



# Training on Reinforcement Techniques for Reinforced Concrete Structures in Jagaraga Village

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**Abstract.** Reinforced concrete plays a crucial role in ensuring the strength and durability of building structures. Yet the community in Jagaraga Village has a limited understanding of proper reinforcement techniques. This study aimed to enhance the community's knowledge and practical skills regarding reinforcement methods for reinforced concrete structures. The training program was designed using a combination of lectures, group discussions, and hands-on practice. To assess the effectiveness of the program, pre-test and post-test evaluations were conducted on both theoretical and practical components. The findings revealed a substantial improvement in participants' competence. with the average theory score increasing from 58.6 to 83.75 (a 30.03% increase) and the practical score improving from 58.10 to 84.90 (a 31.57% increase). These results demonstrate that the training was highly effective in enhancing the participants' understanding and skills in reinforced concrete reinforcement techniques. thereby contributing to improved community capacity in construction practices.

**Keywords:** Community Service, Training, Reinforcement, Reinforced Concrete

## 1 Introduction

Reinforced concrete is one of the most widely used construction materials because of its high compressive strength and flexibility in shaping. However, the quality of reinforced concrete structures depends greatly on workers' understanding and skills in reinforcement techniques. Insufficient skills in reinforcement may reduce structural quality, increase the risk of early damage, and threaten safety. The reinforcement must be in accordance with the contents of the contract and the Specification Work Plan (RKS).

A project is an activity that takes place over a certain period of time and with limited resources. The project management process begins with the planning stage, followed by engineering and design, procurement or auction, construction, commissioning, utilization, and maintenance stages. The implementation of construction projects certainly has risks. Project risks can arise from various factors, including political, environmental, planning, marketing, economic, financial, natural, project, technical, human, criminal, and safety-related. People with an interest in the project, including those in building construction, accessibility, transportation, and lifting equipment, are

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the initial factors that must be considered if we are field implementers. The planning of reinforced concrete structures in split-level house buildings, including determining dimensions, has met the building requirements above (Trijeti et al., 2018). In addition to the above-mentioned aspects of the construction stage. The reinforcement work stage must be considered. Reinforcement must be in accordance with the contents of the contract and the Specification Work Plan (RKS) (Tilik et al., 2019).

These risks can affect the cost, quality and time of project implementation. Beam and column components with existing reinforcement can withstand the shear forces that occur due to earthquakes by fulfilling the requirements for shear capacity design, where the nominal shear capacity is greater than the forces acting on the beams and columns (Honarto et al., 2019).

Jagaraga Village, located in Buleleng Regency, Bali, has many construction workers who are frequently involved in reinforced concrete works. However, most still use traditional methods without considering technical standards. Therefore, structured training is necessary to improve their knowledge and skills.

The objectives of this study are to enhance participants' understanding of the basic concepts of reinforced concrete reinforcement and to provide practical training in reinforcement preparation, cutting, and assembling according to SNI standards, and to evaluate the effectiveness of the training through pre-test and post-test results.

Work accidents in any sector, including the construction sector, cannot be avoided but can actually be controlled or minimized. Additionally, other issues include the occurrence of health problems and the emergence of diseases resulting from the work carried out by workers. The main component of the structure is reinforced concrete, referring to SNI 03-2847-2013. Earthquake load planning uses spectrum response analysis. While non-earthquake loads are adjusted to SNI 03-1727-2012: Minimum Loads for Designing Buildings and Other Structures (Nurjaman, 2019). This will have an impact on reducing labor resources, which, of course, will affect the operational implementation of work. This reduces work productivity, resulting in losses for interested parties, namely, project owners, consultants, contractors, foremen, and the workers themselves. The energy potential and spirit of cooperation of the village residents are also still very high (Jaya et al., 2024).

Currently, members of the carpentry group in Jagaraga Village are still found to have a lack of skills in assembling reinforcement work in concrete structures. Concrete is a solid mixture that hardens with its constituent materials, including cement, sand, gravel, and water, which are stirred together. The construction of civil engineering is definitely related to concrete, the construction of roads, buildings, dams, houses, and irrigation channels (Latif et al., 2024). The knowledge of workers in Jagaraga Village regarding the implementation of reinforcing building structures remains limited. So many buildings are cracked due to errors in the implementation of reinforcement installation. Figure 1 shows construction workers in concrete work. Where there has been no reinforcement work, such conditions require training on assembling reinforcement for construction workers. It is hoped that workers in the field can properly apply the method of reinforcement for building structures.

Empowering and improving the knowledge and skills of the Creative Group of Construction Workers to be economically and socially independent (Muhtar et al.,

2023). Based on the analysis of the problems above, this activity aims to improve the standard of living, empower, and enhance the knowledge and skills of the community working on building projects through the application of research results in the form of assembling a concrete frame structure reinforcement using reinforced concrete.

## **2 Result and Discussion**

### **2.1 Pre-test and Post-test Results**

The training began with a pre-test to assess the participants' initial understanding of reinforced concrete. reinforcement standards. and the ability to read technical drawings. The pre-test results showed that most participants had only a limited understanding of the basics. The average pre-test score fell into the "fair" category at 58.35.

Subsequently, participants were provided with theoretical material covering the basic principles of reinforced concrete, the functions of tensile and compressive reinforcement, and the provisions in SNI 2847:2019 regarding spacing between reinforcement, anchorage, and the bending of reinforcement. The material also emphasized the importance of following construction drawings as a reference during work.

The next stage was hands-on practice. Participants were guided to construct reinforcement frames for beams and columns according to the design drawings. They learned techniques for cutting, bending, and tying reinforcement using binding wire. Practical results were assessed based on neatness, dimensional accuracy, and compliance with the construction drawings.

After the training, participants took a post-test using the same questions as the pre-test, along with a practical evaluation. The post-test results showed a significant improvement, with the average score increasing from 58.35 to 84.33, representing a 25.98-point increase.

**Table 1.** Pre-Test and Post-Test Results of Participants

| No.           | Participant name | Theory   |           | Practice |           | Average  |           | Remark   |
|---------------|------------------|----------|-----------|----------|-----------|----------|-----------|----------|
|               |                  | Pre-test | Post-test | Pre-test | Post-test | Pre-test | Post-test |          |
| 1             | I Made Agus      | 55       | 80        | 58       | 82        | 56.5     | 81.0      | Improved |
| 2             | I Kadek Nova     | 60       | 82        | 59       | 84        | 59.5     | 83.0      | Improved |
| 3             | I Wy. Eka        | 62       | 85        | 60       | 86        | 61.0     | 85.5      | Improved |
| 4             | I Wayan Sudana   | 58       | 83        | 57       | 85        | 57.5     | 84.0      | Improved |
| 5             | I Made Bawa      | 57       | 86        | 56       | 87        | 56.5     | 86.5      | Improved |
| 6             | I Nyoman Kartu   | 59       | 81        | 58       | 82        | 58.5     | 81.5      | Improved |
| 7             | I Ketut Kardana  | 61       | 87        | 60       | 88        | 60.5     | 87.5      | Improved |
| 8             | I Made Suwena    | 56       | 83        | 57       | 84        | 56.5     | 83.5      | Improved |
| 9             | Kadek Putra      | 60       | 85        | 59       | 86        | 59.5     | 85.5      | Improved |
| 10            | I Made Yasa      | 59       | 84        | 58       | 85        | 58.5     | 84.5      | Improved |
| 11            | I Gede Aditya    | 57       | 83        | 56       | 84        | 56.5     | 83.5      | Improved |
| 12            | Yudianta         | 60       | 85        | 60       | 86        | 60.0     | 85.5      | Improved |
| 13            | I Made Lasia     | 58       | 82        | 57       | 83        | 57.5     | 82.5      | Improved |
| 14            | I Wayan Rima     | 55       | 86        | 56       | 87        | 55.5     | 86.5      | Improved |
| 15            | I Made Rana      | 60       | 84        | 59       | 85        | 59.5     | 84.5      | Improved |
| 16            | I Made Wika      | 61       | 85        | 60       | 86        | 60.5     | 85.5      | Improved |
| 17            | I Ketut Sudra    | 57       | 83        | 58       | 84        | 57.5     | 83.5      | Improved |
| 18            | I Wayan Parka    | 59       | 82        | 58       | 83        | 58.5     | 82.5      | Improved |
| 19            | I Ketut Budi     | 60       | 85        | 59       | 86        | 59.5     | 85.5      | Improved |
| 20            | Gede Nadiyahasa  | 58       | 84        | 57       | 85        | 57.5     | 84.5      | Improved |
| Total :       |                  | 1172     | 1675      | 1162     | 1698      | 1167     | 1686.5    |          |
| Average :     |                  | 58.6     | 83.75     | 58.1     | 84.9      | 58.35    | 84.33     |          |
| Improvement : |                  | 30.03%   |           | 31.57%   |           | 30.80%   |           |          |

**Competency Improvement Analysis.** As shown in Table 1 above, all participants experienced an increase in scores in both theoretical and practical aspects. Several points can be concluded.

**Theoretical Aspect.** Participants' understanding of the basic concepts of reinforced concrete improved, particularly regarding the function of tensile and compressive reinforcement, spacing rules, and the role of concrete cover.

**Practical Aspect.** Participants became more skilled in cutting, bending, and assembling reinforcement. Their work demonstrated improved neatness and accuracy, as indicated by the design drawings.

**Drawing Interpretation Skills.** Before the training, some participants had difficulty understanding reinforcement symbols. After the training, they were able to read detailed drawings and apply them in the field.

**Participants' Confidence.** Based on brief interviews, participants felt more confident to engage in construction projects in their village, especially in reinforced concrete structural work.

This improvement suggests that a training method combining theory and practice is effective in enhancing the capacity of village communities in the construction sector.

Training activities for road construction with concrete materials took place on May 24, 2025, and May 25, 2025. This activity began with an Opening activity by the Head of the Bangun Pertiwidi Group, accompanied by the Head of BUMDES Jagaraga Village. Then continued with a presentation of reinforced concrete structures in building construction in Figure 2. For the installation of formwork, strong, sturdy scaffolding is required, which is temporary and will be dismantled when the concrete work is complete (Astanto, 2001).

This activity is the core component of the Community Service initiative in Jagaraga Village, led by the Pertukangan Bangun Pertiwi group, which specializes in construction. Based on the stiffness aspect, the beam-column relationship with steel reinforcement shows a higher stiffness value compared to the relationship without reinforcement, which is indicated by the angle of inclination of the test results (Teknologi et al., 2025). In this activity, they are taught and trained on the types and sizes of reinforcement, as well as the calculation of the amount of reinforcement and assembly of reinforcement. The structural calculations carried out refer to SNI 1726-2012 concerning earthquake load calculations and SNI 2847-2013 concerning reinforced concrete calculations (Danu Hartono et al., 2019).

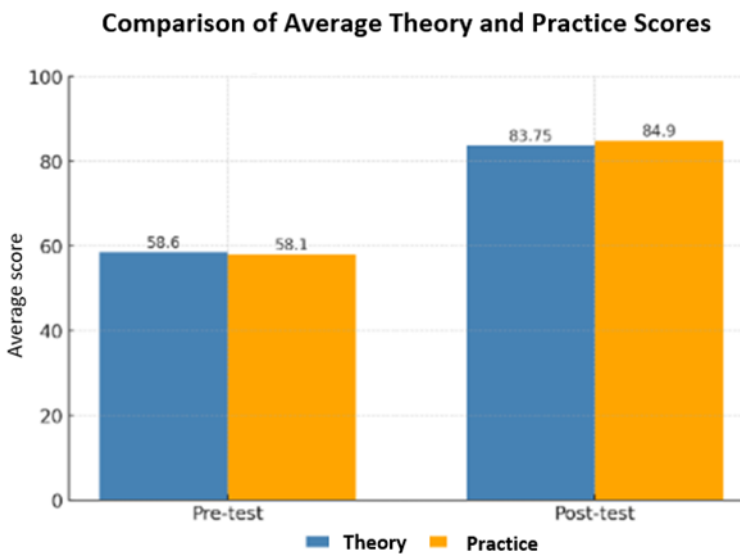
By participating in this community service activity, training participants can learn the basics of building structure construction and practice it through the assembly of concrete reinforcement. In designing a building structure, participants should pay attention to the availability of sondir data for planning the foundation structure, so that the sondir data used is in accordance with the planning location (Setiawan et al., 2022).

## 2.2 Evaluation of Pre-test and Post-test

Based on Table 1, the average scores in theory and practice before and after the training were as follows. The theory scores increased from 58.6 before the training to 83.75 after the training. In contrast, the practice scores rose from 58.1 before the training to 84.90 after the training.

## 2.3 Graphical Analysis

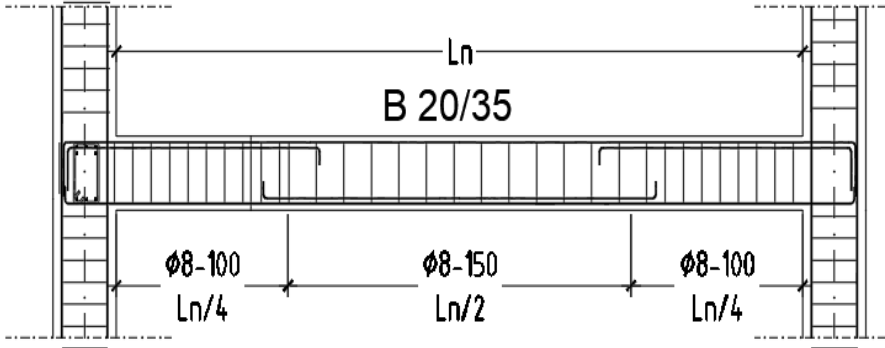
The visual analysis is shown in Figure 1. A significant increase can be observed from the pre-test to the post-test scores in both theoretical and practical aspects.



**Figure 1.** Comparison of Average Pre-test and Post-test Scores of Participants

## 2.4 Reinforcement Sketch

This training also emphasized technical skills. The figure below shows a simple reinforcement sketch of a reinforced concrete beam according to SNI standards.



| NOTATION     | Beam B(20/35) |         | Coloum K(25/25) |         |
|--------------|---------------|---------|-----------------|---------|
|              | END SPAN      | MIDSPAN | END SPAN        | MIDSPAN |
| SECTION      |               |         |                 |         |
| TOP REBAR    | 5 Ø 13        | 2 Ø 13  | 3 D13           | 3 D13   |
| MIDLE REBAR  | —             | —       | 2 D13           | 2 D13   |
| BOTTOM REBAR | 3 Ø 13        | 5 Ø 13  | 3 D13           | 3 D13   |
| STIRRUUPS    | Ø8-10         | Ø8-15   | Ø8-10           | Ø8-15   |

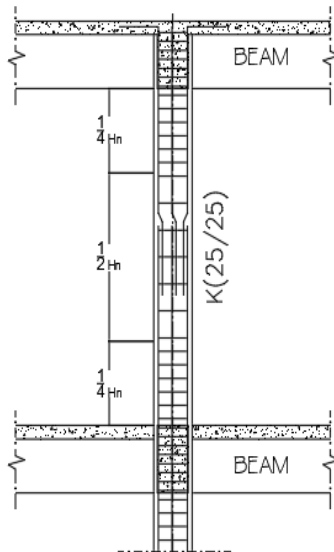


Figure 2. Reinforcement Sketch of a Reinforced Concrete Beam and Column

## 2.5 Reinforcement Sketch

The results of the study indicate that a training method combining theory and practice has a significant impact on improving participants' competence. The average score increase of more than 30% demonstrates that participants effectively absorbed the material. The key factors contributing to the success include an interactive learning method that combines lectures, discussions, and hands-on practice. Training materials that are tailored to field requirements, allowing immediate application at work, and the involvement of experienced instructors who can provide real-life examples. These findings are consistent with the literature, which states that practice-based learning is more effective than lectures alone in enhancing technical skills. Then continued with a presentation on Reinforcement Techniques for Reinforced Concrete Frame Structures. This was followed by practical activities for assembling reinforcement and planning earthquake-resistant reinforced concrete building structures, which included calculations and structural drawings based on SNI 03-2847-2002 and SNI 03-1726-2002, utilizing the Special Moment Resisting Frame System (SRPMK). Building (Naratama et al., 2014). Meanwhile, for the L8 variation, there was an increase of 166.1% with a load of 21.82 kN (Apriansah & Dewi, 2025).

## 3 Methodology

This section must be written out briefly and concisely but adequately so that it can be replicated. This section comprises an explanation of the research approach, tools and objects under study, use of materials or components and instruments, the research procedure, the parameters observed, data collection, the design or approach, and analysis techniques. These are not theories. Any specific criteria used by the researcher in collecting and analyzing the research data should be completely described to produce clear basics for the study under similar conditions.

The training was conducted in Jagaraga Village. Involving 20 participants, the training methods consisted of lectures and discussions on reinforced concrete concepts, as well as practical demonstrations on reinforcement techniques, including cutting, bending, and assembling, and evaluation through pre-test and post-test (10 multiple-choice theory questions and practical assessments using a rubric).

Data were analyzed by comparing pre-test and post-test results to measure participants' improvement in knowledge and skills.

## 4 Conclusion

### 4.1 Conclusions

The reinforced concrete reinforcement training in Jagaraga Village was proven effective in improving participants' knowledge and skills, as the average theory score increased from 58.6 to 83.75 (an increase of 30.03%). In comparison, the practical score

increased from 58.1 to 84.9 (a 31.57% increase), and reinforcement sketches helped participants understand the technical details of reinforcement installation according to standards.

## 4.2 Recommendations

Similar training should be conducted continuously in other villages with a large number of construction workers, and a training module based on SNI standards should be developed so that workers can use it as a standard guide.

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