

Analysis of Cost Structure and Budget Plan for the Construction of the Annuqayah Islamic Boarding School Cafeteria

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Article Information	ABSTRACT
Article History Received : July 22, 2026 Revised : September 21, 2026 Published : October 02, 2026 Keywords: <i>Cost Budget Plan;</i> <i>Construction Cost;</i> <i>Cost Structure;</i> <i>Sensitivity Analysis;</i> <i>Cost Control.</i>	Accurate cost planning is essential for establishing an effective cost structure and supporting cost control in construction projects. This study aims to analyze the Cost Budget Plan (Rencana Anggaran Biaya/RAB) for the Annuqayah Islamic Boarding School Cafeteria Construction Project in Latee, Guluk-Guluk, Sumenep, with particular emphasis on the cost structure, dominant cost components, and their sensitivity to changes in project costs. A descriptive quantitative approach was employed using design drawings, work specifications, field conditions, and the 2025 Sumenep Regency Unit Price Analysis (AHSP) as the primary data sources. The analysis comprised work volume calculations, unit price determination, cost recapitulation, identification of dominant cost components, and sensitivity analysis. The results show that the total project budget is Rp2,093,465,390.82 before Value Added Tax (VAT). Steel structure work represents the largest cost component, amounting to Rp1,111,199,334.60, indicating its substantial influence on the overall project budget. Consequently, variations in steel structure costs have a greater potential to affect the total project cost than other work components. These findings indicate that cost control should prioritize dominant cost components, particularly steel structure work, through careful material cost management, quantity control, and efficient project implementation to minimize the risk of cost overruns.

INTRODUCTION

Cost planning is a crucial component of construction project management because it affects the achievement of cost, quality, and schedule objectives (Dasinangon et al., 2022). One form of cost planning is the preparation of a Cost Estimate (RAB), a document that contains estimates of funding requirements based on the volume of work, material requirements, labor, equipment usage, and unit prices for each type of work. The RAB serves as a reference for estimating the total costs required during project implementation, including various expenses related to the construction process (Yulianti et al., 2024). Therefore, the proper and systematic preparation of a cost estimate serves as an important foundation for cost control while also supporting the decision-making process throughout the project (Alami et al., 2021)

An infrastructure project is a series of interrelated construction activities carried out to achieve predetermined objectives, whether in terms of results, implementation timeline, or development goals (Onibala et al., 2018). Construction projects are generally temporary in nature

because they are carried out only once with a relatively short work period. Therefore, each phase of the work must be managed in a planned manner to ensure that implementation proceeds according to targets. Control over time, costs, and human resources are critical factors in ensuring project success. One of the measures taken is to develop a time schedule to serve as a reference for coordinating and monitoring the progress of the work. In addition, workforce allocation must be tailored to the needs of each type of work both in terms of quantity and skill set to ensure that productivity and work quality are maintained. With effective resource management, projects can be completed on schedule, within the planned budget, and in accordance with established quality standards (Suyansan, 2017).

Unit Price Analysis (UPA) is one of the methods commonly used in preparing a Cost Estimate (RAB) because it provides a more detailed cost estimate based on the labor, materials, and equipment requirements for each type of construction work. By applying this method, cost calculations can be performed more systematically, resulting in a more accurate budget estimate. In addition, AHSP also simplifies the evaluation process as well as (Tisnawan et al., 2025). Therefore, the use of AHSP is considered an appropriate approach to support the preparation of cost estimates for construction projects (Ferdianto & Gondokusumo, 2024).

Accuracy in preparing the Cost Estimate (RAB) plays a crucial role in ensuring the success of a construction project. Cost estimates that do not reflect actual conditions on-site have the potential to cause various problems, such as increased construction costs, delays in project completion, and discrepancies between project planning and execution (Onibala et al., 2018). Therefore, the preparation of the Bill of Quantities must be carried out carefully and systematically, taking into account the volume of each task, the technical specifications used, and the applicable unit prices for each task. By considering these three aspects, the resulting cost estimate is expected to be more realistic, accurate, and accountable (Plamonia et al., 2023).

A Cost Estimate (RAB) is not only used as a basis for estimating a project's funding requirements, but also serves an important function as a control mechanism during the construction process (Ina & Langga, 2021). Through the Bill of Quantities (BOQ), both project owners and contractors can determine the amount of funds allocated for each type of work, thereby enabling more effective and efficient planning of resource utilization. In addition, the BOQ serves as a guideline for the procurement of materials, the determination of labor requirements, and the preparation of work schedules in accordance with the planned phases (Rahman et al., 2025). With systematic cost planning, the potential for budget deviations can be minimized, so that the project is expected to meet the established quality, time, and cost targets (Hakimah, 2021).

A number of studies show that preparing a Cost Estimate (RAB) based on calculations of work volume and a Unit Price Analysis (AHSP) can result in more structured cost estimates. These estimates not only provide an overview of the project's cost requirements but can also be used as a reference for controlling expenditures during the construction process (Rahman et al., 2025). In addition, precision in calculating the volume of work and setting unit prices is a critical factor in determining the accuracy of project cost estimates, so that the resulting plan more closely reflects actual on-site conditions (Dasinangon et al., 2022).

Islamic boarding schools are Islamic educational institutions that play a vital role in shaping the knowledge, moral values, and character of their students (Muhammad Aditya Firdaus & Fauzian, 2020). As times have changed, the role of Islamic boarding schools is no longer limited to providing religious education; they have also evolved into environments that support a variety of social and economic activities, as well as the development of students' skills. This evolution requires adequate facilities and infrastructure to ensure that all educational activities and daily routines within the boarding school environment can proceed smoothly (Ismail et al., 2022). Therefore, the availability of adequate facilities is one of the key factors in creating a comfortable, orderly, and conducive learning environment that supports the productivity of all members of the Islamic boarding school community (Mujahidin, 2022).

As an Islamic educational institution that continues to grow, the Annuqayah Latee Islamic Boarding School requires adequate facilities and infrastructure to support the various activities of

both the students and the school's administrators. One of the planned initiatives to meet this need is the construction of a cafeteria that will serve as a facility to provide meals and support activities within the boarding school. To ensure that construction proceeds in accordance with the established objectives, careful cost planning is necessary so that the budget can be utilized effectively, efficiently, and in line with the project's needs (Ibnu Faruk Fauzi, 2022).

Research on the preparation of cost estimates has been widely applied to various types of construction projects, such as buildings, housing, and public facilities. However, studies that specifically examine the preparation of cost estimates for the construction of educational facilities within Islamic boarding schools remain relatively limited. On the other hand, every construction project has different characteristics in terms of the type of work, material requirements, and technical specifications so the components and amounts of the costs involved are not always (Yulianti et al., 2024). Based on this, this study aims to prepare a cost estimate for the construction of the cafeteria at the Annuqayah Latee Islamic Boarding School, based on calculations of the volume of work and prevailing unit prices. The results of this study are expected to provide an overview of the costs required for the cafeteria's construction and to serve as a reference for the planning and cost control processes in similar projects within Islamic boarding schools (Jea et al., 2023). As well as analyzing the structure, identifying the dominant cost components, and evaluating the sensitivity of cost changes to the total budget estimate.

METHOD

Research Location

This research was conducted at the Annuqayah Islamic Boarding School in the Latee area. The project was carried out over 180 calendar days, from February through July 2025.



Figure 1. Canteen Construction Site

General Information

Conducting this study requires data that is relevant and appropriate to the subject under investigation. This data serves as the foundation for the analysis process, thereby supporting the achievement of the study's objectives. The general data used in this study was obtained from the construction project for the Annuqayah Islamic Boarding School cafeteria, as presented below:

- | | |
|---------------------|---|
| a. Project Name | : Construction of the Annuqayah Islamic Boarding School Cafeteria |
| b. Project Location | : PP. Annuqayah Latee, Guluk-Guluk, Sumenep |
| c. Funding Source | : Community Contributions |
| d. Contract Value | : 2,093,465,390.82 |
| e. Duration | : 180 calendar days |

Data Collection Methods

The data collection phase plays a crucial role in the research process because the quality of the data obtained will affect the accuracy of the analysis and the resulting conclusions. The availability of complete, accurate, and relevant data serves as the foundation for the calculation process and the preparation of the Cost Estimate (RAB), ensuring that the research results can objectively represent the project's conditions. Therefore, data collection activities must be carried out in a planned and systematic manner, tailored to the research needs (Irwan & Nasution, 2024). The analytical process in research requires relevant data and theories related to the subject under study. The availability of such data forms the basis for processing and interpreting research results, ensuring that the analysis achieves a high degree of accuracy. Based on their source, the data used in this study consist of two types, namely:

- a. Primary data, which includes working drawings, field conditions, and documentation of direct observations.
- b. Secondary data, in the form of the 2025 Sumenep Regency Unit Price Analysis (AHSP), to be used as a reference in preparing the Cost Estimate (RAB).

Stages in Preparing a Budget Estimate

The process of preparing a cost estimate requires a high degree of precision through a series of systematic steps. This process proceeds continuously, beginning with analyzing the blueprint and technical specifications of the project, calculating the volume of each work item, and monitoring actual price fluctuations in the market. Through this structured approach, the resulting budget serves as an objective benchmark for controlling the quality, schedule, and cost of project execution (Afandi et al., 2025).

The preparation of the Cost Estimate (RAB) for this study was carried out through a series of systematically organized steps to ensure that the cost calculations were performed accurately. These steps are described as follows:

- a. Compile design drawings and technical specifications for the project as the primary data used in the analysis process.
- b. Identify all work items included in the cafeteria construction project.
- c. Calculate the volume of each type of work based on the prepared design drawings.
- d. Analyze the unit prices for the work using the 2025 Sumenep Regency Standard Unit Prices (AHSP).
- e. The cost of each work item is calculated by multiplying the volume of work by the applicable unit price to determine the cost for each work item.
- f. Add up all the project costs to determine the total estimated project cost.
- g. Conduct an evaluation and analysis of the calculation results obtained.

The following are the steps involved in calculating the Budget Estimate:

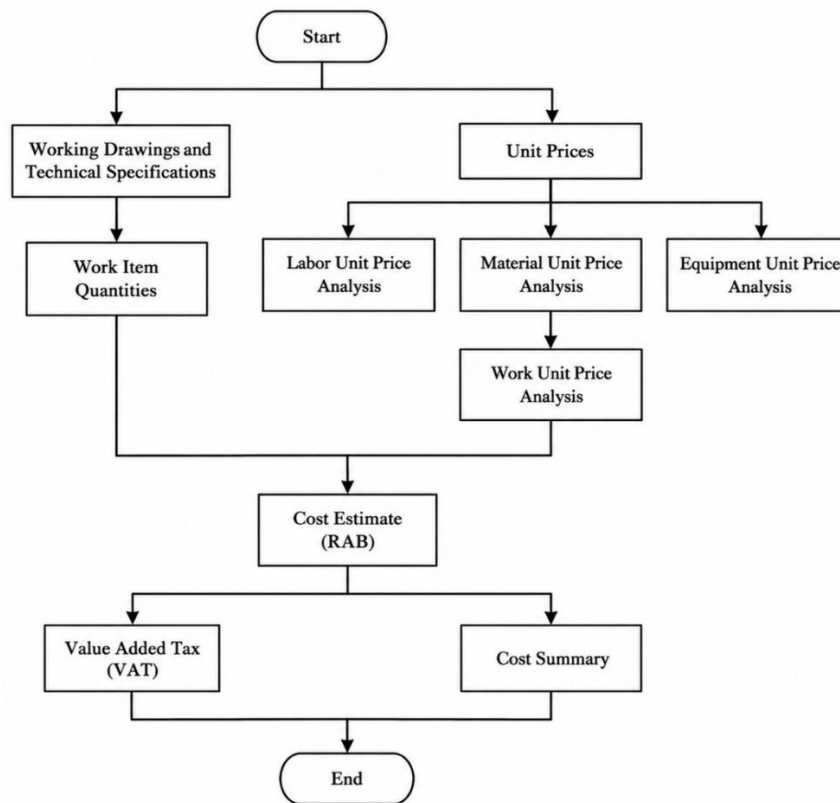


Figure 2. Stages in Preparing a Budget Estimate

RESULTS AND DISCUSSION

List of Unit Prices for Labor and Materials

As a basis for preparing the Cost Estimate (RAB), this study uses a list of unit prices for labor and materials based on the 2025 Sumenep Regency Unit Price Analysis (AHSP). This reference is used as a guideline in the cost calculation process to ensure that the resulting budget is in accordance with applicable standards.

Budget Estimate

A Cost Estimate (RAB) is a document that contains cost estimates for each work item based on material requirements, labor costs, and other cost components required during project implementation (Juansyah et al., 2017). This document serves as the basis for project financial planning and management because it provides an overview of the total budget that must be allocated (Putra et al., 2025). In addition, the cost estimate serves as a cost-control tool to monitor actual expenditures during the construction process, thereby minimizing potential cost overruns and ensuring that the project remains within the planned budget. The following table shows the cost estimate for the construction of the cafeteria at the Annuqayah Latee Islamic Boarding School.

Table 1. Budget Estimate

No.	Job Description	Vol	Unit	Unit Price (Rp)	Quantity Price (Rp)
A. PREPARATORY WORK					
1	Land clearing work + surveying	1,00	1s	1,000,000,00	1,000,000,00
Subtotal					1,000.000,00

B. ANNUQAYAH BOARDING SCHOOL CAFETERIA JOB					
I, EARTHWORK					
1	Standard Earth Excavation	192,73	m ³	99.000,00	19.080.270,00
2	Backfilling	64,24	m ³	71.500,00	4.593.160,00
3	Filling and compaction of local gravel	287,40	m ³	240.700,00	69.177.180,00
				Subtotal	92.850.610,00
II. Structural Work					
II.1 Foundation Work					
1	Concrete Paving Work	2,70	m ³	1.005.900,57	2.715.931,54
2	Footplate fc = 19.3 m-a (k225)	26,98	m ³	1.235.920,60	33.345.137,79
	150x150x40 threaded steel footplate	1.359,73	kg	15.900,00	21.619.707,00
	Pek, 3-use footplate formwork	111,36	m ²	144.570,00	16.099.315.20
3	Pas, ISP 6PH mountain rock foundation	59,91	m ²	941.649,50	56.414221,55
4	Pas, Rollag ISP 6PH Stone	123,12	m ²	233.917,70	28.799.947,22
				Subtotal	158.994.260,00
II.2 Concrete Work					
1	FP1 pedestal column, Fc = 16.9 MPa (k 225)				
	40x40 Concrete Column	5,38	m ³	1,235,918.55	6.649.241,80
	Threaded Rod	279,95	kg	18.133,28	5.076.411,74
	Plain Steel	130,63	kg	15.889,28	2.075.616,65
	Pek. Column formwork, used twice	53,76	m ²	198.121,20	10.650.515,87
2	S1 foundation with a strength of Fc = 21.7 MPa (K250). Semi-mechanical				
	20x40 cm Concrete Footing	11,68	m ³	1,235,918,50	14.435.528,08
	Threaded rod	791,51	kg	18.133,28	14.352.672,45
	Plain Steel	391,92	kg	15.889,28	6.227.326,62
	Set of Formwork for 3-Use Sloof	233,60	m ³	147.873,00	34.543.132,80
3	S2 foundation with a strength of Fc = 21.7 MPa (K250). Semi-mechanical				
	Concrete Footing 15x20 cm	2,28	m ³	1.245.918,55	2.840.694,29
	Threaded Rod	316,19	kg	18.200,00	5.754.658,00
	Plain Steel	95,79	kg	15.889,28	1.522.034,13
	Set of Formwork for a 3x Sloof (Reusable)	60,72	m ²	147.873,00	8.978.848,56
4	Kp Mutu Column, fc = 21.7 MPa (K250)				
	10x10 cm Concrete Column	0,28	m ³	1.235.918,55	346.057,19
	Plain Steel	67,79	kg	15,889,28	1,077.134,29
	Pek. Column formwork, 3x use	7,47	m ²	198.112,20	1.479.898,13
5	Concrete Table Work, Footplate Fc=19.3 MPa (K225)				
	10-cm-thick concrete table	4,16	m ³	1.235.918,55	346.057,19
	Round bar	1.089,2	kg	15.889,28	17.306.762,67
	Set of 3 Reusable Footplate Formwork	7,59	m ²	198.112,20	1.503.671,60
				Subtotal	139.916.622,00
II,3 ROOF FRAME AND ROOFING WORK					
1	Fitting, Spandek Roof Covering	1.207,62	m ²	98.483,00	118.930.040,46
2	Pas. Wuwungan	57,25	m'	56.859,00	3.255.177,75
				Subtotal	185.331.231,25
III.2 FLOOR FINISHING WORK					

1	Paving Work	651,61	m ²	270.055,50	175.970.864,36
2	Tiling Work: 50x50 Floor Tiles	331,50	m ²	198.510,29	65.806.161,14
3	Fill Sand Thickness = 10 cm	65,16	m ³	462.825,00	30.157.677,00
4	Concrete Bedding Work, thickness=5 cm	9,95	m ³	1.005.870,57	10.008.412,17
				Subtotal	281.943.114,66
III,3 STEEL STRUCTURE CONSTRUCTION					
1	H-Section Steel Column 250x250x9x41				
	H-Section Steel Column 250x250x14	10.419,84	kg	40.295,75	419.875.267,68
	12mm-thick steel plate (from column to pile cap)	277,01	kg	30.808,25	8.534.193,33
	12mm-thick steel plate (from column to rafter)	357,28	kg	30.808,25	11.007.171,56
	DIA. 19mm Anchor Bolt, 60 cm Long	144,00	bh	68.000,00	9.792.000,00
	3/4x2.5-A325 bolt and nut (connection bolt and nut)	432,00	bh	18.000,00	9.792.000,00
	16mm Steel Column Wind Bracing	191,21	kg	18.133,28	3.467.264,47
	Zyncromate Paint	178,56	m ²	38.857,50	6.938.395,20
2	IWF Stands 250x125x6x9				
	IWF Steel Horse Stands 250x125x6x9	7.204,36	kg	40.295,75	290.305.089,4
	WF Console 150x75x5x7 mm	362,14	kg	40.295,75	14.592.299,95
	12mm-thick steel plate	203,52	kg	40.295,75	6.270.095,04
	5/8 x 2 A325 Bolt	402,19	kg	30.808,25	12.390.770,07
	5/8 x 2 A325 Bolt	144,00	bh	18.000,00	2.592.000,00
	16mm Steel Truss Wind Brace	409,67	kg	18.133,28	7.428.660,82
	Zyncromate Paint	449,30	m ²	38.857,50	17.458.674,75
3	CNP Channel 125x50x20x2.3				
	CNP Channel 125x50x20x2.3	5.687,90	kg	39.702,30	225.822.712,1
	6mm-thick steel plate	155,46	kg	30.808,25	4.789.450,55
	3/8 x 1 Bolt and Nut - CNP Channel	1.056,00	bh	1.800,00	1.900.800,00
	13mm DIA Threaded Rod + Nut	1.729,09	kg	19.933,28	34.466.435,12
	Zyncromate Paint	663,76	m ²	38.857,50	25.792.054,20
				Subtotal	1.111.199.334,36

Summary Of the Budget Plan

The cost summary is prepared by totaling all costs for each work subitem to determine the total budget required for project implementation.(Saputra et al., 2020). The summary of the budget plan for the construction of the Annuqayah Latee Islamic boarding school cafeteria is as follows:

Table 2. Budget Estimate

NO	JOB DESCRIPTION	JUMLAH HARGA (Rp)
A.	PREPARATORY WORK	1.000.000,00
B.	PLANNING FOR THE ANNUQAYAH BOARDING SCHOOL CAFETERIA	
I	EARTHWORK	92.850.610,00
II	STRUCTURAL WORK	
	II.1 FOUNDATION WORK	158.994.260,30
	II.2 CONCRETE WORK	139.961.622,04
	II.3 ROOF FRAMING AND FLOOR COVERING WORK	122.185.218,21
III.	ARCHITECTURAL PROJECTS	
	III.1 TILING AND PLASTERING WORK	185.331.231,25

III.2 FLOOR FINISHING WORK	281.943.114,66
III. PEKERJAAN PENUTUP BAJA	1.111.199.334,36
TOTAL	2.093.465.390,82

Project Cost Structure Analysis

A summary of the budget plan not only shows the total budget requirements for the project, but can also be used to determine the cost distribution structure for each work group (Karyadi, 2022). A cost structure analysis is conducted by comparing the costs of each work group against the total Cost Estimate. This analysis aims to identify the work groups that contribute the most to overall costs, thereby providing a basis for determining project cost control priorities. (Fadillah Taufik, 2026). The percentage contribution of each work group's costs is calculated using the following formula: Cost percentage (%) = (Work group cost / Total Bill of Quantities) × 100%

Based on these calculations, the cost structure for the construction of the Annuqayah Latee Islamic Boarding School cafeteria is presented in Table 3.

Tabel 3. Project Cost Structure Analysis

NO	JOB	COST (Rp)	PERCENTAGE (Rp)
1	Preparatory Work	1.000.000,00	0,05
2	Earthwork	92.850.610,00	4,44
3	Foundation Work	158.994.260,30	7,59
4	Concrete Work	139.961.622,04	6,69
5	Roof Framing and Shingling Work	122.185.218,21	5,84
6	Tiling and Plastering	185.331.231,25	8,85
7	Floor Finishing Work	281.943.114,66	13,47
8	Steel Structure Projects	1.111.199.334,36	53,08
TOTAL		2.093.465.390,82	100,00

Based on Table 3, the cost structure for the construction of the Annuqayah Latee Islamic Boarding School cafeteria shows that project costs are not evenly distributed across each work category. Steel structure work accounts for the largest share of costs, at 53.08% of the total Budget Estimate. Next, floor covering work accounts for 13.47%, while masonry and plastering work accounts for 8.85%. Meanwhile, other work categories account for less than 8% of the total project budget.

The dominant share of costs associated with steel structure work indicates that this work group plays a significant role in determining the total project budget. Therefore, the project cost structure must be a focus of attention in the planning and cost control processes, particularly for work groups with a large share of the total costs. In contrast, preparatory work accounts for only 0.05% of the total project costs, so its impact on changes to the total budget is relatively small.

The results of this cost structure analysis provide an overview of how the budget is allocated across each work group. This information can then be used to identify the dominant cost

components and serve as the basis for conducting a sensitivity analysis of cost changes in the work groups that contribute the most.

Dominant Cost Analysis

Based on the results of the cost structure analysis, steel structure work is the category of work with the largest cost contribution to the construction of the Annuqayah Latee Islamic Boarding School cafeteria. The cost of the steel structure work is Rp1,111,199,334.36, or approximately 53.08% of the project's total budget of Rp2,093,465,390.82. This indicates that more than half of the project budget is allocated to steel structure work. The cost of a steel structure is influenced by several key components, such as steel columns, steel trusses, and purlins. In addition, the cost also includes supporting components, such as steel plates, bolts, anchors, wind bracing, and material coatings. Thus, the high cost of a steel structure stems not only from the main elements but also from the need for supporting components within the structural system.

Based on these results, steel structure work can be identified as the dominant cost component in this project. Since it accounts for more than 50% of the total cost estimate, changes in the cost of steel structure work will have a greater impact on the total project budget than changes in other types of work. In addition to the steel structure, floor covering work is the second-largest cost category, totaling Rp281,943,114.66, or 13.47% of the total budget estimate. Meanwhile, masonry and plastering work amounts to Rp185,331,231.25, or 8.85%. This disparity indicates that cost control should be prioritized for the work items with the largest cost contributions, particularly the steel structure work. The identification of these dominant costs then serves as the basis for conducting a sensitivity analysis. This analysis is performed to determine the extent to which changes in the cost of steel structure work affect the total project cost estimate.

Cost Sensitivity Analysis

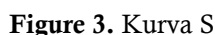
A sensitivity analysis was conducted to determine the impact of changes in the costs of dominant cost components on the project's total budget. Based on the results of the previous analysis, steel structure work is the work group with the largest cost contribution, amounting to Rp1,111,199,334.36, or approximately 53.08% of the total project budget. Therefore, changes in the cost of steel structure work have the potential to significantly affect the total project budget. In this study, a sensitivity analysis was conducted using hypothetical scenarios involving a 5% and 10% increase in the cost of steel structure work. These scenarios were used to illustrate the extent of the change in the total cost estimate when costs change in the work groups that contribute the most to the project budget. The results of the sensitivity analysis are presented in Table 4.

Tabel 4. Cost Sensitivity Analysis

Scenario	Cost of steel structures (Rp)	Changes to initial costs (Rp)	Total Project Budget (Rp)	Total Change in the Budget Estimate (%)
Initial Conditions	1.111.199.334,36	—	2.093.463.390,82	—
A 5% increase	1.166.759.301,08	55.559.966,72	2.149.025.357,54	2,65%
A 10% increase	1.222.319.267,80	111.119.933,44	2.204.585.324,26	5,31%

Thus, steel structure work can be viewed as a component that is highly sensitive to changes in the total project budget. These results highlight the importance of paying special attention to cost changes in this work group during the project planning and cost control processes.

After completing various research stages, such as the AHSP, the Cost Estimate, and the Cost Estimate Recapitulation, it is essential to create an S-curve. The following is the S-curve for the Annuqayah Islamic Boarding School Cafeteria Construction Project, which is used to illustrate the progress of the work based on the weight of the work during the project implementation period.



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Conclusion

Based on the results of the research and analysis conducted, the Cost Estimate (RAB) for the construction of the Annuqayah Latee Islamic Boarding School cafeteria is Rp2,093,465,390.82, excluding 11% VAT, with a planned implementation period of 180 calendar days. The results of the cost structure analysis show that project costs are not evenly distributed across each work group. Steel structure work is the dominant cost component, amounting to Rp1,111,199,334.36, or approximately 53.08% of the project's total budget estimate. This indicates that more than half of the project budget is allocated to steel structure work, meaning this work category has a significant impact on changes in the total project cost.

The results of the sensitivity analysis show that, based on the simulation scenarios, a 5% increase in the cost of steel structure work could increase the total project budget by approximately 2.65%, while a 10% increase could raise the total budget by approximately 5.31%, assuming the costs of other work groups remain constant. These results indicate that cost changes in the dominant work components can have a significant impact on the total project budget. Based on these results, cost control for the construction of the Annuqayah Latee Islamic Boarding School cafeteria should focus primarily on work packages that account for a significant portion of the costs, particularly steel structure work. Thus, the preparation of the Bill of Quantities (BOQ) not only serves to determine the total budget requirement but can also be used to analyze the cost structure, identify dominant cost components, and evaluate the impact of cost changes as a basis for supporting more targeted project cost control.

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