



**National Statistics Office of Georgia  
(Geostat)**

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The National Statistics Office of Georgia  
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# **Price Index for Material Inputs to Construction Industries**

## **Technical Manual**

The presented technical manual is prepared by the National Statistics Office of Georgia according to the international methods and practices and is based on the following handbook:

**1. *“Producer Price Index Manual: Theory and Practice”*, International Monetary Fund, 2004;**

Responsible organizations: the International Labor Organization (ILO), International Monetary Fund (IMF), Organization for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE) and World Bank;

<https://www.imf.org/en/Publications/Manuals-Guides/Issues/2016/12/30/Producer-Price-Index-Manual-Theory-and-Practice-16966>

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## **1. Introduction**

### **1.1 Price index for material inputs to construction industries and its use**

The price index for material inputs to construction industries measures average price level of the materials purchased by construction companies compared to the reference period.

The index includes buildings and building construction works, constructions and construction works for civil engineering, as well as specialized construction works, which corresponds to divisions 41, 42, 43 of the constructions and construction works section (Section F) of the Statistical Classification of Products by Activity (CPA 2008).

The price index for material inputs to construction industries is used for the following purposes:

- The Index has an important role in deflating different economic indicators;
- The index is used for indexation of contracts in both public and private sectors;
- The index is an analytical instrument for researchers and representatives of business sector.

### **1.2 Coverage of the index and the observable prices**

The prices are collected on building materials bought by construction companies operating in the country.

The observable price of material is the value of building material bought by the construction companies for the preparation of the construction site and building of the structure in the specified period.

## **2. The selection of organizations and materials for observation**

The observable construction organizations are selected based on the statistical data of enterprises. All the large organizations that are relevant to divisions 41, 42, 43 of the constructions and construction works section (Section F) of the Statistical Classification of Products by Activity (CPA 2008) are selected, while small and medium size organizations are selected selectively.

After the selection of organizations, they are surveyed in order to determine the characteristics of materials. For this purpose, organizations that are selected at the previous stage are provided by additional electronic questionnaires. They are required to indicate the top four (less than four in case of absence) material inputs to construction purchased during the previous year as well as their shares in the total value of all purchased materials. Furthermore, the total amount spent on materials is also indicated.

During the selection process of materials detailed specifications are determined for them. To follow the specifications is the most important part of price registration, since the monthly recorded difference between prices should be caused by the pure price change of material, rather than by changes in their characteristics. Relying on the obtained survey data the prices for sampled materials are recorded monthly across the year.

For the purpose of price registration for material inputs to construction industries, the sample of organizations is updated annually. The basis for the selection is the data of enterprise statistics. In case the company stops functioning in the reporting period, the substitution does not occur until updating the sample.

### **3. Price collection fieldworks**

During the price collection fieldworks the representative of the organization fills the questionnaire published on Geostat's website. The price collection fieldworks are conducted from the 1<sup>st</sup> to the 8<sup>th</sup> of the month following the reporting period. The questionnaire contains information on characteristics of the selected material, measurement unit, prices in the reporting and previous months and, in case of a price change, a comment for the reason of this change. The base price for material is registered in the beginning of the reporting year and remains unchanged during the whole year.

The information about the price for material inputs is confidential and is protected by the "General Administrative Code of Georgia" and article 28 of the "Law of Georgia on Official Statistics".

Unless otherwise provided for by the legislation of Georgia, legal entities registered in the Register of entrepreneurial and non-commercial legal entities are obliged to provide Geostat, upon Geostat's written request, including such request in electronic form, with the available information (including confidential information) in paper or electronic form.

### **4. Validation Procedures**

The validation procedures for the price index for material inputs to construction industries are conducted in two stages:

**At the first stage** validation takes place simultaneously with the price registration fieldworks. In case of price change, the person responsible for filling the questionnaire is required to explain by a comment the reason of the change. After the data are sent to the central office, a responsible employee conducts analysis and logical control of the data.

At the second stage accuracy of the prices, which are extremely deviated from the previous month, is checked after calculating the overall index.

If the above mentioned stages are passed the index is considered to be reliable.

## 5. Weights

Individual material weights, which are included in the price index for material inputs to construction industries, represent the share of purchased material in the total value of the purchased materials. For the weights of period  $t$  the data from  $t-2$  period is used. Weights are updated annually and are based on expenditures for material inputs purchased by selected companies in  $t-2$  period. During the annual weight update the list of materials in the index might also change.

## 6. Imputation techniques

If in the reporting month no price is recorded for one of the building materials, the price index for material inputs to construction industries is calculated using one of the following imputation methods:

1. For example, if no price is recorded in April for one of the material inputs (material A), the imputed index for it is calculated using long term index for material A in previous month and short term index in April for the group, which includes this material. The group index is calculated using the actual price indices of materials in this group (Table 1).

*Table 1.*

Material	Product weight, %	Base price	Price in March	Price in April	Price Ratio (March/December)	Price Ratio (April/December)
Material A	0.051	4.55	4.50	-	4.50/4.55≈0.99	1.15*
Material B	0.032	5.20	5.20	5.50	5.20/5.20=1.00	5.50/5.20≈1.06
Material C	0.067	5.00	4.50	5.50	4.50/5.00=0.90	5.50/5.00=1.10

*\*Imputed index*

In April the imputed index for material A is calculated in the following steps:

$$1. \text{ Group long term index} = 1.06 \times \frac{0.032}{0.032+0.067} + 1.10 \times \frac{0.067}{0.032+0.067} \approx 0.34 + 0.74 = 1.08;$$

2. *Long term index for the corresponding group in March* =  $1.00 \times \frac{0.032}{0.032+0.067} + 0.90 \times \frac{0.067}{0.032+0.067} \approx 0.32 + 0.61 = 0.93$ ;
3. *Group short term index in April* =  $\frac{1.08}{0.93} \approx 1.16$ ;
4. *Imputed long term index for material A* =  $1.16 \times 0.99 \approx 1.15$ .

2. If in the reporting month no price is recorded for materials included in CPA group (3 digit level), imputation will be conducted using the carry-forward method for the materials presented in this group, according to the structure of the Classification of Products by Activity (CPA 2008).

## 7. Quality adjustment

If in the reporting month a company stopped purchasing the observed material, but purchases another similar material, it is possible to replace the old material with the new one.

If the characteristics of the observed material has changed, but the criteria for comparison are not violated, it is allowed to compare the old and new materials. In this case it is important that the price change caused by quality change is not reflected in the index.

In order to ensure the comparability of prices for the old and new materials, a quality adjustment method should be used, for which a conditional base price is calculated using the following methods:

1. If in the reporting month a replacement material is qualitatively different from the material in the previous month, and value of the difference is evaluated, the base price for the replacement material is calculated using previous month's price and the qualitative difference defined by the person, responsible for filling the questionnaire (Table 2):

Table 2.

Material	Base price	Price in March	Price in April	Qualitative difference	Price ratio (April/December)
Material A	4.55	4.50	-		
Qualitatively different Material B	5.86*	-	8.50	1.30	8.50/5.86≈1.45

*\*Imputed base price*

The imputed base price for material B is calculated as follows:

$$\text{Base Price} = \frac{4.50 + 1.30}{4.50/4.55} \approx 5.86$$

2. If in the reporting month it is possible to define previous month's price for the replacement material, the base price for it is calculated using this price and the index of previous month (Table 3).

Table 3.

Material	Base price	Price in March	Price in April	Price ratio (March/December)	Price ratio (April/December)
Material A	4.55	4.50	-	4.50/4.55≈0.99	
Replacement material B	5.26*	5.20	5.50		5.50/5.26≈1.05

*\*Imputed base price*

Imputed base price for material B is calculated as follows:

$$\text{Base price} = \frac{5.20}{4.50/4.55} \approx 5.26$$

3. If in the reporting period price enumerator discovers that material A will no longer be purchased starting from the reporting month, and it is impossible to get information on previous month's price and value of qualitative difference for the replacement material B, the difference between current month's price of material B and previous month's price for material A will be totally treated as qualitative difference.



The imputed base price of the replacement material is calculated based on current month's imputed long term index and price of material B (see table 4).

Table 4.

Product	Material's weight, %	Base price	Price in March	Price in April	Long term index in March	Long term index in April
Material A	0.051	4.55	4.50	-	4.50/4.55≈0.99	
Replacement material B	0.051	6.09**	-	7.00		7.00/6.07≈1.15*
Material C	0.032	5.20	5.20	5.50	5.20/5.20=1.00	5.50/5.20≈1.06
Material D	0.067	5.00	4.50	5.50	4.50/5.00=0.90	5.50/5.00=1.10

\*Imputed long term index

\*\*Imputed base price

Imputed base price for material B is calculated as follows:

1.  $Group\ long\ term\ index\ in\ April = 1.06 \times \frac{0.032}{0.032+0.067} + 1.10 \times \frac{0.067}{0.032+0.067} \approx 0.34 + 0.74 = 1.08;$
2.  $Group\ long\ term\ index\ in\ March = 1.00 \times \frac{0.032}{0.032+0.067} + 0.90 \times \frac{0.067}{0.032+0.067} \approx 0.32 + 0.61 = 0.93;$
3.  $Group\ short\ term\ index\ in\ April = \frac{1.08}{0.93} \approx 1.16;$
4.  $Imputed\ long\ term\ index\ in\ April\ for\ material\ A = 1.16 \times 0.99 \approx 1.15;$
5.  $Imputed\ base\ price\ for\ material\ B = 7.00 \div 1.15 \approx 6.09$

## 8. Calculation of the price index for material inputs to construction industries on different levels

### 8.1 Calculation of the lowest level index

An index calculated for a particular building material purchased by a construction organization represents the lowest level index for material inputs to construction industries. Graph #1 shows the structure of construction section, where the price indices for materials A, B and C are the elementary indices. The lowest level index compared to the price reference period is obtained from the ratio of reporting (t) and reference period prices:

$$I_i^{t/0} = \frac{P_i^t}{P_i^0}$$

where:

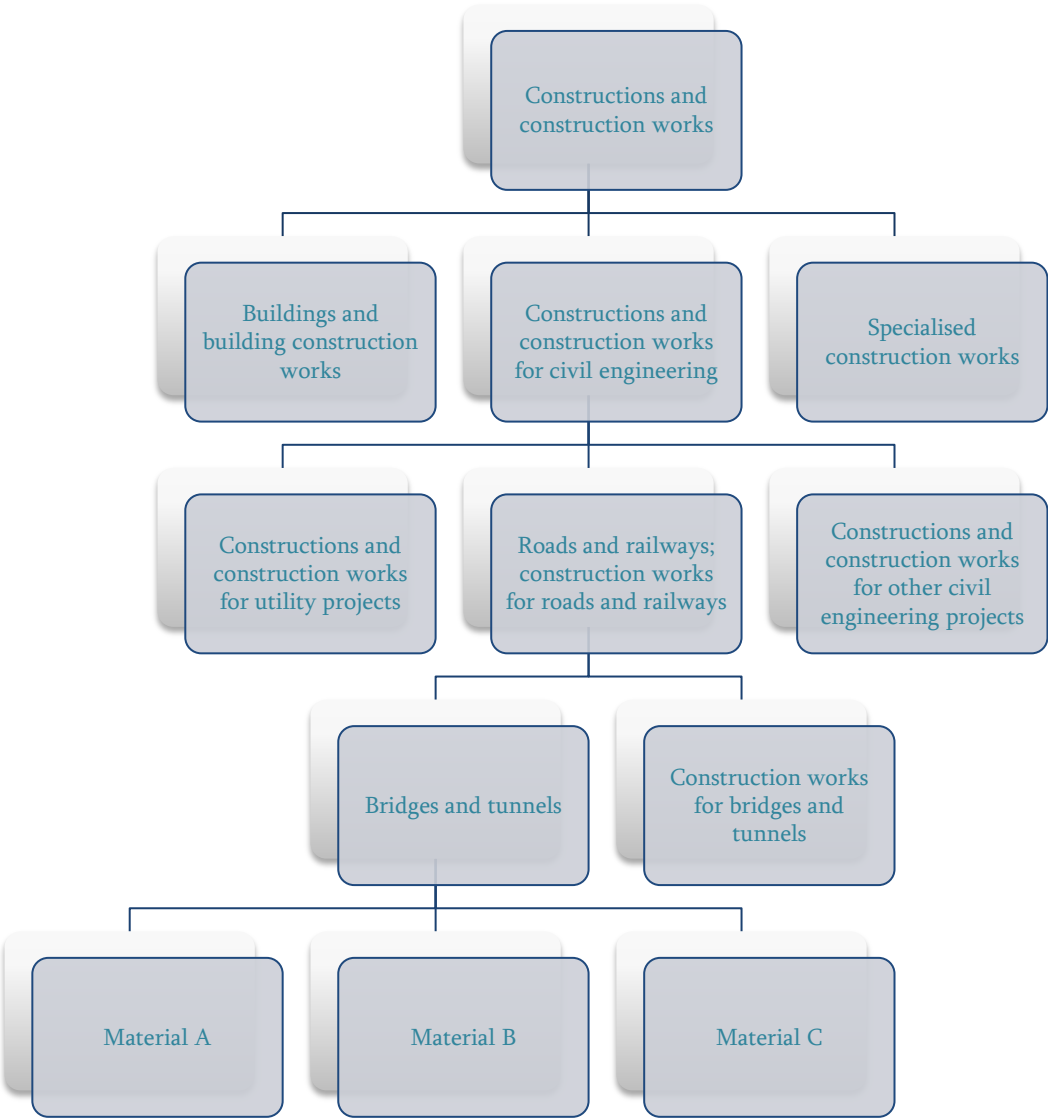
$i$  - material purchased by organization for which a comparable price is registered;

$I_i^{t/0}$  is the lowest level index for material  $i$  in the reporting period  $t$ , compared to the index reference period;

$p_i^t$  - price of material  $i$  in period  $t$ ;

$p_i^0$  - price of material  $i$  in the price reference period.

Graph #1. The structure of the price index for material inputs to construction industries



## 8.2 The index for separate groups and the whole section

The long term index for the whole section compared to the price reference period is calculated using the following Laspeyres-type formula:

$$I^{t/0} = \sum_{i=1}^n (I_i^{t/0}) \times s_i^b, \text{ where:}$$

$I_i^{t/0}$  is the lowest level long term index for material  $i$  compared to the price reference period;

$s_i^b = \frac{p_i^b q_i^b}{\sum p_i^b q_i^b}$  is the weight of material  $i$  in the weight reference period, which represents the share of material  $i$  in the whole volume of materials, where  $\sum_{i=1}^n s_i^b = 1$ .

$p_i^b$  - the price of material  $i$  purchased by the sampled organization in the weight reference period ( $b$ );

$q_i^b$  - quantity of material  $i$  in the weight reference period ( $b$ ).

The same formula is used for calculation of all upper level indices. For example, the sub-section index is calculated by weighting the long term indices of the materials, where the sum of the weights of the indices is 1.

Short term index compared to the previous month is obtained from the ratio of long term indices in the reporting and previous months, calculated compared to the price reference period.

## 8.3 Chain index

During annual update of construction organizations and materials in the update period, December, prices are collected for materials both in the old and new samples. This enables chain-linking of indices, calculated for two different samples. Chaining enables to calculate indices with a long term reference period, notwithstanding the changes in weights.

For example, before December 2016, compared to December 2015, the overall (whole industry) index was calculated using  $w_i$  weights, whereas the 2017 index is calculated comparing to December 2016, using  $k_i$  weights (see table 5).

$X_1$  is the chain index for January 2017, which is calculated with the reference period of December 2015. Calculation of this index can be represented as follows:

Table 5.

12.2015=100	12.2016=100
12.2016: $I^{12.16/12.15} = \sum_i I_i^{12.16/12.15} \times w_i = 106$	12.2016: $I^{12.16/12.16} = \sum_i I_i^{12.16/12.16} \times k_i = 100$
$X_1$	01.2017: $I^{01.17/12.16} = \sum_i I_i^{01.17/12.16} \times k_i = 102$

$$\frac{106}{X_1} = \frac{100}{102}, \text{ resulting } X_1 = \frac{106 \times 102}{100} \approx 108$$

The following result is derived from the chain-linking as well:

$$I^{12.2016/12.2015} \times I^{01.2017/12.2016} = 106 \times \frac{102}{100} \approx 108$$

## 9. Publication

Every Month the following time series for the price index for material inputs to construction industries are published on Geostat's website:

1. The index to the previous month;
2. The index to the long term base period (Average of 2010=100);
3. The index to the same month of the previous year;
4. The index 12 month average over the previous 12 month average.

The published indices are rounded to four digits and are final data. The time series data are published on the web-site along with the corresponding graphs.

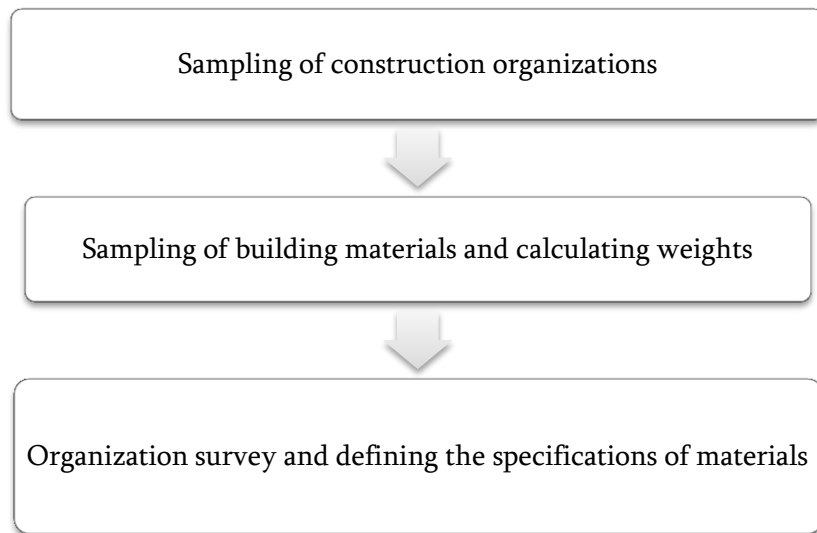
The data are also available by using PC-Axis - data dissemination software. It is a complex system of data dissemination that gives an opportunity to a user to obtain different types of information in different format (text, tables, graphs, etc.) from Geostat's website ([www.geostat.ge](http://www.geostat.ge)).

The information about the price index for material inputs to construction industries is also disseminated through an android application.

Graph #2 represents the stages of the index calculation and its periodicity.

## Graph #2. Index calculation stages

### Annual activities:



### Monthly activities:

