

COST PLAN ANALYSIS UPPER STRUCTURE WORKS (Case Study of Urban Homes Residential Tower B North Lippo Village Project, Tangerang)

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ABSTRACT

The construction of apartment buildings is vulnerable to changes in costs from the budgeted plan. Including the project of Urban Homes Residential Tower B North Lippo Village which needs to calculate the cost plan from the design stage, to reduce the impact on the implementation stage. This study aims to determine the factors that affect the calculation of cost plan, to determine the calculation volume of works, preparation of analysis and cost plans, and to analyze the difference between the cost plan and contract cost. The scope of work for the analysis of the calculation of upper structure in Urban Homes Residential project for the tower B (Urban Two) starting from the 1st floor to the 42nd floor is to calculate the quantity of the upper structure (shear wall, slab, beam, column, ramp, and parapet wall works), to prepare cost plan using Work Unit Price Analysis (AHSP) refer to Minister of Public Works Regulation 28/2016 with the unit rate of wages, materials, and equipment of DKI Jakarta 2021 as well as the cost plan. Cost plan is influenced by location, type of structure and soil conditions, building design and space composition, building size, contract period, and implementation method. The cost required to carry out the upper structure works on this project is Rp. 129,195,120,664 with an area of 89,054.11 m² and the cost per m² of upper structure works is Rp. 1,523,000.00. The comparison of the cost plan and cost contract is Rp. 3,084,359,691 with a comparison percentage of 2.45% of the cost contract.

Keywords: Unit Rate Analysis Works, Cost Plan, Upper Structure Work, Apartment Project.

INTRODUCTION

Cost planning analysis is a technique or method in which the budget of a project is created and allocated into cost posts or cost elements so that planners get a cost limit that is used as a benchmark in planning or producing the design expected by the Owner/Investor. The cost planning process is a pre-contract stage conducted by a consultant quantity surveyor who aims to assist in the preparation of projects, design, tender, and cost control (Lestari, 2016).

Traditionally, the purpose of cost planning in construction projects is as a basis for development funding, a basis for efficient design planning, and a basis for controlling costs during the construction period (Usvita, 2019). Otherwise, if the project cost planning is not appropriate, it will potentially become a risk, which will have an impact on cost overruns (the use of costs that exceed the project budget), schedule delays, lack of benefit (results do not reach the expected target) (Cognoscenti, 2016).

In the construction of apartment projects, there are vulnerable to changes in costs from the planned plans. Including the Urban Homes Residential Tower B North Lippo Village Project, it is necessary to calculate the cost of planning since the design stage, to reduce the impact at the implementation stage.

The purpose of the study was to find out which factor affects the calculation of cost planning, calculates the volume of work of the upper structure, and the budget plan of the cost of upper structure work as well as the difference between planning costs and contract costs on the Urban Homes Residential Tower B project.

METHOD

The research method used is a combination of Urban Homes Residential data and questionnaire data provided to the experts concerned. The secondary and primary data are analyzed in the following order:

1. Identify factors that affect cost planning by charging a related expert.
2. Project data collection in the form of design development drawing, list of unit prices of materials, wages, and tools for the DKI Jakarta area in 2021.
3. Calculating the required volume in the take-off quantity for upper structure work (shear wall work, floor slabs, beams, columns, ramps, and parapet walls)
4. Compile a Unit Rate Analysis based on the work items required in the upper structure work.
5. Create a cost budget plan (Bill of Quantity) from the calculation of quantity take-off, analyze the unit price of work to obtain the total price of work.
6. Analyze the comparison of planning costs and contract values so that different percentages and factors can affect the value of the work.

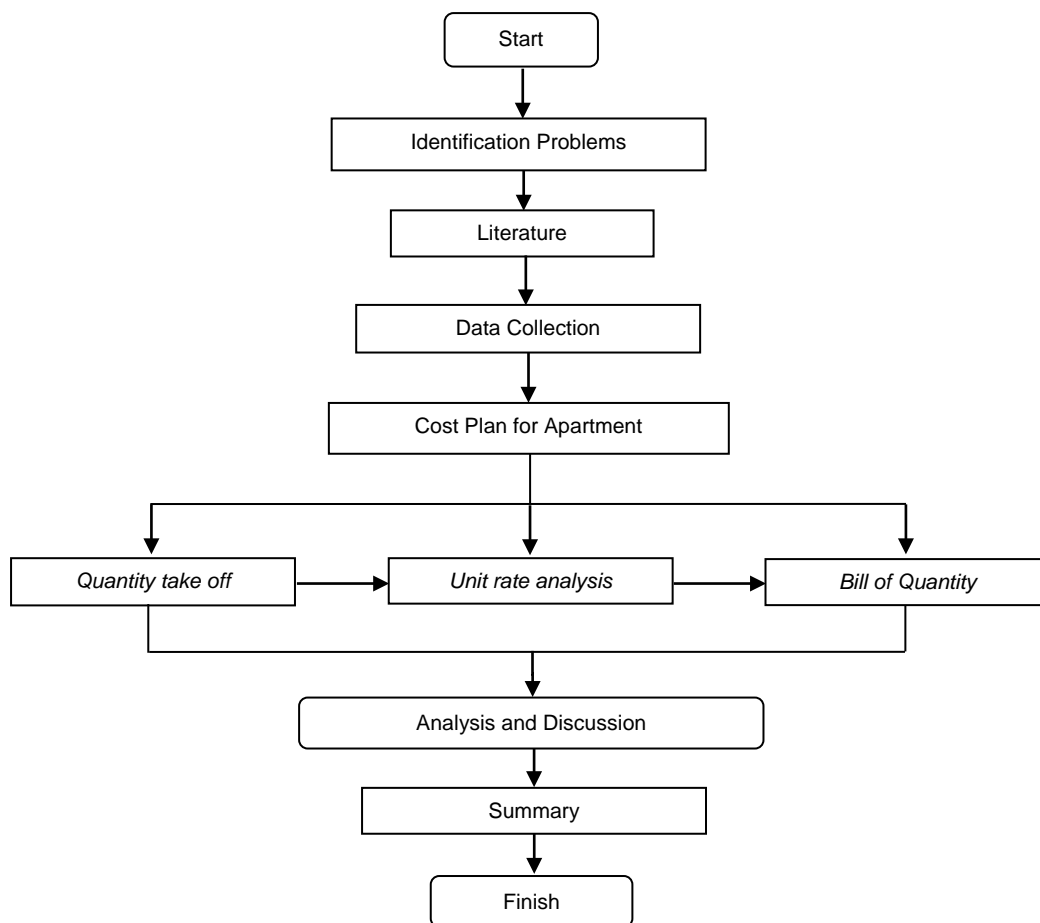


Figure 1. Research Flowchart

ANALYSIS AND DISCUSSION

The structure of the building must have a complete lateral and vertical force, which can provide strength, rigidity, and energy dissipation capacity that sufficiently restrains the motion of the design ground within the limits of the deformation needs and the required strength of the structure of the building (SNI, 2012). The Upper Structure of the project consists of shear walls, columns, beams, floor plates, stairs, ramps, and parapet walls with the function and role of each element. The upper structure is planned to assume based on minimum criteria in Standard Procedures for Calculation of Concrete Structures number: SNI 2647-2013.

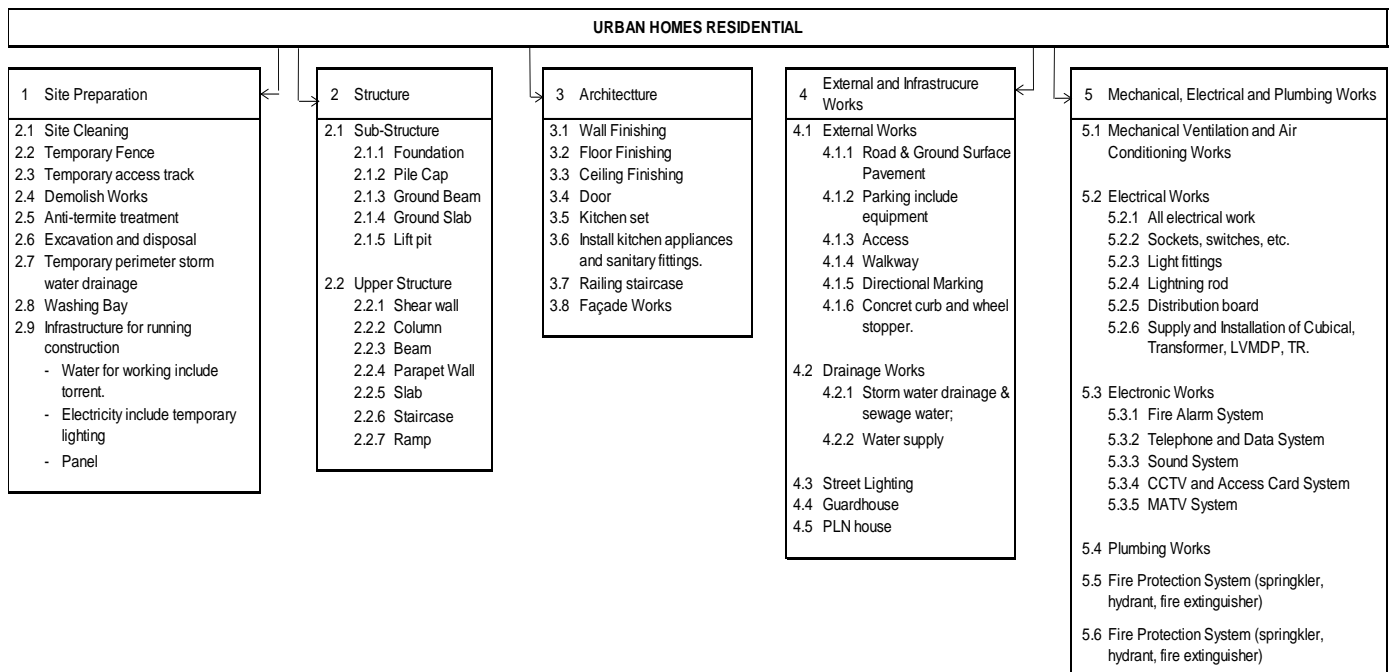
Based on references and expert opinions in the field of Quantity Surveyors, the planning of construction project costs at the estimation stage will be influenced by the following:

1. Location
The farther the location is from the city center, the greater the cost of building the project, and if the closer it is, the smaller the cost spent.
2. Type of structure and soil condition
In the selection of building structures following the condition of the land because it needs consideration so that there is no over design or budget.

3. Building design and space composition
The more complex the shape of the building and the amount of space composition in it the greater the cost of building the project, and vice versa (Chandra, 2011).
4. Size of building
The smaller the size of the building (the floor area of the building) the greater the cost of building the project, and the larger the size of the building, the smaller the cost of building the project (Chandra,2011).
5. Contract Period
The Contract Period relates to the size of the building, usually the larger the building the longer the construction time (contract period).
6. Implementation Method (Construction Method)
The method of implementation used in construction will affect the costs incurred. The selection of working methods must be adjusted to the location and work carried out.

Scope work in a project is spelled out in the Works Breakdown Structure (Table 1) to approve the planning and scheduling of the project. The scope of work in the Urban Home Residential project consists of some work packages as following: (1) field preparation, (2) structure, (3) architecture, (4) external and infrastructure work, and (5) mechanical, electrical, and plumbing.

Table1. Works Breakdown Structure (WBS) on the Urban Homes Residential Tower project



Every element of the upper structure work consists of the shear wall, columns, beams, parapet walls, floorplates, stairs, and ramps are calculated in quantity

take-off so that the quantity for concrete work, formwork, and reinforcement of the upper structure work elements in Table 2.

Table 2. Summary of Upper Structure Work Quantity

	Concrete (m3)				Formworks (m2)	Wiremesh (m2)		Rebar (kg)					Ratio		
	FC' 45Mpa	FC' 40Mpa	FC'35Mpa	FC'30Mpa		M6	D8	D10	D13	D16	D19	D22	D25	m2/m3	kg/m3
Shear Wall	1,238	1,748	1,840	1,857	36,823	-	-	5,038	711,499	78,541	126,644	178,191	260,110	5.51	203.48
Column	2,327	1,058	852	563	21,728	-	-	100,672	346,959	-	-	197,328	821,499	4.53	305.54
Beam	-	-	4,356	2,293	51,309	-	-	63,615	219,300	17,878	43,773	1,182,171	14,509	7.72	231.81
Slab	-	-	3,974	5,255	68,845	193,833	-	332,023	-	-	-	-	-	7.46	35.98
Staircase	-	-	170	-	1,130	-	-	20,327	-	-	-	-	-	6.67	119.89
Parapet Wall	-	-	-	208	1,611	-	5,189	4,043	13,037	-	-	-	-	7.75	82.15
TOTAL	3,565	2,807	11,192	10,175	181,446	193,833	5,189	525,718	1,290,796	96,420	170,417	1,557,689	1,096,119	6.54	170.78

Based on Table 2 is that enter the appropriate quantity on Bill of Quantity.

Table 3. Bill of Quantity of Cost Plan

Description	Quantity	Unit	Unit Rate	Amount (Rp)
<u>Reinforced concrete with grade Fc' 30 Mpa as described in</u>				
to shear wall	1,857	m3	1,198,560	2,225,725,920
to column	563	m3	1,198,560	674,789,280
to beam	2,293	m3	1,198,560	2,748,298,080
to slab	5,255	m3	1,198,560	6,298,432,800
to parapet wall	208	m3	1,198,560	249,300,480
<u>Reinforced concrete with grade Fc' 35 Mpa as described in</u>				
to shear wall	1,840	m3	1,209,780	2,225,995,200
to column	852	m3	1,209,780	1,030,732,560
to beam	4,356	m3	1,209,780	5,269,801,680
to slab	3,974	m3	1,209,780	4,807,665,720
to staircase	170	m3	1,209,780	205,662,600
<u>Reinforced concrete with grade Fc' 40 Mpa as described in</u>				
to shear wall	1,748	m3	1,277,100	2,232,370,800
to column	1,058	m3	1,277,100	1,351,171,800
<u>Reinforced concrete with grade Fc' 45 Mpa as described in</u>				
to shear wall	1,238	m3	1,344,420	1,664,391,960
to column	2,327	m3	1,344,420	3,128,465,340
<u>Sawn formwork as described to</u>				
to shear wall	36,823	m2	129,103	4,753,972,043
to column	21,728	m2	128,619	2,794,640,875
to beam	51,309	m2	131,919	6,768,649,074
to slab	68,845	m2	125,331	8,628,402,860
to staircase	1,130	m2	117,920	133,249,600
to parapet wall	1,611	m2	129,103	207,985,470
<u>Mild Steel rod reinforcement: BJTP-24: to concrete works including stirrups, binders, hooks and cranks as described in</u>				
to parapet wall				
8mm diameter rods	5,189	kg	12,491	64,815,799
<u>High tensile deformed rod reinforcement: BJTD-40: to concrete works including stirrups, binders, hooks and cranks as described in</u>				
to shear wall				
10mm diameter rods	5,038	kg	12,606	63,509,028
13mm diameter rods	711,499	kg	12,606	8,969,156,394
16mm diameter rods	78,541	kg	12,606	990,087,846
19mm diameter rods	126,644	kg	12,606	1,596,474,264
22mm diameter rods	178,191	kg	12,606	2,246,275,746
25mm diameter rods	260,110	kg	12,606	3,278,946,660

Description	Quantity	Unit	Unit Rate	Amount (Rp)
to column				
10mm diameter rods	100,672	kg	12,606	1,269,071,232
13mm diameter rods	346,959	kg	12,606	4,373,765,154
22mm diameter rods	197,328	kg	12,606	2,487,516,768
25mm diameter rods	821,499	kg	12,606	10,355,816,394
to beam				
10mm diameter rods	63,615	kg	12,606	801,930,690
13mm diameter rods	219,300	kg	12,606	2,764,495,800
16mm diameter rods	17,878	kg	12,606	225,370,068
19mm diameter rods	43,773	kg	12,606	551,802,438
22mm diameter rods	1,182,171	kg	12,606	14,902,447,626
25mm diameter rods	14,509	kg	12,606	182,900,454
to slab				
10mm diameter rods	332,023	kg	12,606	4,185,481,938
13mm diameter rods	-	kg	12,606	-
to staircase				
10mm diameter rods	20,327	kg	12,606	256,242,162
to parapet wall				
10mm diameter rods	4,043	kg	12,606	50,966,058
13mm diameter rods	13,037	kg	12,606	164,344,422
<u>Wiremesh reinforcement: Fy = 500 Mpa: to concrete works including stirrups, binders, hooks and cranks as described in</u>				
to slab				
M6	193,833	m2	61,981	12,013,999,581
Total				129,195,120,664

Items on the Bill of Quantity of cost plan are adjusted to drawings and technical specifications of the work. The unit rate on the Bill of Quantity of cost plan can be obtained from the calculation of Work Unit Price Analysis (AHSP) refer to Minister of Public Works Regulation 28/2016 on the Cipta Karya building and the price of material, wages, and equipment from the price of DKI Jakarta in 2021.

Then, the total cost of upper structural work on the Urban Homes Residential Tower B project is become amounted to Rp129,195,120,664. The calculation result can be seen in Table 3.

To find out the difference in the bill of quantity of cost plan and bill of quantity of cost contract, firstly, can be seen at the bill of quantity of cost contract on Table 4.

Table 4. Bill of Quantity of Cost Contract

Description	Quantity	Unit	Unit Rate	Amount (Rp)
<u>Reinforced concrete with grade Fc' 30 Mpa as described in</u>				
to shear wall	1,857	m3	1,084,300	2,013,545,100
to column	563	m3	1,084,300	610,460,900
to beam	2,293	m3	1,084,300	2,486,299,900
to slab	5,255	m3	1,084,300	5,697,996,500
to parapet wall	208	m3	1,084,300	225,534,400
<u>Reinforced concrete with grade Fc' 35 Mpa as described in</u>				
to shear wall	1,840	m3	1,117,300	2,055,832,000
to column	852	m3	1,117,300	951,939,600
to beam	4,356	m3	1,117,300	4,866,958,800
to slab	3,974	m3	1,117,300	4,440,150,200
to staircase	170	m3	1,117,300	189,941,000
<u>Reinforced concrete with grade Fc' 40 Mpa as described in</u>				
to shear wall	1,748	m3	1,139,300	1,991,496,400
to column	1,058	m3	1,139,300	1,205,379,400
<u>Reinforced concrete with grade Fc' 45 Mpa as described in</u>				
to shear wall	1,238	m3	1,183,250	1,464,863,500
to column	2,327	m3	1,183,250	2,753,422,750
<u>Sawn formwork as described to</u>				
to shear wall	36,823	m2	136,450	5,024,498,350
to column	21,728	m2	111,600	2,424,844,800
to beam	51,309	m2	147,300	7,557,815,700
to slab	68,845	m2	132,200	9,101,309,000
to staircase	1,130	m2	136,450	154,188,500
to parapet wall	1,611	m2	136,450	219,820,950

Description	Quantity	Unit	Unit Rate	Amount (Rp)
<u>Mild Steel rod reinforcement: BJTP-24: to concrete works including stirrups, binders, hooks and cranks as described in</u>				
to parapet wall				
8mm diameter rods	5,189	kg	11,500	59,673,500
<u>High tensile deformed rod reinforcement: BJTD-40: to concrete works including stirrups, binders, hooks and cranks as described in</u>				
to shear wall				
10mm diameter rods	5,038	kg	12,942	65,201,796
13mm diameter rods	711,499	kg	12,942	9,208,220,058
16mm diameter rods	78,541	kg	12,942	1,016,477,622
19mm diameter rods	126,644	kg	12,942	1,639,026,648
22mm diameter rods	178,191	kg	12,942	2,306,147,922
25mm diameter rods	260,110	kg	12,942	3,366,343,620
to column				
10mm diameter rods	100,672	kg	12,942	1,302,897,024
13mm diameter rods	346,959	kg	12,942	4,490,343,378
22mm diameter rods	197,328	kg	12,942	2,553,818,976
25mm diameter rods	821,499	kg	12,942	10,631,840,058
to beam				
10mm diameter rods	63,615	kg	12,942	823,305,330
13mm diameter rods	219,300	kg	12,942	2,838,180,600
16mm diameter rods	17,878	kg	12,942	231,377,076
19mm diameter rods	43,773	kg	12,942	566,510,166
22mm diameter rods	1,182,171	kg	12,942	15,299,657,082
25mm diameter rods	14,509	kg	12,942	187,775,478
to slab				
10mm diameter rods	332,023	kg	12,942	4,297,041,666
13mm diameter rods	-	kg	12,942	-
to staircase				
10mm diameter rods	20,327	kg	12,942	263,072,034
to parapet wall				
10mm diameter rods	4,043	kg	12,942	52,324,506
13mm diameter rods	13,037	kg	12,942	168,724,854
<u>Wiremesh reinforcement: Fy = 500 Mpa: to concrete works including stirrups, binders, hooks and cranks as described in</u>				
to slab				
M6	193,833	m2	48,013	9,306,503,829
Total				126,110,760,973

Based on Table 4, volume on the work item can be known in advance by doing calculations on the quantity take-off and unit price is the price proposed by the

vendor on the Urban Homes Residential development project with a total cost of Rp126,110,760,973. After calculating the cost plan and contract cost, the comparison value can be calculated in Table 5.

Table 5. Comparison Bill of Quantity Cost Plan and Contract Cost

Description	Amount (Rp)
A. COST PLAN	
SHEAR WALL WORKS	30,246,905,861
COLUMN WORKS	27,465,969,403
BEAM WORKS	34,215,695,910
SLAB WORKS	35,933,982,899
STAIRCASE WORKS	595,154,362
PARAPET WALL WORKS	737,412,229
TOTAL COST PLAN	129,195,120,664

Description	Amount (Rp)
B. CONTRACT COST	
SHEAR WALL WORKS	30,151,653,016
COLUMN WORKS	26,924,946,886
BEAM WORKS	34,857,880,132
SLAB WORKS	32,843,001,195
STAIRCASE WORKS	607,201,534
PARAPET WALL WORKS	726,078,210
TOTAL CONTRACT COST	126,110,760,973
COST DIFFERENCE (B-A)	3,084,359,691
PERCENTAGE OF COST PLAN AND CONTRACT COSTS (%)	2.45%

Based on Table 5 the total cost of upper structure work on the Urban Homes Residential Tower B project for cost plan is Rp129,195,120,664 and contract cost is Rp126,110,760,973 with a cost difference of Rp3,084,359,691 with a comparative percentage of 2.45% of the contract cost.

Based on Table 3 and Table 4 comparison in Bill of quantity cost plan and contract rate is in the unit price. The difference in unit prices is caused by differences in the prices of wages, materials, and tools and the Work Unit Price Analysis (AHSP). The prices for wages, materials, and tools at cost plan are the prices for DKI Jakarta in 2021 without any discounts and negotiations with vendors, while the prices for wages, materials, and materials at the contract value are the prices for Tangerang in 2020 which have been discounted and negotiated with vendors. Work Unit Price Analysis (AHSP) on cost plan refer to PM-PUPR-28/2016 while on contract cost refer to Work Unit Price Analysis (AHSP) from vendors which cause differences in coefficients from materials, wages, and tools.

The difference between cost plan and contract costs also occurs in research conducted by Artiani & Surya (2019), the difference between planning costs and contract costs is 18%. The calculation of planning costs is calculated by the planning consultant. Things that can be done to maximize planning costs include a more accurate calculation of the volume of work.

CONCLUSION

Cost planning in construction projects is influenced by location, type of structure and soil conditions, building design and space composition, building size, contract period, and implementation method. The cost needed to carry out the upper structure work on the Urban Homes Residential project is Rp. 129,195,120,664 with an area of 89,054.11 m² and the cost per m² of the upper structure is Rp. 1,523,000. The comparison of

planning costs and contract costs is Rp3,084,359,691 with a comparison percentage of 2.45% of contract costs. Differences in the budget plan of cost plan and contract cost are found in unit prices in the RAB caused by differences in the prices of wages, materials, and tools and the Work Unit Price Analysis (AHSP). Further studies are needed to reduce the difference between the cost plan and the contract cost.

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