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ANALYSIS OF CONCRETE COLUMN REQUIREMENTS IN THECONSTRUCTION OF IPEKA BSD CHRISTIAN SCHOOL PHASE3: AN APPROACH TO EFFECTIVE IMPLEMENTATION METHODS

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Abstract: The construction of the Ipeka Christian School is an effort made to improve the quality of education based on Christian values. The Ipeka Foundation is constructing the third building of the Ipeka BSD Christian School which is located on Jl. BSD Boulevard Utara No. Lot 02, Lengkong Kulon, Pagedangan District, Tangerang Regency, Banten. This project was built on an area of 3,500 m^2, building area 5,700 m^2 with a building height of ± 28.50 m. The Ipeka Foundation as the owner entered into the contract agreement *lump sum fixed* price worth IDR 41,000,000,000.00 to PT. Ekamitra Talentama as the main contractor with an implementation time of 7 months and a maintenance time of 1 year. Observations carried out in the field were in the form of upper structural work which included beams, floor plates and columns with a discussion regarding the implementation of column work and the volume requirements for C1B type column concrete on the 5th floor. Column structures are building structures that function to carry vertical loads and distribute these loads to foundation. Based on the data and calculation results, the volume of concrete required for type C1B columns on the 5th floor is 26,044 m^3. The stages of the column work implementation method include: *marking as* columns, rebar fabrication, reinforcement installation, reinforcement checking, formwork installation, casting work, formwork removal and concrete maintenance.
Keywords: Column, Concrete Volume, Implementation Method.

INTRODUCTION

The development of educational facilities and infrastructure is one of the factors in supporting the learning process in schools, for this reason it is necessary to improve its utilization and management. The construction of the Ipeka BSD Christian School Phase 3 is an effort to meet the needs of the community in the Bumi Serpong Damai (BSD) area regarding a Christian school that is quality, superior and based on Christian values. Construction of the Ipeka BSD Christian School Phase 3 will begin in December 2023 with an implementation period of 7 months and building maintenance time of 1 year.

The role of school buildings is that planning for school construction, both structural and non-structural buildings, must be based on careful planning in order to achieve maximum results and satisfaction. The stages of construction work have different implementation methods for each job. Column work is one of the ongoing works when the author is doing practical work in the field. Columns are building structures that function to carry vertical axial compressive loads from the upper structural frame and channel these loads into the foundation (Ayu M. and Priyanto, 2023). This research aims to determine the method of carrying out column work and calculating the concrete volume requirements for type C1B columns on the 5th floor. This report was prepared based on data and the results of direct student observations in the Ipeka BSD Christian School Phase 3 Construction project.

RESEARCH METHODS

This research was conducted using observation methods and qualitative methods. The observation method is a method carried out by directly observing field work, interviews with project workers and documentation of an object during the working day at the Ipeka BSD Christian School Construction Project Phase 3. The qualitative method is a method that focuses on analytical data and information obtained from construction project. The research method is contained in Figure 1.

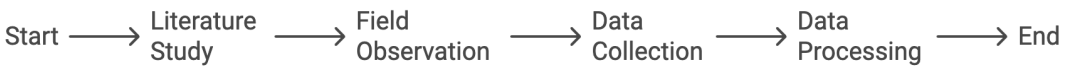

Figure 1. Research Method Flow Diagram

RESULTS AND DISCUSSION

Column Work Implementation Method

One of the main structures of a building is a column. Columns are building structures that function to carry vertical axial compressive loads and channel these loads into the foundation. The material used in the column structure is reinforced concrete. Reinforced concrete is two types of construction materials that combine the compressive strength of concrete with the tensile strength of reinforcing steel, thus providing strength and bending power to support the load above it. The construction project implementation method is the stages of work implementation that are logical and in accordance with the availability of required resources and field conditions to support the implementation of effective and efficient work. The stages of implementing column work in the Ipeka BSD Christian School Construction Project Phase 3 can be seen in the flow diagram below.

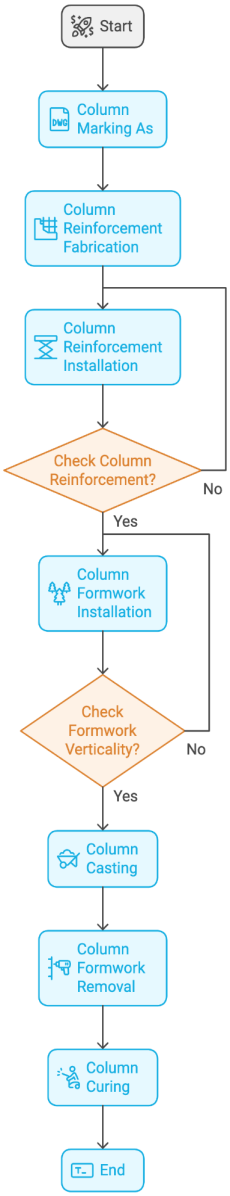

Figure 2. Flowchart of Column Work Implementation Methods

The explanation of the method for carrying out column work in the Ipeka BSD Christian School Construction Project Phase 3 is as follows.

1. *Marking As* Column
   Column preparation work is carried out by marking. *Marking* serves to determine the axle point of a column or base line for determining location *formwork* and reinforcement according to the working drawings. *Marking as* column is done using *total station.*

Figure 3. *Marking As* Column

2. Column Reinforcement Fabrication
   Column reinforcing steel fabrication is the manufacture of column reinforcement which is carried out at the project manufacturing location in accordance with predetermined plan drawings. All iron materials are manufactured according to requirements such as length of reinforcement, diameter of reinforcement, bending length, and the manufacture of stirrup reinforcement must comply with the provisions specified in the work drawings.

Figure 4. Column Reinforcement Fabrication

3. Reinforcement Installation
   Reinforcing columns function as concrete reinforcement and increase the column's resistance to the load carried. The column reinforcement that has been assembled at the manufacturing location is then lifted using *tower crane* and placed perpendicularly at the specified column axle point.

Figure 5. Installation of Column Reinforcement

4. Checking Column Reinforcement
   Checking the reinforcement serves to ensure the amount of reinforcement, the distance between the stirrup reinforcement and the dimensions of the reinforcement used are in accordance with the work drawings and column reinforcement specifications.

Figure 6. Checking Column Reinforcement

5. Installation *Formwork* Column
   Installation *formwork* column is carried out after checking the column reinforcement is complete. Formwork functions as a concrete mold and as a temporary holding device during casting. Installation *formwork* sturdy, you can use a column belt tensioner and inter-column binding wire.

Picture 7. Installation *Formwork* Column

6. Checking *Verticality Bekisting*
Checking *verticality bekisting* done to be sure *formwork* The column is installed in a perpendicular position so that the column structure is perpendicular in accordance with the working drawings.

Figure 8. Checking *Verticality Bekisting*

7. Column Casting
Casting is done in stages by pouring fresh concrete from *truck mixer* the *concrete pump machine* or *bucket concrete*, which is then poured into *formwork* Columns and concrete are compacted using tools *vibrator concrete*. Before casting is done, test it *slump* to find out the value of concrete slippage.

Figure 9. Column Casting

8. Demolition *Formwork* Column
   The column structure that has been cast is then left for ± 12 hours for the concrete drying process. After the drying process has passed the standard disassembly, release *formwork* can be dismantled.

Figure 10. Disassembly *Formwork* Column

9. Column Maintenance
   Column maintenance is carried out after dismantling the column by covering the concrete surface with water. Column maintenance aims to maintain the temperature and humidity of the concrete until the concrete reaches the desired quality.

Figure 11. Column Maintenance

Calculation of Concrete Volume Requirements for Type C1B Columns

Using the right reinforcement and concrete volume is a way to ensure the strength and durability of the column. Column reinforcement provides additional strength to withstand the load received by the column, both compressive and tensile loads. There are 41 columns on the 5th floor with 7 different column types including column type C1, type C1A, type C1B, type C2, type C4, type C10 and type C13 which can be seen in the working drawings in attachment 7. There are 12 type C1B columns. where the calculation of the C1B type column reinforcement requirement for the Ipeka BSD Christian School Construction Project Phase 3 is as follows.

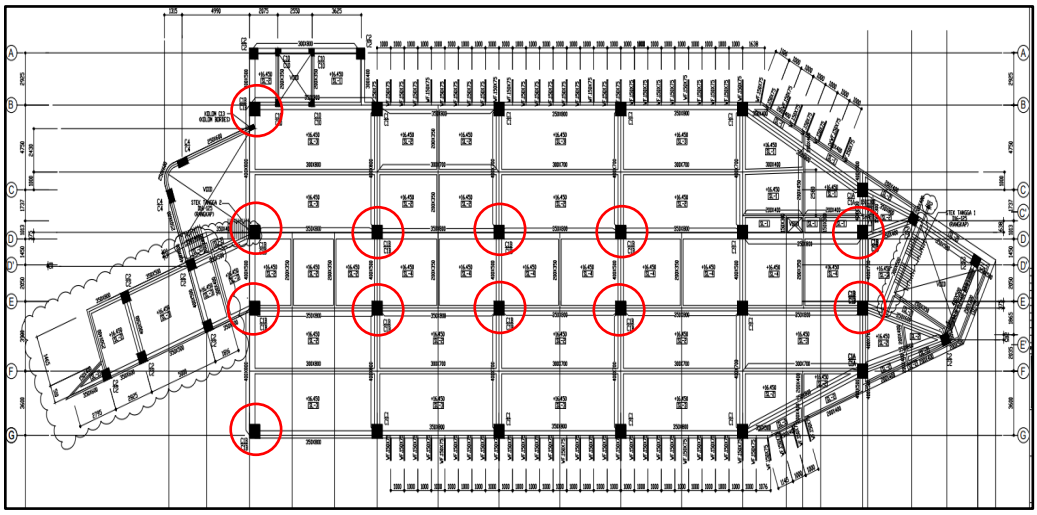

Figure 12. Floor Plan 5 of Ipeka BSD Christian School Project Phase 3

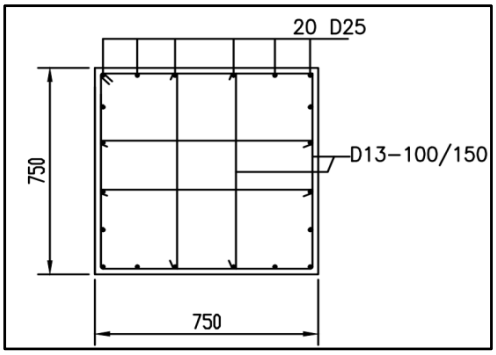

Figure 13. Column Type C1B

1. Column Specifications
   a. Number of columns of type C1B = 12 pieces
   b. Column height = 4,000 m
   c. Column dimensions = 0,75 × 0,75
   d. Concrete blanket = 0,040 m
   e. Main reinforcement = 20D25
   f. Stirrup reinforcement = D13 – 100/150

2. Main Reinforcement
   a) Reinforcement length = (Column height + Tul connection.) × Number of tul.

      = (4,000 + (45 × 0,025)) × 240
      = 1230 m

   b) Volume = $\left(\frac{1}{4}\times\pi\times D^2\right)\times$ Panjang tulangan

      = $\left(\frac{1}{4}\pi\times 0,025^2\right)\times 1230$

      = 0,604 m^3

3. Support Stirrup Reinforcement

a) Total length of tul. = (Tul. length + Hook length) × Number of tuls. × Number of columns
= (2,680 + 0,156) × 22 × 12
= 748,704 m

b) Reinforcement volume = $\left(\frac{1}{4}\times\pi\times D^2\right)$ × Total panjang tulangan
= $\left(\frac{1}{4}\times\pi\times 0,013^2\right)\times 748,704$
= 0,099 m^3

Table of Recapitulation of Column Iron Calculation Results

Information	Length (m)	Volume (m^3)
Main reinforcement	1230	0,604
Support Stirrup Reinforcement	748,704	0,099
Sengkang Field Reinforcement	476,448	0,063
Sengkang Reinforcement Ties in X & Y Direction	1427,328	0,189
Reinforcement D25	**1230**	**0,604**
Reinforcement D13	**2652,480**	**0,352**

4. Calculation of Reinforcement Requirements

a) D25 reinforcement requirement = $\frac{1230}{12}$
= 102.5 ≈ 103 reinforcing iron

b) Reinforcement requirements D13 = $\frac{2652,480}{12}$
= 221,040 ≈ 222 reinforcing iron

5. Concrete Volume Calculation

a) Column volume = P × L × T × Jumlah kolom
= 0,750 × 0,750 × 4,000 × 12
= 27 m^3

b) Concrete volume = Column volume – Reinforcement volume
= 27 m^3 – 0,956 m^3
= 26,044 m^3

Based on calculations, it is concluded that the C1B type column on the 5th floor requires 26,044 m of fresh concrete[3] or 4 *truck mixer* with a capacity of 7 m^3. The availability of work equipment is a very important factor in carrying out construction work to influence the success of a project development work. The construction equipment used in the implementation of the Ipeka BSD Christian School Construction Project Phase 3 is a*go compressor*, *bare bender*, *bar cutter*, claw, *concrete bucket*, *concrete pump truck*, *concrete vibrator*, *core drill machine*, *excavator*, grinder, lighting lamp, *mixer truck*,

tower crane, *scaffolding* (scaffolding), properties, *total station*, *trowel*, little by little *spirit level*.

Construction materials are materials needed for project construction work. The choice of material must pay attention to its quality to get good building quality. The materials used in the implementation of the Ipeka BSD Christian School Construction Project Phase 3 are light brick and red brick, reinforcing iron, concrete *decking*, concrete *ready mix*, chicken claws, wire and white wire, concrete glue, sand, cement mortar and Portland cement.

CONCLUSIONS AND SUGGESTIONS

Based on observations of the Ipeka BSD Christian School Construction Project Phase 3, the method for implementing column work includes work *marking as* columns, fabrication of reinforcing steel, installation of column reinforcement, checking of reinforcement, installation *formwork* column, column casting, removal *formwork* and concrete maintenance. Based on calculations, the C1B type column on the 5th floor requires 1230 m of D25 reinforcement or 103 rebars and 2652,480 m of D13 reinforcement or 222 rebars with a required concrete volume of 26,044 m.^{3} or as many as 4 mixer trucks with a capacity of 7 m^3.

Suggestions that can be given for further observation of column work are to obtain more data so that we can calculate the quantity of column reinforcement in reinforced concrete structures using *bar bending schedule* or the per unit length approach method that has been researched.

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