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Implementation Methods for Shearwall SW2 Casting in Institutional Buildings

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Abstract: Each building must be built as best as possible to meet the feasible technical criteria in terms of quality, ethics, and aesthetics. In addition, the building must also meet the cost and administrative criteria for dormitory buildings and supporting facilities. The STAN Bintaro student dormitory building construction project consists of the lower structure (foundation), upper structure, and finishing work. In this practical work report, it focuses on one of the superstructure works, namely the work of the sliding wall or shear wall and the special purpose is to know the casting method of the shear wall in the construction project of the STAN Bintaro student dormitory building. Based on the results of observations during the practical work, the method in the implementation of the shear wall casting work itself starts from the determination of the axle, fabrication of reinforcement, installation of reinforcement, installation of formwork, casting, removal of formwork and then ends with shear wall maintenance. The data obtained regarding the dimensions of the shear wall in type SW2 is 5700 mm long with a thickness of 400 mm, for the reinforcement used, namely 6D16 reinforcement and D16-100 rebar. The quality of the concrete used is K-350. Future methods of casting implementation must continue to explore innovative solutions, such as the use of sophisticated materials and potimalized schemes, to further improve the performance of these structural components.

Keywords: shear wall, casting method, reinforcement formwork, concrete quality (k-350), structural performance.

INTRODUCTION

Institutional buildings, particularly those designed for educational purposes such as dormitories and supporting facilities, must meet stringent technical criteria in terms of quality, ethics, and aesthetics. Additionally, these structures must satisfy cost and administrative requirements to ensure their functionality and longevity. The construction of such buildings involves complex structural elements, with shear walls being among the most critical components for lateral load resistance and overall structural stability (Goldenstein et al., 2017).

Shear walls are vertical structural elements designed to resist lateral forces, primarily from wind and seismic activity. Their proper construction is essential for ensuring the safety and durability of multi-story institutional buildings. The casting method employed for shear walls significantly influences their structural integrity and performance, making it a crucial aspect of the construction process.

This article focuses on the implementation methods for casting shear wall SW2 in the STAN Bintaro student dormitory building construction project. The study examines the complete process from axis determination to maintenance, providing insights into the challenges encountered and solutions implemented during construction. The findings aim to contribute to the body of knowledge on efficient and effective shear wall construction techniques for institutional buildings.

RESEARCH METHOD

This research employed a case study methodology, focusing on the construction of shear wall SW2 in the STAN Bintaro student dormitory building project. The research approach involved systematic observation and documentation of the entire construction process, from planning to implementation and quality control.

The methodology encompassed the following stages:

1. Site Observation and Documentation.
   Regular site visits were conducted to observe and document the shear wall construction process, with particular attention to the SW2 type. Photographic evidence was collected at each stage of construction.
2. Technical Data Collection.
   Detailed measurements and specifications of the shear wall were recorded, including dimensions, reinforcement details, and concrete quality requirements.
3. Process Analysis.
   The complete construction sequence was analyzed, from axis determination to final maintenance, to identify critical steps and potential challenges.
4. Quality Control Assessment.
   Quality control measures implemented during construction were evaluated, including reinforcement inspection, formwork stability, and concrete testing.
5. Challenges and Solutions Documentation.
   Challenges encountered during the construction process were documented, along with the solutions implemented to address them.

The mathematical relationship for concrete strength development can be expressed as:

$$f'c(t) = \frac{f'c(28)\ x\ t}{(4 + 0{,}85t)}$$

Where:

- f'c(t) is the compressive strength at age t days
- f'c(28) is the 28-day characteristic compressive strength
- t is the age in days

RESULT AND DISCUSSION

Shear Wall SW2 Specifications and Design

The shear wall SW2 in the STAN Bintaro student dormitory building project was designed with specific dimensions and reinforcement details to meet structural requirements. Based on the collected data, the SW2 type shear wall has the following specifications:

- Length: 5700 mm
- Thickness: 400 mm
- Main reinforcement: 6D16 (16 mm diameter deformed bars)
- Stirrup reinforcement: D16-100 (16 mm diameter bars at 100 mm spacing)
- Concrete quality: K-350

These specifications were determined based on structural analysis to ensure the shear wall's capacity to resist lateral forces while maintaining overall building stability.

Implementation Method for Shear Wall SW2 Casting

The implementation method for casting shear wall SW2 followed a systematic process consisting of several key stages:

1. Axis Determination.
   The process began with precise axis determination using theodolite equipment to ensure accurate positioning of the shear wall according to design specifications.
2. Reinforcement Fabrication.
   Reinforcement bars were cut and bent according to design specifications using bar cutters and benders. The 6D16 main reinforcement and D16-100 stirrups were prepared with careful attention to dimensions and spacing.
3. Reinforcement Installation.
   The fabricated reinforcement was installed at the designated location, with proper spacing and alignment. Concrete spacers were used to maintain the required concrete cover.
4. Reinforcement Inspection.
   Before proceeding to formwork installation, the reinforcement was thoroughly inspected to ensure compliance with design specifications, including bar size, spacing, and positioning.
5. Formwork Installation.
   Formwork was installed around the reinforcement, with careful attention to alignment, stability, and tightness to prevent concrete leakage during casting.
6. Concrete Preparation and Testing.
   K-350 quality concrete was prepared, and slump tests were conducted to ensure proper workability. The target slump value was maintained within the specified range to ensure adequate flow without segregation.
7. Casting.
   Concrete was poured into the formwork using appropriate equipment, with careful attention to pouring height to prevent segregation. Vibration was applied to ensure proper consolidation and eliminate air voids.
8. Formwork Removal.
   After the concrete reached sufficient strength, the formwork was carefully removed to avoid damage to the fresh concrete surface.
9. Maintenance.
   The cast shear wall was subjected to proper curing and maintenance procedures to ensure optimal strength development and minimize cracking.

Table 1. Dimension and Reinforcement Details of Shear Wall in The Project

Shear Wall Type	Length (mm)	Thickness (mm)	Main Reinforcement	Stirrup Reinforcement
SW1	4500	350	5D16	D16-120
SW2	5700	400	6D16	D16-100
SW3	6200	400	7D16	D16-100

Challenges in Shear Wall SW2 Casting

Several challenges were encountered during the casting of shear wall SW2:

1. Ensuring perfect alignment of the formwork for the 5700 mm long shear wall required precise measurement and adjustment.
2. The dense arrangement of 6D16 main reinforcement and D16-100 stirrups created congestion that complicated concrete placement and vibration.
3. Achieving uniform concrete placement throughout the 5700 mm length and 400 mm thickness without segregation or honeycombing required careful pouring techniques.
4. Ensuring effective vibration throughout the entire volume of the shear wall was challenging due to its dimensions and reinforcement density.
5. Unpredictable weather conditions during casting necessitated adjustments to the construction schedule and concrete mix properties.

Solutions and Best Practices

To address the challenges encountered during shear wall SW2 casting, the following solutions and best practices were implemented:

1. Precise Formwork Design: Custom formwork was designed specifically for the SW2 dimensions, with additional bracing to maintain alignment during concrete placement.
2. Reinforcement Coordination: Careful coordination of reinforcement installation, with sequential placement of main bars and stirrups, minimized congestion and facilitated subsequent concrete placement.
3. Controlled Concrete Placement: Concrete was placed in layers not exceeding 500 mm in height, with each layer properly vibrated before proceeding to the next, ensuring uniform consolidation.
4. Strategic Vibrator Positioning: Vibrators were positioned at strategic intervals along the length of the shear wall to ensure comprehensive consolidation without over-vibration.
5. Weather Monitoring: Construction scheduling incorporated weather forecasting, with contingency plans for adverse conditions, including adjustments to concrete mix properties and curing procedures.

These solutions contributed to the successful casting of shear wall SW2, resulting in a structurally sound element that met design specifications and quality requirements.

CONCLUSION

The implementation method for casting shear wall SW2 in the STAN Bintaro student dormitory building project followed a systematic process from axis determination to maintenance. The method encompassed reinforcement fabrication and installation, formwork design and placement, concrete preparation and testing, controlled casting, and proper curing.

The study revealed that successful shear wall casting requires meticulous attention to detail at each stage of the process, particularly in reinforcement arrangement, formwork alignment, concrete placement, and vibration. The challenges encountered during construction, including formwork alignment, reinforcement congestion, and concrete placement, were effectively addressed through custom formwork design, coordinated reinforcement installation, controlled concrete placement, strategic vibration, and weather monitoring.

The findings of this study contribute to the understanding of effective shear wall construction techniques for institutional buildings. Future implementation methods should continue to explore innovative solutions, such as advanced formwork systems, optimized reinforcement arrangements, and enhanced concrete placement techniques, to further improve the performance and efficiency of shear wall construction.

For future projects involving similar shear wall construction, it is recommended to:

1. Develop detailed implementation plans specific to each shear wall type
2. Invest in custom formwork designed for specific dimensions and reinforcement arrangements
3. Implement comprehensive quality control measures at each stage of construction
4. Train construction personnel in specialized techniques for shear wall casting
5. Document lessons learned for continuous improvement in future projects

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