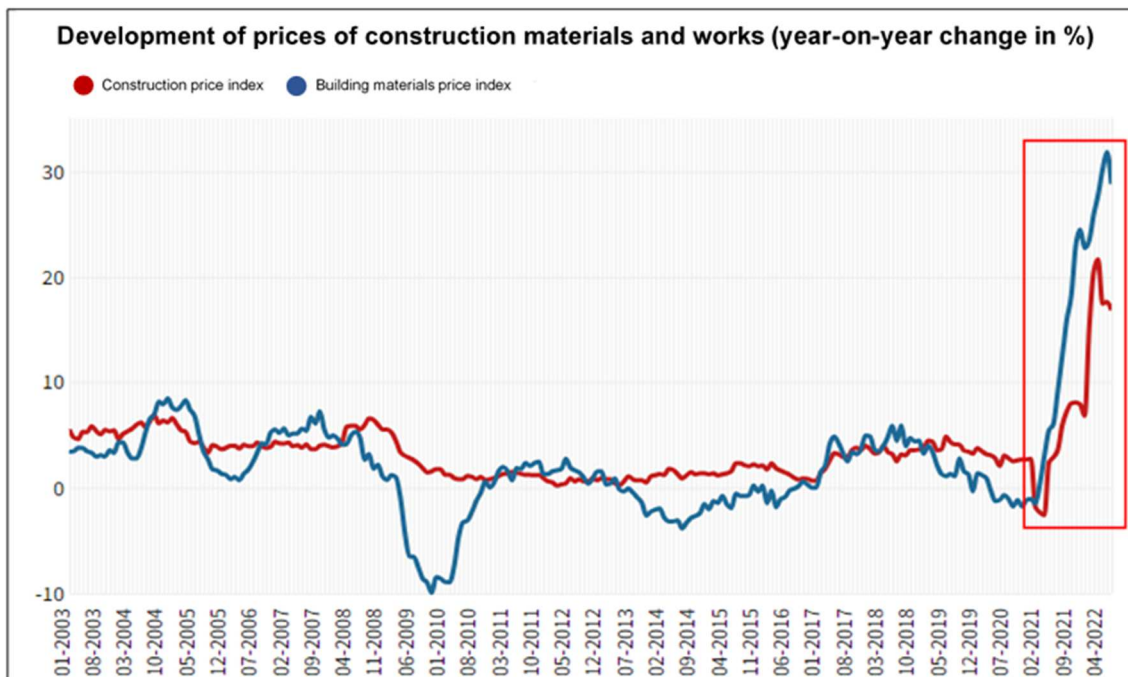


Fig. 1 Development of prices of construction materials and construction work (year-on-year change in %) [7].

By signing a contract to perform work, each developer guarantees professionally that the work will be completed according to the schedule and for a pre-agreed financial compensation – price. The agreed price is based on a number of factors, including contracted subcontractors, internal experience with previous construction projects and an estimate of the normal ongoing rise in commodity costs in the market – known as price evolution. The development of the price can be considered as a certain type of prediction – an estimate, an acceptable fact – which is taken into account in the risk (profit) of the implementer and is included in the total price of the work. The contractor uses his experience, knowledge, and possibly the price development index to estimate the price of the completed construction project and thus arrive at a specific number – the final price for the construction project. Realtors and suppliers of construction works and materials set and adjust prices according to their data (questionnaires, market research, feedback) for the most recent previous three years.

It is essential to distinguish between unpredictable fluctuation — which can have multiple causes, such as the COVID-19 pandemic, the escalation of the conflict in Ukraine, the shortage of labor and raw materials, the rising prices of commodities necessary for production, etc. and a predictable change (increase or decrease) that has a basis in historical price development data.

The statistics created by the Statistical Office of the Slovak Republic, which creates indexes of construction projects, materials and products used in the construction sector, make it possible to observe the overall growth of prices for the monitored period of 2015 – the present. In addition, there are Construction Work Price Indexes according to Construction Classification Fig. 2. The prices of the selected delegates items are set taking into account profit, implementation costs and, last but not least, the materials themselves. Prices are quoted without value added tax (VAT).

The attached graph shows the price of labor for various construction projects according to the Classification of Constructions in order to demonstrate the unpredictability of the growth of the price of labor in the construction sector in the Slovak Republic.

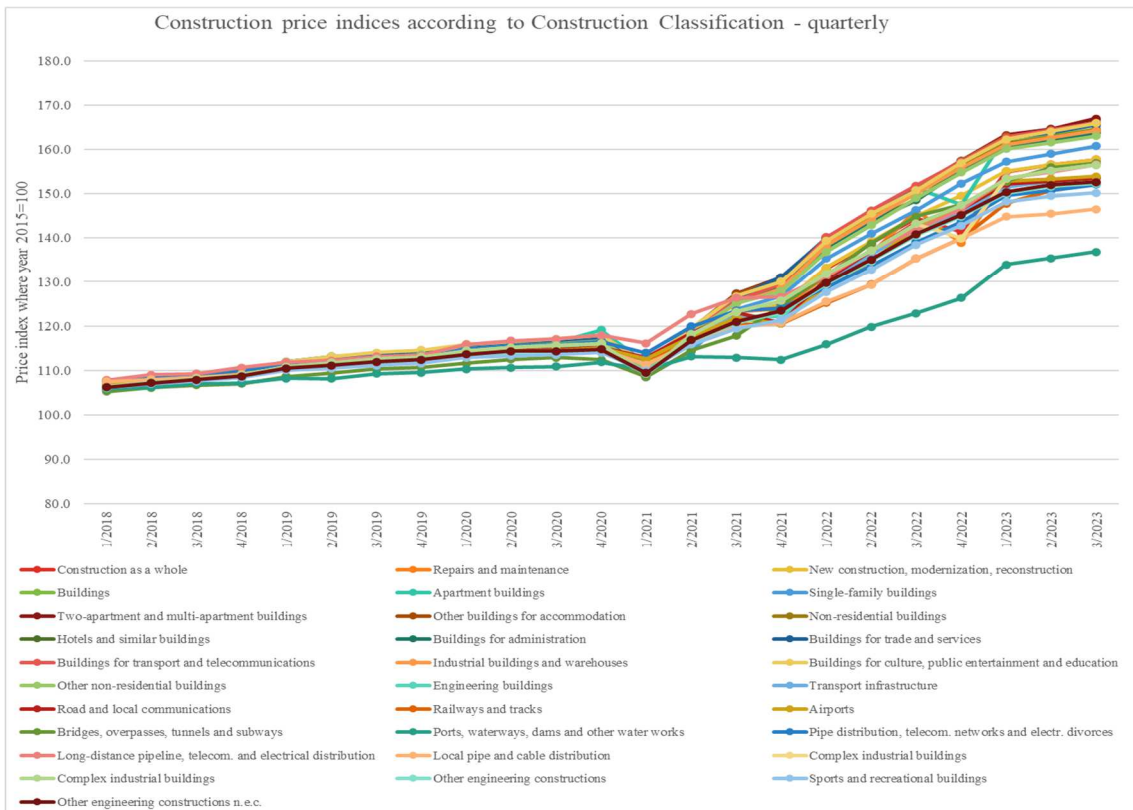


Fig. 2 Quarterly development of construction work price indexes according to Status Classification [11].

The increase in prices has affected not only construction work but mainly materials used in the construction industry. The unexpected increase in price of the most commonly used materials in the construction sector is shown in the following Fig. 3.

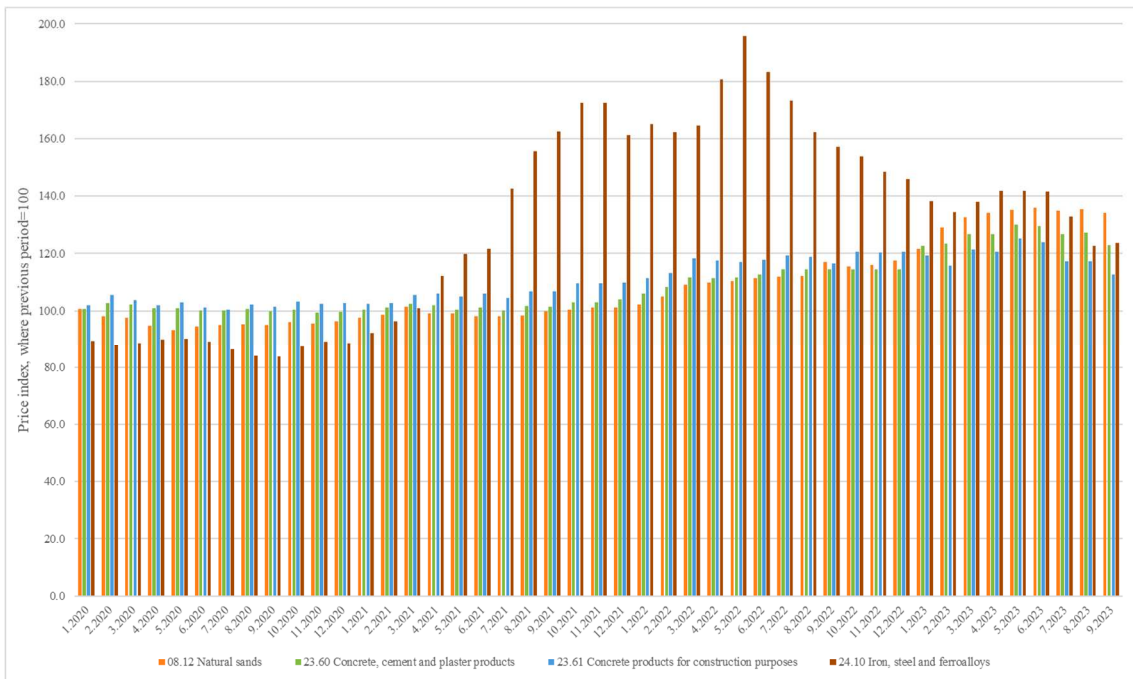


Fig. 3 Development of the prices of the most commonly used building materials.

Development of proposed measures provided by the responsible authorities

Proposals to compensate for the unpredictable development of prices in the construction sector began to appear in mid-2022 from the Ministry of Transport of the Slovak Republic, primarily for future public contracts and for contracts that are currently underway. Simultaneously with the MDSR, the Office for Public Procurement issued its analysis of the current situation along with a set of measures for dealing with it. The periods of validity of the applicable legislative methodology instructions and guidelines for dealing with the price development situation are shown in Fig. 4 below.

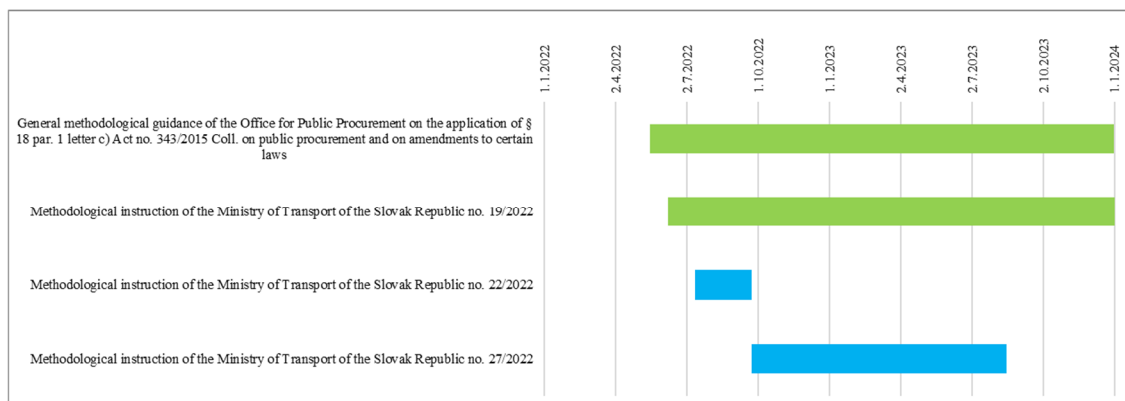


Fig. 4 Provided measures and their validity.

Measures provided by the responsible authorities in chronological order with their period of validity:

- General Methodological Guidelines (GMG) of the Office for Public Procurement on the application of § 18 par. 1 letter c) Act no. 343/2015 Coll. on public procurement and on the amendment of certain laws (valid from 16.5.2022 to the present).
- Methodological Instruction (MI) of the Ministry of Transport of the Slovak Republic no. 19/2022, which establishes the price adjustment mechanism as a result of cost changes in projects for the repair and maintenance, construction, modernization and reconstruction of engineering structures and buildings (for future contracts) (valid from 8 June 2022 to the present).
- Methodological Instruction of the Ministry of Transport of the Slovak Republic no. 22/2022, which establishes the price adjustment mechanism as a result of cost changes in repair and maintenance projects, in the construction, modernization and reconstruction of engineering structures and buildings – the amendment of the contract, framework agreement and concession contract during its duration (valid from 13.07.2022 to 23.9.2022) – replaced by Methodological Instruction no. 27/2022.
- Methodological Instruction no. 27/2022, which establishes the price adjustment mechanism as a result of cost changes in repair and maintenance projects, in the construction, modernization and reconstruction of engineering structures and buildings – amendment of the contract, framework agreement and concession contract during its duration (valid from 23.9.2022 to 16.08.2023).

Content of the methodological instructions provided

Methodological Instruction no. 19/2022, for new construction work

Methodological Instruction of the Ministry of Transport of the Slovak Republic no. 19/2022, which establishes the price adjustment mechanism due to cost changes in repair and maintenance projects, construction, modernization and reconstruction of engineering structures and buildings. This mechanism employs the following formula (1):

$$P_t = 0.10 + 0.20 * \left(\frac{HICP_t}{HICP_{t_0}} \right) + 0.08 * \left(\frac{D_t}{D_{t_0}} \right) + 0.62 * \left(\frac{CMI_t}{CMI_{t_0}} \right) \quad (1)$$

where P_t is the adjustment multiplier (coefficient of variation) to be applied to the estimated value of a contract made for period t , this period being a quarter. The value of the adjustment multiplier shall be rounded off mathematically to 3 decimal places. The variable t represents the completed quarter (end), which is the relevant period for which the tenderer applies the indexation. The next variable t_0 is a reference period, a quarter containing the calendar day on which the deadline for the submission of tenders for a construction contract expired. Number

0.10 is a fixed coefficient of 10% representing the cost of construction activities and construction not subject to indexation. Number 0.20 is a coefficient of 20%, representing the part of the costs of works and works carried out which are subject to indexation and, more precisely, representing the change in personnel and labor costs. $HICP_t$ is the value of the indicator Harmonized Indices of Consumer Prices (2015 average=100) – monthly in sp0017ms – Consumer prices in aggregate – recalculated per quarter, in period t . $HICP_{t_0}$ is the value of the indicator Harmonized Indices of Consumer Prices (average of year 2015=100) – monthly in sp0017ms – Consumer prices in aggregate – for the reference period (quarter) in period t_0 , i.e. the quarter in which the deadline for submission of tenders for the construction contract expired. Number 0.08 represents a coefficient of 8%, which represents the part of the costs of the structure and the construction work carried out that is subject to price adjustment and represents the change in the price of fuel (diesel). Dt is the value of the indicator Average fuel prices in the Slovak Republic (Diesel) – monthly sp0202ms, calculated per quarter, in period t . Dt_0 is the value of the indicator Average fuel prices in the Slovak Republic (Diesel fuel) – monthly sp0202ms, recalculated per quarter, in the period t_0 , i.e. the quarter in which the deadline for the submission of tenders for the construction contract expired. Number 0.62 represents a coefficient of 62%, which represents the part of the cost of the construction activities and construction works carried out that is subject to price adjustment and represents the change in the cost of the prices of materials and products consumed in the construction sector of the SR. CMI_t is the value of the indicator Construction and materials price indices (2015=100) – quarterly sp2063qs – Construction materials indices (producer prices) in period t . CMI_{t_0} is the value of the indicator Construction and materials price indices (2015=100) – quarterly sp2063qs – Construction materials indices (producer prices) in period t_0 .

The basic prerequisite for the application of the indexation mechanism is for the construction contractor to comply with the contractually established and agreed construction schedule, including construction deadlines. For the application of the indexation mechanism, the decisive period is the quarter, whereby:

- the reference period (referred to as period t_0) shall be the quarter in which the calendar day on which the deadline for submission of tenders for the construction projects expired;
- the reference period (referred to as period t) is the period (quarter) for which the construction contractor claims indexation.

Methodological Instruction no. 27/2022, for existing construction work

Methodological Instruction of the Ministry of Transport of the Slovak Republic no. 27/2022, which establishes the price adjustment mechanism as a result of cost changes in repair and maintenance projects, in the construction, modernization and reconstruction of engineering structures and buildings – amendment of the contract, framework agreement and concession contract during its duration. According to the following formula (2):

$$P_m = \left(\frac{\text{Material } m_t}{\text{Material } m_{t_0}} \right) - TR \text{ average } m_{t \text{ risk}} \quad (2)$$

$$\text{Increase } P_m = [(P_m * JC_m) - JC_m] * \text{Quantity}_m$$

Increase P = the sum of increased values for the individual materials

where P_m is the adjustment multiplier (coefficient of variation) to be used for the calculation of the unit price increase for the building material m between periods t_0 and t . The value of the adjustment multiplier shall be rounded mathematically to 3 decimal places. In a case where the calculated value is less than 1, the number 1 shall be used in the calculation. Variable m represents the specific building material selected in the adjacent according to Article 2, paragraph 5 of MI no. 27/2022. $Material m$ is the index value for the quarter and the selected building material m . The value is calculated as the arithmetic mean of 3 monthly values according to Article 2, paragraph 7 of MI no. 27/2022. The indices entering into the calculation shall be of the nature of indices December 2005=100. Variable t denotes the quarter of implementation, the critical quarter, the quarter in which the construction was carried out and for which the contractor claims compensation via the price adjustment. The variable t_0 represents the bidding quarter, the reference quarter, the quarter in which the calendar day falls on which the deadline for the submission of tenders has expired for a construction contract. The variable t_{risk} represents a period of 5 previous years to calculate what is known as the ‘expected risk’; the period to the calculation of the expected risk based on the evolution of the price of a specific selected building material (m) is a period of 5 years preceding the reference quarter t_0 . The variable $TR \text{ average } m_{t \text{ risk}}$ is an arithmetic average of the year-on-year growth rate of the quarterly indices of a selected building material m over time t_{risk} . In the case where the calculated value is less than 0, the value 0 shall be used. $\text{Increase } P_m$ is the calculated amount of the increase for the selected building material m on the basis of objective reasons for the change in the original unit price of the building material m . JC_m is the unit price, the value in EUR per unit of measurement of a specific building material m at time t_0 based on the method of determination pursuant to Article 2 paragraph 6 of MI no.27/2022. Quantity_m is a realized quantity of the specific

construction material m at time t . Increase P represents the sum of the increases in the individual calculated selected construction materials m .

The methodical instruction and the price adjustment mechanism are required by public contracting authorities and contracting authorities (hereinafter referred to as the procurer) [12] to calculate the value of the contract addendum (increase and claims) due to unforeseeable changes in the cost of construction materials (hereinafter referred to as the price adjustment mechanism) for all procured constructions projects in accordance with Article 1, par. 1.

For the application of the price adjustment mechanism, the decisive period is the quarter, while:

- the reference quarter (marked as the t_0 quarter) is the quarter that includes the calendar day on which the deadline for submitting bids for the competition has expired for construction project;
- the decisive quarter (marked as quarter t) is the quarter in which construction was carried out and for which the construction contractor applies the price adjustment mechanism;
- the period for calculating the expected risk (marked as t_{risk}) based on the development of the price of a particular selected building material (m) – the period is the 5 years prior to the reference quarter t_0 .

Values in EUR expressed per unit of measurement (unit prices) of selected construction materials (marked as m) – we recommend setting the reference period in the following ways:

- It is possible to establish (determine, assess) unit prices of selected building materials (marked as m) for the reference period on the basis of an expert opinion. The expert opinion will contain unit prices for individual materials (m) per quarter t_0 and thereby establishes the base against which the increases between quarters will be calculated for t_0 and t . The expert opinion is prepared by the public contracting authority, contracting authority or contractor.
- In the case that relevant data is available, it is possible to calculate or determine unit prices for selected building materials (m) from project documentation, from a tender submitted in public procurement (analysis of the item or a calculation formula) or from documents (for example, a measurement statement, documentation for the construction project, including its changes and modifications) specified in the contract.
- In the case that relevant data is available, it is permissible to determine the unit prices of selected building materials (m) within the set CPA codes from the submitted invoices for individual materials defined by the essential delivery and quality conditions of validity of the price. It is essential to incorporate these materials on the construction site according to the valid DRS. Only the specific invoice of the material supplier to the contractor which is closest in time to the end of the tender submission period for the construction of the structure in question, and which contains the unit price, will be used for the material. The specified unit price is re-indexed (converted) back to the period t_0 using indexes. The unit price of the given material (m) in time t_0 is calculated as a proportion of the index value of the given material (m) in the quarter corresponding to the day of the invoice and the value of the index of the given material (m) in time t_0 , and the result of this calculation is subsequently used to divide the unit price of the given material (m) stated in the invoice.

3 METHODOLOGY

The analysis of the development of prices in the construction sector was carried out on the basis of the information and knowledge obtained to date and available in the given area. The primary source of data that enters into the analysis was obtained from the web server datacube.statistics.sk, which falls under the Statistical Office of the Slovak Republic. From the obtained documents and data, tables and then graphs were subsequently created with the help of an Excel spreadsheet in which the exact course of the development of prices in the construction industry in the Slovak Republic is shown. The increase in the indices of individual building projects according to the Classification of Buildings, as well as in the price of individual materials frequently used in the implementation of construction works, is shown. Individual analyses and graphic trends provide an overall picture of the development of the current unpredictable situation in the construction sector.

4 RESULTS

The effectiveness and efficiency of individual Methodological Instructions and measures from the responsible authorities are processed in Tab. 1, where we can observe how different methodologies and measures

heterogeneously compensate for the development of construction work prices. The several construction projects included in the table were selected from the database of the Office for Public Procurement [13] in order to show the various compensations not only within the Methodological Instructions but also within the different construction projects Fig. 5. On the basis of indicative calculations carried out by the author, the compensation methodology based on Methodological Instruction no. 19/2022 provides from double to two and a half times the compensation value in contrast with Methodological Instruction no. 27/2022. In contrast to the indices of price development in the construction industry, it is even three and a half times higher in many cases. Therefore, it is necessary to understand what the Methodical Instruction compensates for and in what way. Based on this, the differences are very clear, in some cases even vast.

Tab. 1 Adjustment of the price of a public order based on compensatory measures.

Building object	Estimated v.	Contract price	GMG	MI no.19/2022	MI no.27/2022
Wastewater engineering construction – sewerage for Považská Teplá	969,699.78 €	473,800.00 €	557,804.74 €	549,513.24 €	512,272.56 €
Building construction – Cerová apartment building	1,800,000.00 €	1,908,235.06 €	2,254,007.25 €	2,208,591.26 €	2,027,118.10 €
Road construction – Vřestrevnicová Road	2,006,373.56 €	1,157,800.05 €	1,361,225.52 €	1,330,543.82 €	1,249,150.47 €

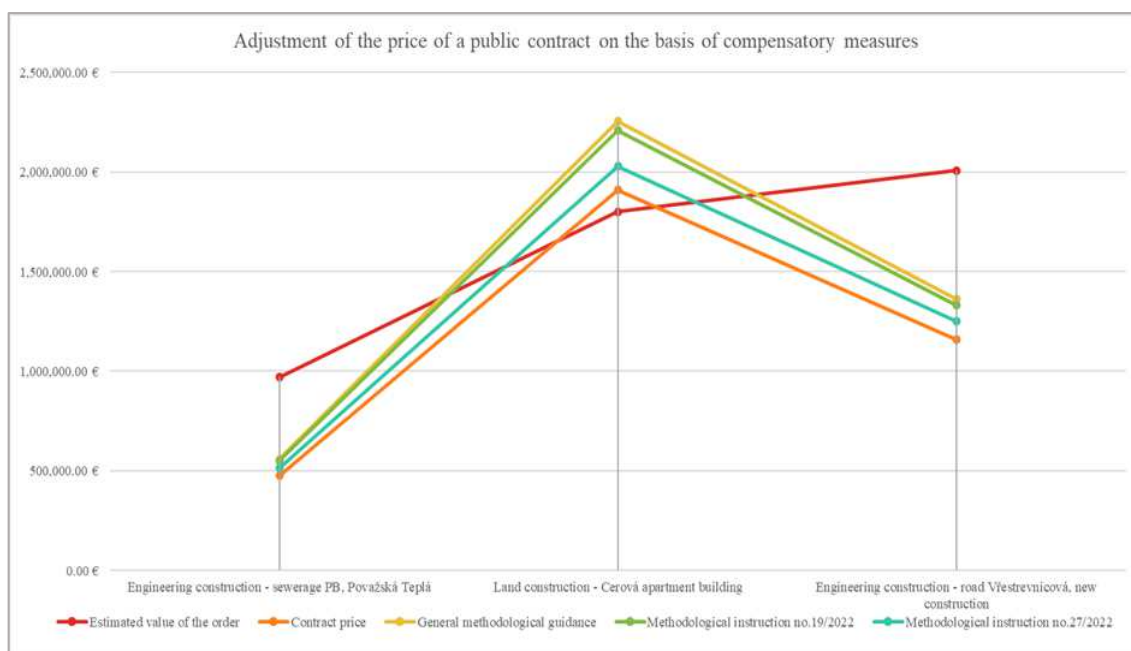


Fig. 5 Adjustment of the price of a public order based on compensatory measures.

5 DISCUSSION

From the data in the previous chapters, it is possible to clearly observe how large and sudden the price increases have been in the construction industry, especially in the period from 2021. It can also be seen that Methodical Instruction No. 19/2022 [5] compensates for this sharp jump a little more than Methodical Instruction No. 27/2022 [4]. From the overall analysis, it can be seen that the increase in prices in the construction industry was unexpected and sudden, and that the introduced measures tried to compensate for this phenomenon as well as possible, but they could not eliminate it completely. Charts 2 and 3 describe in great detail the development of the price of labor and building materials, and these data can be used for further development analyses. This article and

the data obtained for its development confirm the increase in the price of labor and building materials on the territory of the Slovak Republic.

6 CONCLUSION

The article aimed to analyze the unexpected development of the prices of construction projects and materials in the period from 2021 to the present. As a result, the analysis mainly mapped the development over the last 3 years and was based on statistical data made available by the Statistical Office of the Slovak Republic. For the clearest possible evaluation of the development, tables and graphs have been created. Based on the research and the achieved results, it is possible to assess that the increase in prices in the construction industry was large and rapid. This significant jump in prices was most evident in the prices of building materials, which in some periods reached up to 2 times their original prices. The increase in the price of construction work is also high and the increase compared to the original prices in the period before 2021 is clear. These price increases were clearly unpredictable. There is no methodological instruction currently in force that could completely eliminate the sharp increase in prices in the construction sector for ongoing construction projects. Construction projects started within the period of validity of a specific Methodological Instruction shall be completed in accordance with its stipulations after written confirmation and delivery of complete necessary documentation from the investor (Procurer, public contracting authority). However, all new construction projects are still governed by the valid Methodological Instruction No. 19/2022, which precisely determines the method of financial compensation for increases in the construction sector. Based on the results achieved and the data obtained, it is possible to expect that the price of construction work and construction materials will continue to rise, as the construction industry is still struggling with a lack of labor and other factors that negatively affect the prices of construction projects. This development of the construction sector indicates that there may be a need for further analyses and predictions of the development of the prices of construction projects and materials in this sector.

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