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STEEL COLUMN CONSTRUCTION METHOD IN WAREHOUSE DEVELOPMENT: A CASE STUDY IN CENGKARENG, WEST JAKARTA

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Abstract: This study discusses the implementation method of steel column construction in the warehouse in Cengkareng, West Jakarta. Steel columns are essential components in structural systems, responsible for carrying and transferring vertical and lateral loads. The construction process was carried out in several stages: preparation of shop drawings, installation of anchor bolts, erection of steel columns using a crane, vertical alignment checking with a water pass, and final stabilization through grouting. A Tadano TG-500M mobile crane with a 50-ton capacity was used to assist in lifting and installing the steel columns. Over 25 days, a total of 36 columns were successfully installed under careful coordination and field supervision. Grouting was applied to fill the gaps between the base plate and the concrete foundation, ensuring proper structural stability. This method proved to be efficient and aligned with standard construction practices. The study applied a descriptive qualitative approach through direct observation, documentation, and literature review. The results highlight the importance of systematic execution and the use of appropriate tools to ensure structural quality and safety. Moreover, this internship provided valuable hands-on experience in applying civil engineering theory to real-world construction projects.

Keywords: Steel Column, Implementation Method, Crane, Grouting, Civil Engineering Internship

INTRODUCTION

Steel columns are essential components in building structures, functioning to transfer both vertical and lateral loads. In the execution of steel column construction, several common methods are typically applied. For strengthening existing steel columns, techniques such as concrete jacketing and steel jacketing have been proven effective in enhancing structural performance. The concrete jacketing method involves increasing the column's cross-sectional dimensions to improve its ability to resist applied forces. This approach has demonstrated significant effectiveness in enhancing the column's capacity to withstand structural loads ((Hidayati, 2022); (Anand et al., 2021a)). On the other hand, steel jacketing increases the stiffness and load-bearing capacity of existing columns by adding external steel layers. This method has shown high effectiveness, particularly in improving performance under axial loads ((Mujahid, 2023; El-Badawy Sayed, 2009). Research has indicated that columns reinforced using jacketing techniques exhibit substantial improvements in both axial load resistance and deformation capacity (Mujahid, 2023);(Raza et al., 2019).

In this warehouse construction project, the installation of steel columns followed a series of structured steps beginning with material preparation through to structural assembly. The columns were installed using a crane-assisted erection method, where the crane served as the primary lifting and positioning tool for the steel structures. The crane used in this project was a Tadano TG-500M with a 50-ton capacity, rented at approximately IDR 11 million per 8-hour session. The total duration of the steel erection process was 25 days, spanning from October 3, 2024, to November 6, 2024. The total crane rental cost for the period was approximately IDR 275 million, excluding mobilization, demobilization, and VAT charges.

The methodology for enhancing steel column structures encompasses various techniques aimed at increasing their stiffness, load-bearing capacity, and seismic performance. One of the predominant methods involves the utilization of externally wrapped steel plates or angles, which serve as a reinforcement strategy for existing structures, particularly reinforced concrete (RC) columns. This approach, often referred to as steel jacketing, significantly improves the mechanical performance of the columns by increasing stiffness and strength, as demonstrated in several studies (Akter & Habib, 2019; El-Badawy Sayed, 2009b).

The steel jacketing method includes different configurations, such as the use of angle steel wrapped around the corners of columns, which are then welded to flat steel plates to enhance rigidity. This method is divided into dry and wet strengthening techniques, with each showing considerable effectiveness in improving the axial load capacity of the columns under static conditions (Mujahid, 2023; Zhou et al., 2019). Specifically, steel jacketing has been reported to result in an increase in bearing capacity of approximately 80% over unreinforced columns, making it a popular choice in structural retrofitting applications (Anand et al., 2021b).

This study discusses the implementation method of steel column structural work in the construction project of a storage warehouse for PT. Sahabat Intim Plasindo in Kapuk, Cengkareng, West Jakarta. The project involves the application of civil engineering theory in practical settings to gain a comprehensive understanding of the construction process.

RESEARCH METHOD

This research uses a descriptive qualitative approach aimed at systematically and factually describing the implementation method of steel column work on the warehouse construction project. Data were collected through direct field observations, project documentation, and informal interviews with field workers and supervisors.

The research was conducted at the warehouse construction project is located at Cengkareng, West Jakarta. The object of this research is the stages of steel column installation work, including the preparation of shop drawings, installation of anchor bolts, steel column erection using cranes, and the grouting process as the final installation step. Figure 1 shows the detailed procedure for this research.

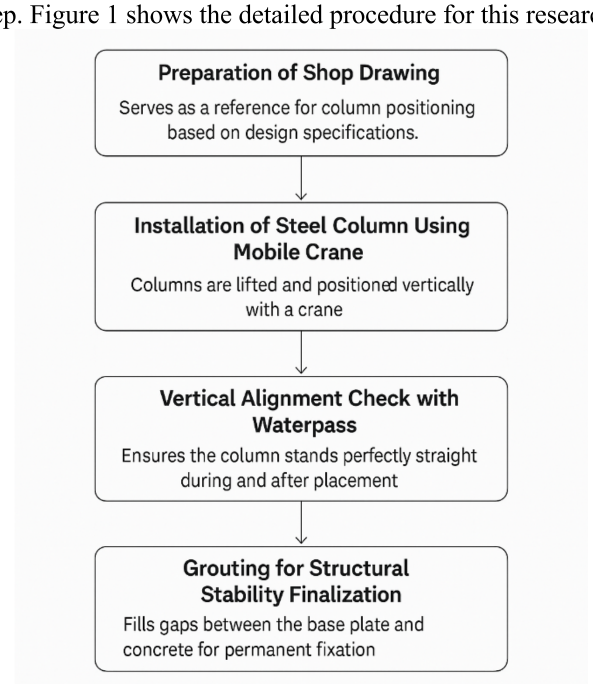

Figure 1. Flowchart of the research methodology

The data collection techniques used in this study include conducting direct observations during the internship activities to record work stages, equipment used, and techniques and procedures applied in the installation of steel columns. Collection of technical drawings (shop drawings), field activity photos, and material specification data from the contractor to support the observations. A literature review was conducted using books and relevant online sources related to steel construction implementation and construction project management.

The collected data were analyzed qualitatively by comparing the field implementation stages with theories and standards of steel construction work. The analysis results were used to evaluate the implementation method in terms of efficiency, work safety, and time accuracy. This study also refers to the steel column installation flow derived from field observations, which includes preparation of shop drawings, installation of anchor bolts, erection of steel columns using a mobile crane, verticality check using a waterpass, and grouting for final structural stability.

RESULT AND DISCUSSION

Implementation of Steel Column Installation

The implementation of the steel column structure at the warehouse construction site of PT. Sahabat Intim Plasindo followed a systematically structured method to ensure safety, stability, and conformity with design specifications. The entire process was carried out over 25 days using a mobile crane (Tadano TG-500M, 50 tons capacity) for lifting and positioning the steel columns.

The main stages of implementation included:

1. Preparation of Shop Drawing
   Detailed technical drawings were produced to determine the exact positioning of 36 steel columns. These drawings were essential for aligning field execution with design specifications, as shown in Figure 2.

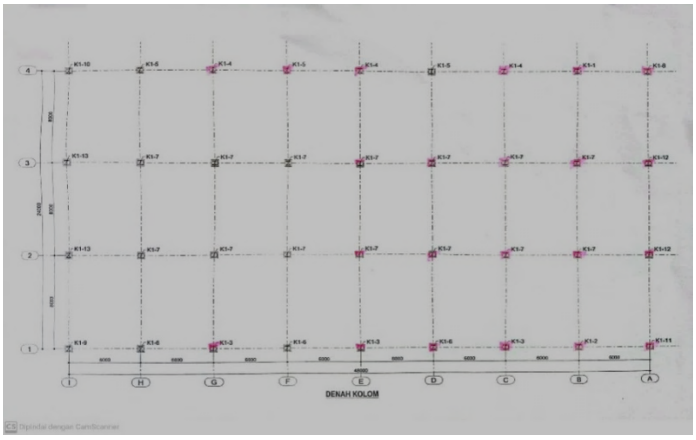

Figure 2. Column Plan

2. Anchor Bolt Installation
   The project employed 24 mm diameter, 1-meter long *cast-in-place* anchor bolts, arranged in sets of eight per column base. The bolts were secured using steel plate molds (4 mm thickness) and welded to the reinforcement of the concrete base prior to casting, as shown in Figure 3.

Figure 3. Embedded Anchors in Concrete Columns

3. Column Erection with Crane
   Steel columns of type H-Beam (400x400x13x21 mm for floors 1–3 and WF 350x175x7x11 mm for floor 4) were lifted and vertically positioned using a mobile crane. Precision was ensured through real-time coordination between crane operators and ground personnel using guide ropes and water passes for verticality checks, as shown in Figure 4.

Figure 4. Steel Column Installation Process

4. Verticality Verification
   Proper alignment was confirmed using waterpass tools. Adjustments were made before tightening the anchor bolts to ensure that the steel column stood perfectly vertical.
5. Grouting for Stability
   The final step involved pouring a cementitious grout mixture under the base plate to fill any voids and provide uniform load transfer. The process used a temporary formwork to contain the grout until it cured, as shown in Figure 5.

Figure 5. Grouting Work Process

Field Challenges and Solutions

During the implementation phase, minor setbacks were observed, notably:

1. Concrete Voids (Honeycombs)
   In several column base regions, the concrete exhibited surface defects due to inadequate vibration during casting. These defects were mitigated using grouting to repair the voids and restore structural integrity.
2. Weather and Logistics
   Occasional rain and delays in material delivery required scheduling adjustments and temporary work stoppages. These were addressed by implementing flexible work shifts and reinforced material tracking.

Discussion

The field implementation demonstrated that applying a structured installation sequence for steel columns, coupled with close supervision and modern equipment, ensures not only safety but also execution efficiency. The use of mobile cranes significantly reduced installation time compared to conventional manual hoisting methods. The integration of shop drawing precision**,** on-site coordination, and quality control measures (e.g., waterpass, grouting inspection) highlighted the importance of procedural standardization in steel structure installation. These findings align with recommendations from Ervianto (2023) and current construction management practices that emphasize methodical execution, material quality control, and collaborative field supervision. Furthermore, the experience enabled student interns to bridge the gap between academic theory and practical application, supporting professional readiness in the civil engineering sector.

CONCLUSION

The implementation of steel column installation in the warehouse construction project of PT. Sahabat Intim Plasindo was carried out through a structured and efficient method that emphasized accuracy, safety, and stability. The stages, which included shop drawing preparation, anchor bolt installation, crane-assisted erection, vertical alignment verification, and final grouting, demonstrated a high level of coordination between technical planning and on-site execution. Field observations confirmed that the use of appropriate tools, such as mobile cranes and waterpass instruments, significantly contributed to installation precision and time efficiency. Grouting played a critical role in ensuring load transfer and minimizing structural gaps at the base connection. Despite encountering minor field issues such as concrete honeycombs and logistical delays, appropriate corrective actions were taken, reflecting effective construction management. These practical experiences also provided valuable learning opportunities for students to bridge academic theory with industry practices, particularly in steel structure implementation. This study highlights the importance of methodological discipline, supervision, and the integration of engineering principles in achieving successful steel structure installations in construction projects.

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REFERENCES

Akter, F., & Habib, Md. H. (2019). Steel Angles and Strips Jacketing of Existing RC Columns: A State of Art. *IARJSET*, *6*(5), 17–22. https://doi.org/10.17148/IARJSET.2019.6504

Anand, P., Sinha, A. K., & Kumar, C. (2021a). Investigation of reinforced concrete jacketed columns under different loading conditions. *International Journal of Advanced Technology and Engineering Exploration*, *8*(81), 957–969. https://doi.org/10.19101/IJATEE.2021.874182

Anand, P., Sinha, A. K., & Kumar, C. (2021b). Investigation of reinforced concrete jacketed columns under different loading conditions. *International Journal of Advanced Technology and Engineering Exploration*, *8*(81), 957–969. https://doi.org/10.19101/IJATEE.2021.874182

El-Badawy Sayed, A. (2009a). Retrofitting And Strengthening Of Reinforced Concrete Columns Using Steel Jackets; Mechanical Performance And Applications. *JES. Journal of Engineering Sciences*, *37*(3), 563–580. https://doi.org/10.21608/jesaun.2009.126485

El-Badawy Sayed, A. (2009b). RETROFITTING AND STRENGTHENING OF REINFORCED CONCRETE COLUMNS USING STEEL JACKETS; MECHANICAL PERFORMANCE AND APPLICATIONS. *JES. Journal of Engineering Sciences*, *37*(3), 563–580. https://doi.org/10.21608/jesaun.2009.126485

Hidayati, N. (2022). Evaluasi dan Perkuatan Struktur Kolom Beton Bertulang Akibat Kebakaran. *Potensi: Jurnal Sipil Politeknik*, *24*(1), 1–9. https://doi.org/10.35313/potensi.v24i1.3606

Mujahid, A. R. , G. A. , M. M. , M. A. S. , H. K. , A. H. A. S. G. M. (2023). Behavior of RC columns strengthened with steel jacket under static axial load. *Archives of Civil Engineering*. https://doi.org/10.24425/ace.2023.145273

Raza, S., Khan, M. K. I., Menegon, S. J., Tsang, H.-H., & Wilson, J. L. (2019). Strengthening and Repair of Reinforced Concrete Columns by Jacketing: State-of-the-Art Review. *Sustainability*, *11*(11), 3208. https://doi.org/10.3390/su11113208

Zhou, C., Li, X., Wang, D., & Xia, S. (2019). Analysis of Bearing Capacity and Seismic Performance of Circular RC Columns Strengthened with Externally Wrapped Steel Plates. *Advances in Civil Engineering*, *2019*(1). https://doi.org/10.1155/2019/2515091