



Comparative Unit Price Analysis of Reinforced Concrete Structures Pasar Inpres Painan Project Based on Actual Analysis and Standard Nasional Indonesia (SNI) Analysis

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ABSTRACT

Work concrete is a very important factor in development projects because this work has a larger volume than other work projects. The contractor must have more details inside analyze the price of unit work to get effective and efficient cost. Contractor often makes price cost analyses different from Standard National Indonesia (SNI), over cost or under cost. The contractor should analyze unit prices based on actual conditions to ensure a cost-efficient project budget. This research aims to count the total cost structure concrete reinforced (columns, beams, slabs) Pasar Inpres Painan Projects, Pesisir Selatan, West Sumatra, Indonesia with actual analysis and Standard National Indonesia (SNI) analysis. The Standard National Indonesia (SNI) method provides guidelines for calculating unit price analysis that develop standard national construction, with adapt conditions using AHSP 2023 published by the regulation minister of PUPR no. 8 in 2023. In the actual method, unit price analysis is based on index cost from daily project progress, including quantity and productivity. The results of the research, with actual methods analysis, obtained a total project cost of IDR. 10,979,791,988.17, with the column cost at IDR 2,064,056,033.12, the beam cost of IDR 5,864,218,409.93, and the slab cost at IDR 3,051,517,545.13. However, the SNI method showed the total project cost of IDR 15,371,771,346.57, with the column cost at IDR 2,877,891,431.64, and the beam cost at Rp. 7,877,841,167.72, and the slab cost at IDR 4,616,038,747.19. Hence the Actual method analysis showed that the total cost project is much cheaper than the SNI analysis, IDR 4,391,979,358.40 or 28.57. Analysis based on actual conditions project can be efficient, causing index cost from daily project progress including quantity and productivity, if workers increase, actual total costs will be efficient.

1.0 Introduction

A project is a unique activity with a set goal with limited time to be able to reach a specified target. Within the arrangement of a construction project, cost estimates play a significant role. The greater value of a construction project causes the need for resources to manage the work (Endom, Saleh, & Titaley, 2023). Construction estimating is the process of calculating all the required costs for a construction project, including direct costs (e.g. materials and worker wages) and indirect costs (e.g. equipment depreciation and office worker salaries). Professional construction

estimators perform this essential step in the preconstruction process, which helps ensure that owners and contractors can complete a construction project profitably (Widoseno, 2015).

One of type the main work in construction is reinforced concrete structure, including column, beam, and slab work. The work-reinforced concrete structure is a very important factor in a project because this work has a larger volume than another work project (Natalia, Adibroto, Hamid, Muluk, & Dinna, 2019). Productivity workers on work reinforced concrete structures contribute large factors because will influence the time or project schedule designed (Saputra, 2022). For this reason, contractors must be more detailed in analyzing the unit price of work to obtain more effective and efficient costs. This procedure is crucial to avoid losses to the construction company as well as to evade financial statement fraud in the report (Abdul Rahman et.al., 2020). Construction cost analysis construction is the calculation price of unit work construction, which is described by the multiplication of the index material buildings and labor with the price of material buildings and labor standards (Ratag, Malingkas, & Tjakra, 2021). Price analysis unit work is the calculation price unit work construction described in multiplication need material building, labor, and equipment for complete per unit work construction. Price analysis unit work is influenced by numbers coefficient (index) which shows unit materials, value unit tools, and values unit labor that can be used as plan or control construction work (Natalia, Adibroto, Hamid, Muluk, & Dinna, 2019). Very important to detailed comparison of cost estimation between actual cost and SNI cost analysis, because it can be used as a reference for a contractor and prevent loss (Suhermawan & Agustapraja, 2023).

The problem has been that contractors often make price offers based on the number coefficient (index) of costs that are not based on analysis according to SNI so analysis of price unit work is different from SNI analysis which can be over-cost or under-cost. Contractors tend to count price unit work based on index cost, based on experiences in finishing something work construction, so budget costs are so high, and when implemented, more expensive than plan budget costs project.

There are various types of methods used in estimation cost work projects or calculation analysis price unit work, among others use method Standard National Indonesia (SNI) and actual cost analysis methods (Rifada, 2023). Price analysis unit work method SNI is guidelines calculation analysis price unit work that follows the development standard national or specification technical work construction, with adapt condition work construction planned or will be built (SNI, 2008). Price analysis unit work with the SNI method uses AHSP published by the regulation minister of PUPR (PUPR, 2023). Actual cost analysis price unit work, number coefficient (index) of costs obtained with method register progress project every day and also data collection to amount workers do every day. From the quantity of work obtained productivity daily for each work item (Natalia, Adibroto, Hamid, Muluk, & Dinna, 2019).

From the results calculation plan budget project construction of SD Negeri 1 Alue Bilie with SNI 2011, BOW 2008, and AHSP 2019 methods, the results estimation cost with The SNI 2011 method is the cheapest because the index coefficient price unit wages and materials is the smallest compared other method (Mawardi, Iskandar, Sutanto, Sulaiman, & Hidayat, 2023). In the Aeon Mixed Use Project Phase II Development Project- Apartment 3 Sentul City, Bogor with different cost analysis contractor with AHSP SNI 2016 concrete reinforced cost amounting to IDR 1,972,412.528,00. The contractor analysis is lower than the AHSP SNI 2016 analysis (Natalia, Adibroto, Hamid, Muluk, & Dinna, 2019). Project development Apartment the Wahid Residences, ratio comparison price unit work on work concreting, ironing, and formwork in actual conditions is cheaper compared to PUPR regulation (Rahman, Nursyamsi, & Rambe, 2018). Project development building Laboratory Integrated BALITTAS Malang, analysis cost work foundation based on analysis contractor 23.5% more expensive than calculation cost with Microsoft projects (Widoseno, 2015). Comparison estimation budget cost with SNI 2008, BOW, AHSP 2016, and

estimation methods contractor on the Management Office and Laboratory Construction Project Place Final Processing in District Humbang Hasundutan, obtained cost lowest use analysis of SNI 2008 (Syahputra, 2020).

This study was carried out on the Pasar Inpres Painan Project, Pesisir Selatan Regency, West Sumatra Province, Indonesia, which was built on a 7,500 m² area, 5,300 m² building with 116 kiosks and 3 stalls, is planned can accommodate 533 traders (Zaid & Asri, 2024).

This research aims to count the total cost of concrete reinforced structure (columns, beams, slabs) Pasar Inpres Painan Projects, Pesisir Selatan, West Sumatra, Indonesia with actual analysis and Standar Nasional Indonesia (SNI) analysis. Standar Nasional Indonesia (SNI) method is a guidelines calculation analysis price unit work that develops standard national or specification technical work construction, with adapt conditions using AHSP 2023 published by regulation minister of PUPR no. 8 in 2023. In the actual method, unit price analysis is based on index cost from daily project progress, including quantity and productivity. Furthermore, it compares actual and SNI analysis methods.

2.0 Research methods

2.1 Research location and time

This study was carried out on the project construction of Pasar Inpres Painan, Pesisir Selatan Regency, West Sumatera, Indonesia, from May 6, 2024 until July 6, 2024.

2.2 Data collection

Data collection for the study includes; (1) Type of work, that is items of work observed, (2) Time observation, which consists of time observation, (3) Duration observation, time used by a worker to finish a work item, (4) Results of work to know what volume of work can be done by the worker in duration that has been measured, and (5) Labour, the amount workers involved in the implementation process work.

2.3 Data processing

2.3.1 Determine time factors for every worker

Time factors determined for calculation index, time productive labor.

$$\text{time factor} = \frac{\text{time productive}}{\text{total time}} \quad [1]$$

2.3.2 Determine labour coefficient

The labour coefficient is determined by to amount of labour and time used to complete one work item-specific volume, calculated by:

$$\text{Coefficient man hour} = \frac{\text{labor} \times \text{duration work}}{\text{quantity work}} \quad [2]$$

Labour paid is calculated in units of days, so it is necessary to know the man-day coefficient of labor calculated by:

$$\text{coefficient man day} = \frac{\text{coefficient man hour}}{\text{calculate time in 1 day}} \quad [3]$$

As labour is paid not only for productive time but also for non-productive time, the work time factor needs to be taken into account only for productive time, calculated by:

$$\text{coefficient labor} = \frac{\text{coefficient man hour}}{\text{timefactor}} \quad [4]$$

2.3.3 Determine coefficient materials for each work item
Coefficient material determines the amount of material used in each work item.

2.3.4 Count price labour
Count price labour based on coefficient labor from actual direct. Calculation price labour calculated:

$$\text{Labour price} = \text{coefficient labour} \times \text{day price} \quad [5]$$

2.4 Data analysis

After obtaining the results of the labour coefficient for concreting, ironing, and formwork, then calculated the price unit work for each item and obtained the total cost actual method. After that, calculate the unit price of the work and total cost with SNI analysis, and then compare each method and the result is calculated percentage cost ratio.

3.0 Results

3.3 Unit price analysis Work Actual Field and SNI

Price analysis unit work based on actual methods and SNI for concrete work can be seen in Table 1, unit price reinforce work can be seen in Table 2, unit price formwork column in Table 3, unit price formwork beams in Table 4 and unit price formwork slab in Table 5.

Table 1: Unit Price Concrete Work

No	Description	Unit	Index	Actual Cost		Index	SNI	
				Unit Price (IDR)	Total Price (IDR)		Unit Price (IDR)	Total Price (IDR)
A Labor worker								
	Worker	OH	2.1267	121,000.00	257,335.07	1.6500	121,000.00	199,650.00
	Bricklayer	OH	0.1519	165,000.00	25,065.10	0.2750	165,000.00	45,375.00
	Head craftsman	OH	0.0214	181,500.00	3,889.84	0.0280	181,500.00	5,082.00
	Foreman	OH	0.0214	170,500.00	3,654.09	0.0830	170,500.00	14,151.50
Amount cost labor					289,944.11			264,258.50
B Material								
	Portland cement	Kg	406.00	1,560.00	633,360.00	406.00	1,560.00	633,360.00
	Sand concrete	Kg	684.00	121.43	83,057.14	684.00	121.43	83,057.14
	Gravel (max 30mm)	Kg	1026.0	92.41	94,816.55	1026.00	111.11	114,000.00
	Water	Liter	215.00	20.00	4,300.00	215.00	18.10	3,891.50
Amount cost material					815,533.69			834,308.64
C Equipment								
Amount cost equipment					-			-
D Amount					1,105,477.80			1,098,567.14
E Overhead & profit (10%)					110,547.78			109,856.71
F Unit price work					1,216,025.58			1,208,423.86

Table 2: Unit Price Reinforcement Work

No	Description	Unit	Index	Actual Cost		Coefficient	SNI	
				Unit Price (IDR)	Total Price (RP)		Unit Price (RP)	Index
A	Labor worker							
	Worker	OH	0.0037	121,000.00	445.28	0.0700	121,000.00	8,470.00
	Bricklayer	OH	0.0037	165,000.00	607.20	0.0700	165,000.00	11,550.00
	Head craftsman	OH	0.0000	181,500.00	5.30	0.0070	181,500.00	1,270.50
	Foreman	OH	0.0000	170,500.00	4.98	0.0040	170,500.00	682.00
	Amount cost labor				1,062.77			21,972.50
B	Material							
	Iron concrete	Kg	10.5000	14,500.00	152,250.00	10.5000	14,500.00	152,250.00
	Wire concrete	Kg	0.1000	20,000.00	2,000.00	0.1500	20,000.00	3,000.00
	Amount cost material				154,250.00			155,250.00
C	Equipment							
	Amount cost equipment				-			-
D	Amount				155,312.77			177,222.50
E	Overhead & profit (10%)				15,531.28			17,722.25
F	Unit price work				170,844.04			194,944.75
G	Unit price per kg				17,084.40			19,494.48

Table 3: Unit Price Column Formwork

No	Description	Unit	Index	Actual Cost		Coefficient	SNI	
				Unit Price (IDR)	Total Price (RP)		Unit Price (RP)	Index
A	Labor worker							
	Worker	OH	0.1645	121,000.00	19,901.32	0.6600	121,000.00	69,860.00
	Head craftsman	OH	0.0617	165,000.00	10,176.81	0.3300	165,000.00	44,450.00
	Craftsman	OH	0.0029	181,500.00	533.07	0.0330	181,500.00	5,989.50
	Foreman	OH	0.0029	170,500.00	500.76	0.0330	170,500.00	5,626.50
	Amount cost labor				31,111.96			125,926.00
B	Material							
	Class III wood	m3	0.0200	3,200,000.00	64,000.00	0.0400	3,200,000.00	128,000.00
	Nails 5 – 10 cm	Kg	0.2000	22,500.00	4,500.00	0.4000	22,500.00	9,000.00
	Oil formwork	Liter	0.1000	13,800.00	1,380.00	0.2000	13,800.00	2,760.00
	Wood beam class II	m3	0.0075	3,500,000.00	26,250.00	0.0150	3,500,000.00	52,500.00
	Plywod 9mm thick	Lbr	0.1750	145,900.00	25,532.50	0.3500	145,900.00	51,065.00
	Wooden Dolken ϕ 8-10 cm	Stem	1,0000	34,100.00	34,100.00	2,0000	34,100.00	68,200.00
	Amount cost material				155,762.50			311,525.00
C	Equipment							
	Amount cost equipment							
D	Amount				186,874.46			437,451.00
E	Overhead & profit (10%)				18,687.45			43,745.10
F	Unit price work				205,561.91			481,196.10

Table 4: Unit Price Beam Formwork

No	Description	Unit	Index	Actual Cost		Coefficient	SNI	
				Unit Price (IDR)	Total Price (RP)		Unit Price (RP)	Index
A Labor worker								
	Worker	OH	0.2264	121,000.00	27,400.36	0.6600	121,000.00	69,860.00
	Head craftsman	OH	0.0906	165,000.00	14,945.65	0.3300	165,000.00	44,450.00
	Craftsman	OH	0.0226	181,500.00	4,110.05	0.0330	181,500.00	5,989.50
	Foreman	OH	0.0226	170,500.00	3,860.96	0.0330	170,500.00	5,626.50
Amount cost labor				50,317.03				125,926.00
B Material								
	Class III wood	m3	0.0200	3,200,000.00	64,000.00	0.0400	3,200,000.00	128,000.00
	Nails 5 – 10 cm	Kg	0.2000	22,500.00	4,500.00	0.4000	22,500.00	9,000.00
	Oil formwork	Liter	0.1000	13,800.00	1,380.00	0.2000	13,800.00	2,760.00
	Wood beam class II	m3	0.0090	3,500,000.00	31,500.00	0.0180	3,500,000.00	63,000.00
	Plywood 9mm thick	Lbr	0.1750	145,900.00	25,532.50	0.3500	145,900.00	51,065.00
	Wooden Dolken ϕ 8-10 cm	Stem	1,0000	34,100.00	34,100.00	2,0000	34,100.00	68,200.00
Amount cost material					161,012.50			322,025.00
C Equipment								
Amount cost equipment					-			-
D Amount					211,329.53			447,951.00
E Overhead & profit (10%)					21,132.95			44,795.10
F Unit price work					232,462.48			492,746.10

Table 5: Unit Price Slab Formwork

No	Description	Unit	Index	Actual Cost		Coefficient	SNI	
				Unit Price (IDR)	Total Price (RP)		Unit Price (RP)	Index
A Labor worker								
	Worker	OH	0.7375	121,000.00	89,237.17	0.6600	121,000.00	69,860.00
	Head craftsman	OH	0.2950	165,000.00	48,674.82	0.3300	165,000.00	44,450.00
	Craftsman	OH	0.0105	181,500.00	1,912.23	0.0330	181,500.00	5,989.50
	Foreman	OH	0.0105	170,500.00	1,796.33	0.0330	170,500.00	5,626.50
Amount cost labor					141,620.56			125,926.00
B Material								
	Class III wood	m3	0.0400	3,200,000.00	128,000.00	0.0400	3,200,000.00	128,000.00
	Nails 5 – 10 cm	Kg	0.4000	22,500.00	9,000.00	0.4000	22,500.00	9,000.00
	Oil formwork	Liter	0.2000	13,800.00	2,760.00	0.2000	13,800.00	2,760.00
	Wood beam class II	m3	0.0150	3,500,000.00	52,500.00	0.0150	3,500,000.00	52,500.00
	Plywood 9mm thick	Lbr	0.3500	145,900.00	51,065.00	0.3500	145,900.00	51,065.00
	Wooden Dolken ϕ 8-10 cm	Stem	6,0000	34,100.00	204,600.00	6,0000	34,100.00	204,600.00
Amount cost material					447,925.00			447,925.00
C Equipment								
Amount cost equipment								
D Amount					589,545.56			573,851.00
E Overhead & profit (10%)					58,954.56			57,385.10
F Unit price work					324,250.06			631,236.10

Recapitulation analysis price unit work actual methods and SNI can be seen in Table 6.

Table 6: Recapitulation of Unit Price Analysis Actual Method and SNI

Unit Price Analysis of Work					
No	Job Description	Actual	SNI	Cost Difference	%
1	Concreting	1,216,025.58	1,208,423.86	-7,601.72	-0.63
2	Reinforcing	17,084.40	19,494.48	2,410.08	12.36
3	Column Formwork	205,561.91	481,196.10	275,634.19	57.28
4	Beam Formwork	232,462.48	492,746.10	260,283.62	52.82
5	Slab Formwork	324,250.06	631,236.10	306,986.04	48.63

Based on Table 6 can be seen that the price unit concreting Pasar Inpres Painan Project obtained method is more expensive IDR 7,601.72 (0.63%), causing worker index much from the SNI index, because need amount more workers for concrete work. For reinforcement, columns formwork beams formwork, and slab formwork obtained price unit actual work cheaper from SNI analysis. For reinforcement work, the cost of actual analysis is cheaper Rp. 2,410.08 (12.36%), for work formwork column cheaper Rp. 275,634.19 (57.28%), beam formwork cheaper Rp. 260,283.62 (52.82%) and slab formwork cheaper Rp. 306,986.04 (48.63%) than SNI analysis.

3.2 Comparison Actual Total Cost SNI Field and Methods

Recapitulation comparison of total costs of structure concrete reinforced (columns, beam, slab) actual analysis and SNI analysis can be seen in Table 7 and Figure 1.

Table 7. Recapitulation of Total Cost Actual and SNI Analysis

No	Work item	Total Cost Actual Analysis (IDR)	Total Cost SNI Analysis (IDR)	Cost difference (IDR)	% difference
1	1st floor				
	Column	1,307,592,683.08	1,791,963,330.89	484,370,647.81	27.03
	Beam	2,609,889,932.22	3,545,473,946.19	935,584,013.97	26.39
2	2nd Floor				
	Column	737,013,244.21	1,054,265,796.58	317,252,552.37	30.09
	Beam	2,322,439,573.71	3,080,665,217.56	758,225,643.85	24.61
3	3rd floor				
	Column	19,450,105.83	31,662,304.17	12,212,198.34	38.57
	Beam	931,888,904.00	1,251,702,003.97	319,813,099.97	25.55
	Slab	478,971,725.47	725,218,352.54	246,246,627.07	33.95
	Total cost	10,979,791,988.17	15,371,771,346.57	4,391,979,358.40	28.57

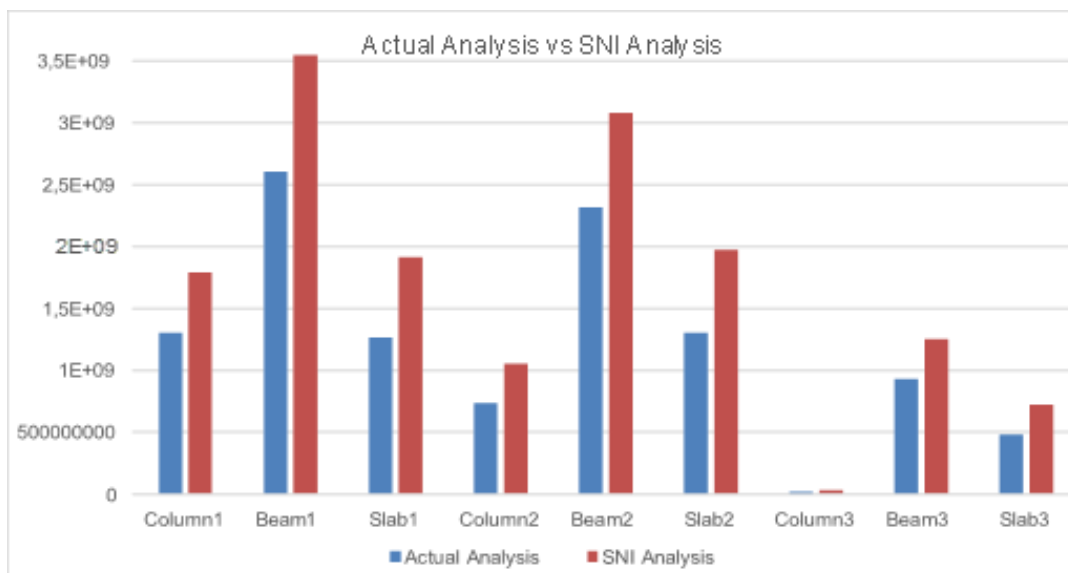


Figure 1: Comparison of Total Cost Actual Analysis and SNI Analysis

From Table 7, the total actual costs are obtained amounting to IDR 10,979,791,988.17 and the total cost of SNI analysis is IDR 15,371,771,346.57. The total cost of actual analysis is obtained cheaply amounting to IDR 4,391,979,358.40 (28.57%) compared to the total cost of SNI analysis. From Figure 1, can be seen that the actual cost for all of the concrete reinforcement structures (column, beam, slab) is cheaper than the SNI analysis.

4.0 Conclusion

In the Pasar Inpres Painan Project, for reinforced concrete (column, beams, slab), the total cost with actual methods analysis IDR. 10,979,791,988.17 with column cost IDR 2,064,056,033.12, beam cost IDR. 5,864,218,409.93, and slab cost IDR 3,051,517,545.13. SNI method obtained total project cost IDR. 15,371,771,346.57, with column cost IDR. 2,877,891,431.64, beam cost Rp. 7,877,841,167.72, slab cost IDR 4,616,038,747.19. Total cost with actual analysis much cheaper than SNI analysis IDR 4,391,979,358.40 or 28.57%. Analysis based on actual conditions project can be efficient cause index cost from daily project progress including quantity and productivity, if workers increase, actual total costs will be efficient.

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Author Contributions

Mafriyal: Conceptualization, Methodology, Software, Writing- Original Draft Preparation, Data Curation, Formal Analysis; **Monika Natalia:** Data Curation, Validation, Supervision, Writing- Review & Editing; **Regi Pratama:** Validation, Resources; and **Mila Asti:** Resources, Project Administration.

Conflicts of Interest

The manuscript has not been published elsewhere and is not being considered by other journals. All authors have approved the review, agree with its Submission, and declare no conflict of interest in the manuscript.

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