

# Cost estimation using ministerial regulation of public work no. 11/2013 in construction projects

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**Abstract.** One of the first tasks in starting a construction project is to estimate the total cost of building a project. In Indonesia there are several standards that are used to calculate the cost estimation of a project. One of the standards used is based on the Ministerial Regulation of Public Work No. 11/2013. However in a construction project, contractor often has their own cost estimation based on their own calculation. This research aimed to compare the construction project total cost using calculation based on the Ministerial Regulation of Public Work No. 11/2013 against the contractor's calculation. Two projects were used as case study to compare the results. The projects were a 4 storey building located in Pantai Indah Kapuk area (West Jakarta) and a warehouse located in Sentul (West Java) which was built by 2 different contractors. The cost estimation from both contractors' calculation were compared to the one based on the Ministerial Regulation of Public Work No. 11/2013. It is found that there were differences between the two calculation around 1.80 % - 3.03% in total cost, in which the cost estimation based on Ministerial Regulation was higher than the contractors' calculations.

**Keywords:** cost estimation, construction project, ministerial regulation, building contractor

## 1. Introduction

Cost estimating holds an important role in establishing a construction project. Cost estimation is an activity of estimating all of the cost needed for each work in a construction project so that the total cost of a project is identified. It is necessary to check the cost estimated by the project management against experiential data and against the subjective knowledge of management professional. The first key question to ask when estimating a project cost is the estimation of total cost of the project reasonable? Poor overall estimations will often result in inadvertent omissions of key elements in the Web Breakdown Structure (WBS) and Resource Breakdown Structure (RBS) [1].

In Indonesia there are several types of standard in calculating estimation cost of a construction project. There is the SNI (Standar Nasional Indonesia) standard, the BOW (Burgerlijke Openbare Werken) standard and the Ministerial Regulation of Public Work No. 11/2013 standard. However in this paper only the Ministerial Regulation of Public Work No. 11/2013 standard will be used. When



estimating a construction project cost, each contractor usually has their own calculation based on their own judgment. In this paper a comparison between the contractor's project cost estimate and the project cost estimate based on the Ministerial Regulation of Public Work No. 11/2013 standard will be investigated. This paper is based on two case studies project, a 4 storey building located in Pantai Indah Kapuk and a warehouse located in Sentul.

## 2. Literature Study

### 2.1. Unit Price Analysis

Cost estimation of a construction project is based on analysis of each of the material's, labors' wage and equipment's unit price. The cost estimation based on the unit price analysis is used as an owner's estimate (OE) and engineering's estimate (EE). The total amount of owner's estimate is the total calculation of the volume of work multiplied by the unit price and subjected to the tax and profit applied [2].

Unit price contract is a work contract where the total cost of a project stated in the contract based on the work unit price. Work unit price is definite and binding for each and every sub-work. The total cost of a project is derived by multiplying each work unit price by the volume of sub-works stated in the bill of quantity. The work unit price consists of direct cost and indirect cost. The components of direct cost are the labor's wage, material and equipment. For the indirect cost, the components are the overhead and profits.

Steps in analyzing work unit price are as followed:

- Define the unit used to calculate the requirement of material, labor and equipment needed to produce a specific work.
- Define the quantity or coefficient of material, labor, and equipment to deliver a specific work.
- Define the basic unit price of building material, basic unit price of labor, basic unit price of equipment based on the location of the project.
- Multiply each of the coefficients by the basic unit price to generate the work unit price of a specific work.

These are the components that will be re-calculated by using the Ministerial Regulation of Public Work No. 11/2013 Standards. The contractors of each project chosen as case studies have already made their own calculation based on their own judgment. The two cost estimate for each project chosen will then be compared.

### 2.2. Comparison of Cost Estimate of Construction Projects

A calculation of project cost estimate in a hospital in Tangerang City using the BOW standard and the SNI standard, and compared them with the contractor's calculation, showed that the contractor's calculation is more efficient [3].

There is also a difference in coefficient in each standards used. Based on the coefficient of unit price of labor's wage on the framework job, the contractor's calculation is smaller than that of the BOW and SNI standards. However in the coefficient of reinforcement concrete job, the contractor's coefficient is smaller than the BOW standard but larger than the SNI standard [4].

In Batang Anai Irrigation II project, the unit price of reinforced concrete is compared using the BOW standard, SNI standard and the contractor's calculation. Based on the calculation, the major differences on the project cost estimation were on the unit price of the labor's wage [5].

The total project cost of the Joang/Legiun Veteran building in Samarinda, East Kalimantan was calculated using 2 different standards, the SNI standard and the BOW standard. The result of the cost estimation calculation shows that the SNI calculation is smaller than the BOW calculation. This is because the coefficient in the SNI standard is smaller than that of the BOW standard [6].

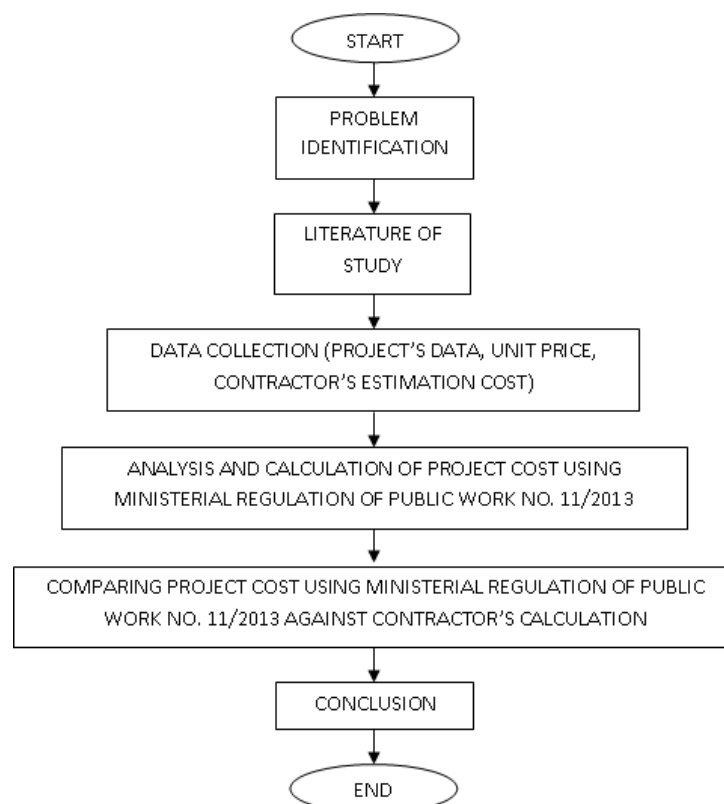
The total unit price of the reinforced concrete work in the UM Rector Building was analyzed by using the SNI standard and Microsoft Project. The result shows that the difference of the result is

caused by the different calculation of material, labor and equipment. Hence there was an 80.59% difference in the total unit price of the reinforced concrete work using the two calculations [7].

According to the previous research, the comparison of the estimation cost of a project or work only comprised of the SNI standard and the BOW standard. These two standards are quite old, the BOW standard was published in 1921 and the latest SNI standard was published in 2008.

The Ministerial Regulation of Public Work No. 11/2013 standard is chosen for this research as a comparing calculation because this is the latest standard on cost estimation published by the Indonesian Government. Some improvements have also been done from the BOW standard and the SNI standard.

### 3. Methodology of Study



**Figure 1.** Flowchart of the Research

The data collection to estimate the project cost are the project layout, the volume of work, and labor's wage, material's and equipment's unit price. Those data will be used to estimate the project cost using the coefficient in the Ministerial Regulation of Public Work No. 11/2013 standard and will be compared with the contractor's own project cost estimation.

### 4. Result and Discussion

#### 4.1 Unit Price Analysis using the Ministerial Regulation of Public Work No. 11/2013 Standards

The Ministerial Regulation of Public Work No. 11/2013 standard has their own coefficient in calculating the unit price of each work for a building. In Table 1, can be seen an example of unit price analysis of one of the work in a building project.

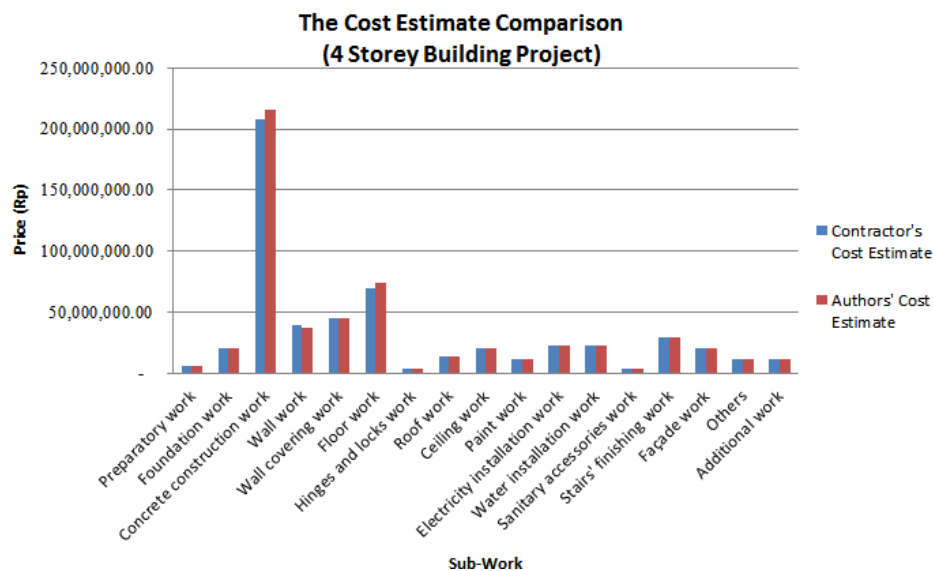
**Table 1.** Unit Price Analysis of 1 m<sup>2</sup> of 20cm x 20cm Floor Tiles

No	Components	Unit	Coefficient	Unit Price (Rp)	Total Price (Rp)
A	LABOR				
	Worker	man/day	0.250	106,000	26,500
	Stone worker	man/day	0.125	133,000	16,625
	Head worker	man/day	0.013	160,000	2,080
	Foremen	man/day	0.013	187,000	2,431
	<b>Total Price of Labor</b>				<b>47,636</b>
B	MATERIAL				
	Floor tiles	pcs	11.87	3,985	47,301.95
	Cement	kg	10.00	1,418	14,180
	Portland				
	Sand	m <sup>3</sup>	0.045	157,300	7,078.5
	<b>Total Price of Material</b>				<b>68,560.45</b>
C	TOTAL (A+B)				116,196.45
D	Overhead & Profit (15%)				17,429.47
	Work unit price (C+D)				133,625.92

#### 4.2 4 storey building in Pantai Indah Kapuk

The first project was based on the estimating cost of a 4 storey building project in Pantai Indah Kapuk, North Jakarta. The building has a surface area of  $\pm 67.5$  m<sup>2</sup> and a building area of  $\pm 270$  m<sup>2</sup>. The total project cost based on the contractor's calculation is Rp 672,686,300.00.

Using the Ministerial Regulation of Public Work No. 11/2013 standard, the total cost of the project is Rp 684,778,600.00. Based on the total project cost from both calculations, there is a difference of 1.80 %. When the works are divided into smaller sub-works, it can be seen which sub-works contribute the most in the difference between the two calculations. In Figure 2, it can be seen that the sub-work that contributes on the difference of the project cost estimation are the concrete construction work, wall work and the floor work.

**Figure 2.** Comparison Diagram of Cost Estimation in the 4 Storey Building Project

When investigated even further to the both of the contractor's and authors' calculation, there is a difference in the coefficient used by the contractor. The coefficient difference used by the contractor compared to the Ministerial Regulation of Public Work No. 11/2013 standard can be seen in Table 2.

**Table 2.** Coefficient Differences in Cost Estimation in the 4 Storey Building Project

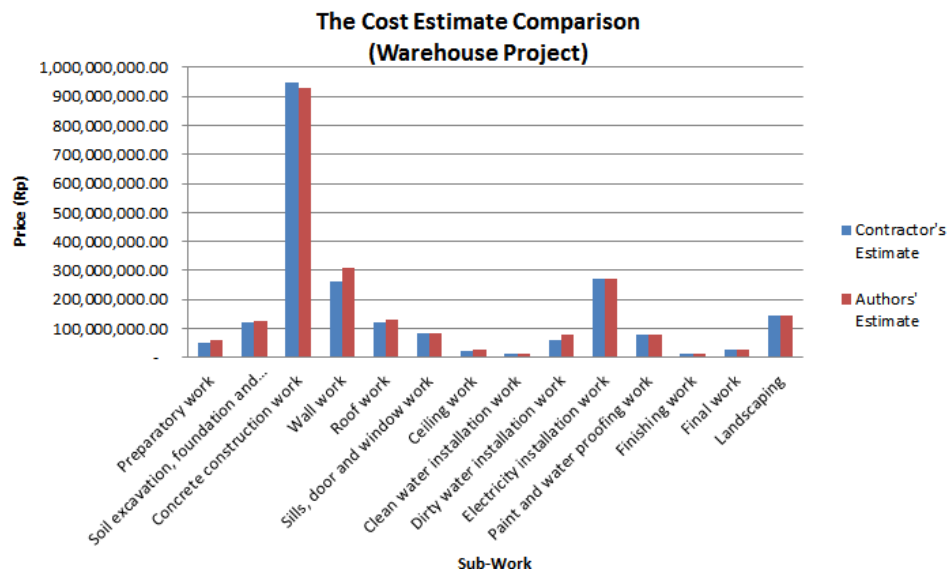
No.	Work Item	Sub-Item	Contractor's Coefficient	Ministerial Regulation of Public Work No. 11/2013's Coefficient
1	Concrete ready mix K-225	Ready mix	1.05	1.02
2	1 kg of steel	Steel bar	1	1.05
3	installation	Wire belt	0.04	0.015
4	1 kg of wire mesh	Wire mesh	1,1	1.02
5	installation	Wire belt	0.02	0.005
6	Column framework	Multiplex 12 mm	0.12	0.21
7		Wood 5/7 cm	0.014	0.0794
8		Nail 5 cm & 7 cm	0.2	0.25
9		Framework oil	0.03	0.2
10	Floor installation	Cement	1.03	4.94
11		Sand	0.61	0.621
12		Gravel	1.15	0.74
13	Brick installation	Light brick	0.11	0.1

In the 4 storey building project, the differences of the coefficient are mainly in the material's coefficient. However in term of total cost of the project, the difference was only 1.80%.

#### 4.3 Warehouse in Sentul

The second project was based on the estimating cost of a warehouse project in Sentul, Bogor City. It has a surface area of  $\pm 900 \text{ m}^2$  and a building area of  $\pm 2,700 \text{ m}^2$ . The total project cost based on the contractor's calculation is Rp 2,396,145,000.00.

Based on the cost estimation using the Ministerial Regulation of Public Work No. 11/2013, the total cost of the project is Rp 2,468,867,000.00. The difference between the two total cost calculations is 3.03%. There are a difference between the sub-work that contributed to the differences between the contractor's cost estimation against the authors' cost estimation in the 4 storey building project and the warehouse project. In Figure 3, it can be seen that the sub-work that contributes on the difference of the project cost estimation in the warehouse project are the preparatory work, soil excavation, foundation and soil filling work, concrete construction work, wall work, roof work, ceiling work, and clean and dirty water installation work.



**Figure 3.** Comparison Diagram of Cost Estimation in the Warehouse Project

For the warehouse project there are several sub-works as stated earlier that contributed the most on the difference of the total cost estimation between the two calculations. However, only the preparatory work estimation cost and dirty water installation work estimation cost that contributed more than 19.0% of the difference between the calculations. The rest of the sub-works only contributed less than 17.0%. The coefficient differences in the preparatory work and dirty water installation work can be seen in Table 3.

**Table 3.** Coefficient Differences in Cost Estimation in the Warehouse Project

No.	Work Item	Sub-Item	Contractor's Coefficient	Ministerial Regulation of Public Work No. 11/2013's Coefficient
1	Measuring and installing bouwplank	Worker	0,04	0,1
2		Wood worker	0,034	0,1
3		Head worker	0,003	0,01
4		Foreman	0,01	0,005
5		Wood 5/7	0,004	0,012
6		Nail 2"-3"	0,05	0,02
7		Wood 3/20	0,004	0,007
8	Floor drain	Worker	0.1	0.01
9		Stone worker	0.05	0.1
10		Head worker	-	0.01
11		Foreman	-	0.16
12	Sitting toilet	Worker	0.4	2.16
13		Stone worker	0.1	0.72
14		Head worker	0.04	0.072
15		Foreman	0.015	0.011
16	Controlling tub	Worker	0.4	2.16
17		Stone worker	0.1	0.72
18		Head worker	0.04	0.072
19		Foreman	0.015	0.011
20		Red brick	56	40
21		Sand	0.1	0.07

Having a different result from the 4 storey building project, the warehouse project's differences of the coefficient are mainly caused by the labor's wage coefficient.

## 5. Summary and Conclusion

The result of this research shows that there is a difference in the calculation of total project cost based on the contractor's cost estimation and the authors' estimation using the Ministerial Regulation of Public Work No. 11/2013 standard. The difference on the total project cost is 1.80% for the 4 storey building project and 3.03% for the warehouse project.

The difference in total project cost estimation is due to the different coefficient used during the cost estimation process. According to the Ministerial Regulation of Public Work No. 11/2013 standard, it has its own coefficient for each labor and material used for a specific sub-work. However, each contractor in the 4 storey building project and the warehouse project also has a different set of coefficient when calculating their project cost.

In the 4 storey building project the difference coefficient is due to the material's coefficient difference. However in the warehouse project, the difference is mainly due to the labor's wage coefficient.

The Ministerial Regulation of Public Work No. 11/2013 standard is used to estimate the owner's estimate or the engineering estimate. However, a contractor has their own judgment in calculating the project cost to receive more profit. A contractor's judgment is also based on each of the contractor's experience in similar projects.

However based on the result of the total project cost from both calculation (contractor's and authors'), the Ministerial Regulation of Public Work No. 11/2013 standard is only a 1.80% – 3.03% different from the contractor's own calculation. This indicates that the contractor's judgment is not far from the current standard applied in Indonesia.

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