

A Case Study of Using the Concrete Cover Block in Steel Reinforcement Bar: Ghorahi Dang, Nepal

Hemant Basnet¹, Chudamani Bista¹, Ajay Yadav², and Umesh Adhikari³

¹Student, Rapti Engineering College, B.E Civil, Ghorahi Dang, Nepal

²Research Scholar, Department of Geo-technical Engineering, IIT Roorkee, Utrakhand, India

³Msc. Completed from University of South East, Norway: Lecturer at Rapti Engineering College

Corresponding Author - Ajay Yadav, Email - ajayy018804@nec.edu.np

Abstract - Cover block is one of the basic component on building structure like slab, column, beam, foundation. It is a multi-functionary engineering material. In maximum construction sites, bricks, stones, steel bars are used instead of cover block. This brings a lots of depraved consequences on building structures like lack of well spacing between surface and reinforcement bars, unbalance position of steel bars, reduce the lifespan of building and corrosion. Here, the main function of cover block is to reinforce the building structure by avoiding the corrosion on steel bar or avoiding the moisture with the steel bar, providing the resistive property, distributing an uniform load and managing space. In this way, the cover block is attached in a reinforcement bar in order to reinforce a building structure. When cover block was applied in a building structure, it made a building more durable as well as more attractive by maintaining the shape. This observation suggests that the use of cover block can contribute in strengthening a building structure and maintaining a position and space of a reinforcement bars as well as a structure.

Key Words: Concrete cover block, Reinforcement bar, Potential failure of structure, Space maintaining, Corrosion activity.

1.INTRODUCTION

Cover block is a civil engineering material which is formed from the plastic, concrete, polyvinyl chloride (PVC), stone, wood and metal. It can also be defined as the spacer that is used to uplift the rebar matrix off the ground surface so that the concrete may flow underneath the rebar. It is portable on shape and a size. It is more durable and cost effective. On the basis of dimension, it has range from 25mm to 75mm in height and from 25mm to 100 mm in width and length. Its application on structure depend upon the dimension of block.

Generally, concrete cover block is maximum used in a building structure because it is highly feasible. All types of cover block are more durable and have a maximum load bearing capacity due to its high compressive strength. It can be easily formed on site and can be easily brought from the market in readymade form.. Mainly, it helps in maintaining a space between rebar and shuttering framework. Similarly, it has a resistive property against fire and environmental effects, which protects the steel reinforcement bars. It doesn't contact the steel reinforcement bar with the moisture. It prevents the slip of steel bars which helps in decreasing the potential failure of structure. It takes the steel bars on required fixed position.

Similarly, the numerous workers in a site use a stone or brick instead of cover block. This causes the slip of steel bar, contact the moisture with steel bar, non-spacing or unbalanced space between rebar and shuttering and the potential failure of the structure. The main aim of this research study is to overcome these problems on building structure using a cover block, especific sized cover block is used in a building structure. The below mentioned figure (fig 1) shows the picture of concrete cover block.



Figure 1: Concrete cover block

2. Materials and Methods

First, the case study of concrete cover block was done in a specific building of Ghorahi Dang.

2.1 Manufacturing process of cover block

= Cover block can be prepared from various materials and it can be formed in a site and can be brought. For example, for a concrete cover block, concrete, cement and water are used and hence for other cover block, different materials are used, but here especially, we discuss for a concrete block,

- First, the materials like sand, aggregate(10mm), water and cement are taken in the ratio of 1:3:6 or M10 grade..
- All the materials are mixed with a definite proportion.
- The mixture is molded by shovel or trowel.
- After, molding the mixture, it is cut into a definite shape and size using a scale.
- After cutting, it is dried upto 24 hours and curing in morning and evening upto 5 days.
- After 5 days of curing, it can be used.

2.2 Required number of cover block in rebar.

For a 1 square meter slab area, 4 to 6 cover blocks can be used. Similarly, for a 3 meter high column, cover blocks are kept at an interval of 50-75 cm which leads about 4 to 6 cover blocks per vertical rebar. Not only this, the number of cover blocks is determined based on the design requirements and the structural engineer's specifications

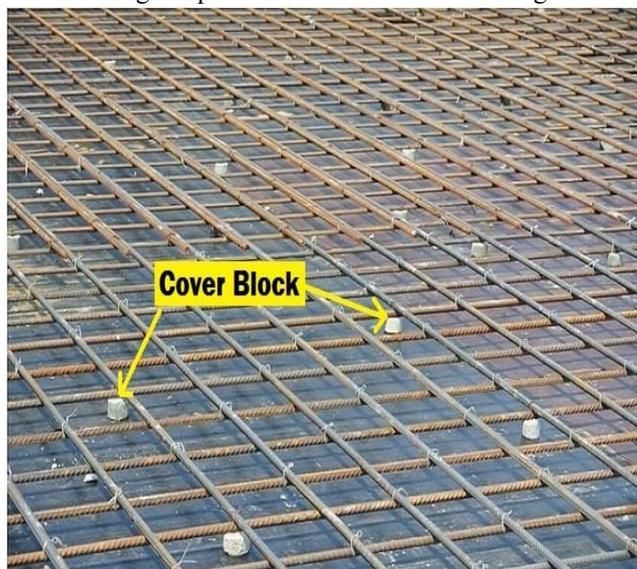


Fig 2: Concrete Cover block under Steel Reinforcement bar

2.3 Case study of reinforcement bar with cover block

Generally, reinforcement bars are used for making various structures like beam, column, slab and foundation. In these separate structures, the different size cover block is applied. The respective size and applications of cover block is mentioned in the below table.(Table 1)

Table 1: Detailing of structures with cover block size

Structures	Size
Slab	20mm
Staircase	15mm
Water retaining wall	20/25mm
Water retaining structure	20/30mm
Flat slab	20mm
Beam	25mm
Column	40mm
Shear wall	25mm
Strap beam	35mm
Raft foundation(bottom and side)	50-80mm

2.4 3-D Modeling of Reinforcement bar with cover block

The 3-D modeling of rebar analyzes the position of cover block in a rebar. Basically, the cover blocks are just kept between the shuttering framework and reinforcing bar which helps in maintaining a space between rebar and ground. And the 3-D model of various structures was taken from the online site which has been cited below.

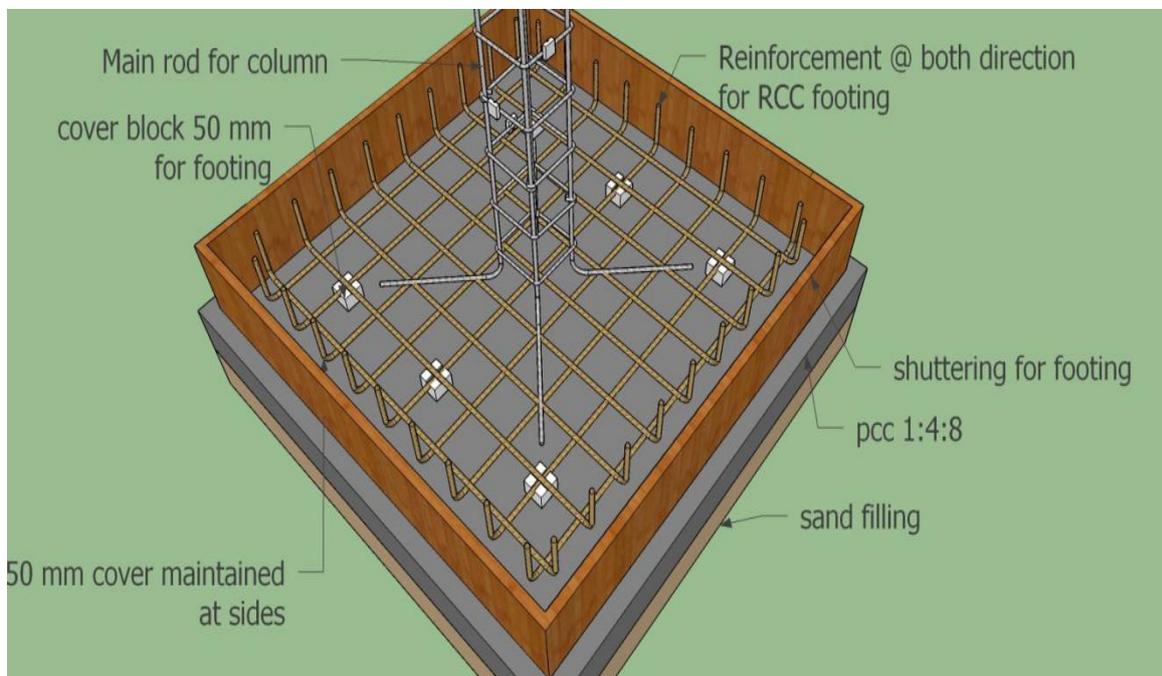


Fig 3: 3-D model of foundation and column with cover block

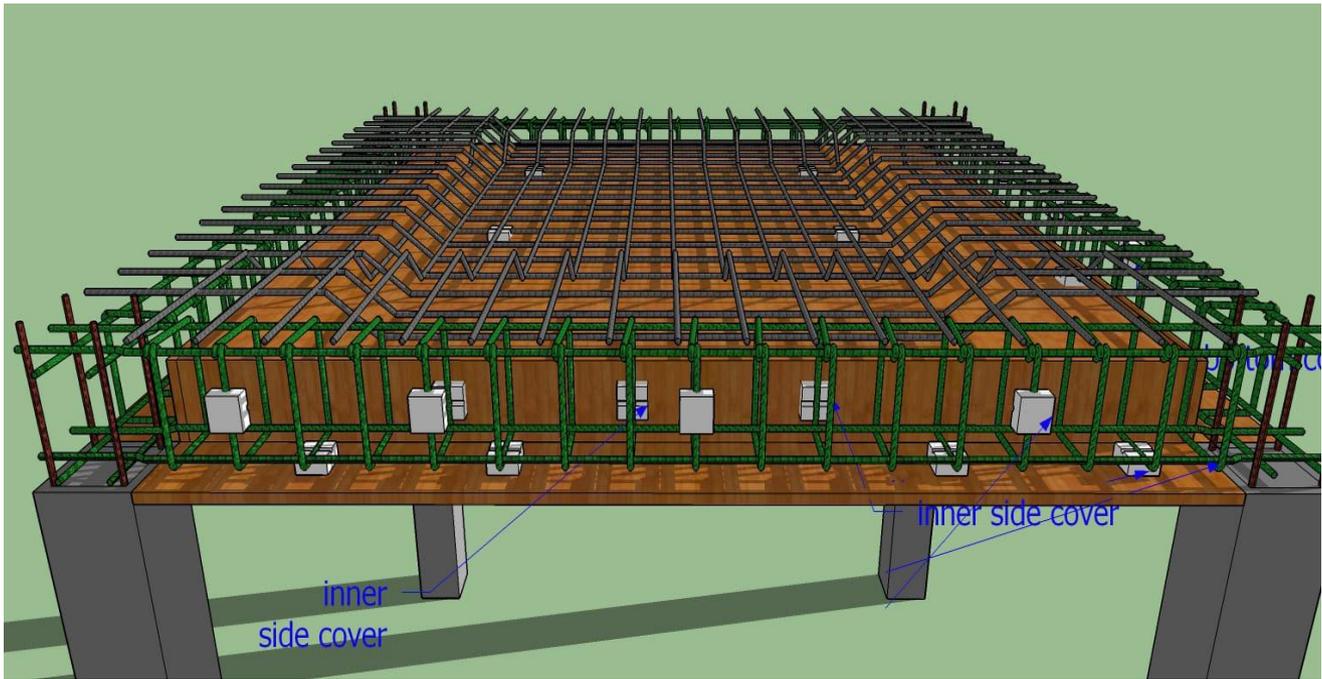


Fig 4: 3-D model of slab with cover block

2.5 Compressive strength test of cover block.

For compressive strength test of cover block, it was kept one by one in “Automated Compression Testing Machine”(ASTM) . The compressive strength was provided until its failure. This was done continuously using 5 sample of blocks and the total datum was recorded for determining the total average compressive strength. The below depict graph(Fig 5) shows the compressive strength of each block.

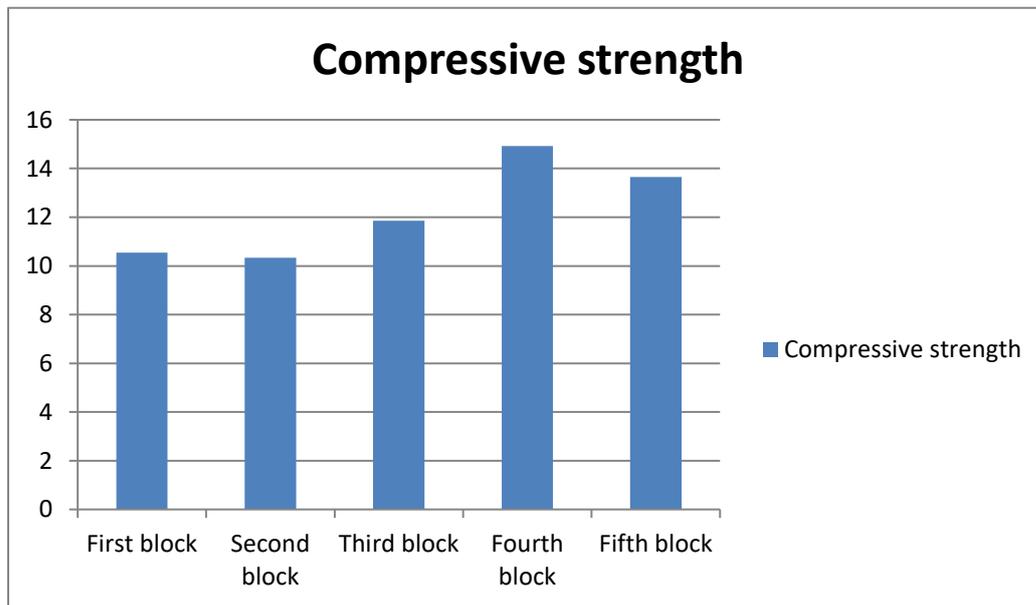


Fig 5: Bar graph of compressive strength test of concrete cover block

Cover Block	Compressive strength(N/mm ²)
1 st Cover block	10.55
2 nd Cover Block	10.34
3 rd Cover Block	11.86
4 th Cover Block	14.92
5 th Cover Block	13.65
Total	= 61.32

Here,

The average compressive strength of 5 cover blocks is $(10.55+10.34+11.86+13.65+)/5$
 $= 12.264 \text{ N/mm}^2$

Through this observation, cover block can bear almost the load upto **12.264 N/mm²**. It is sufficient strength of cover block for the reinforcement bar.

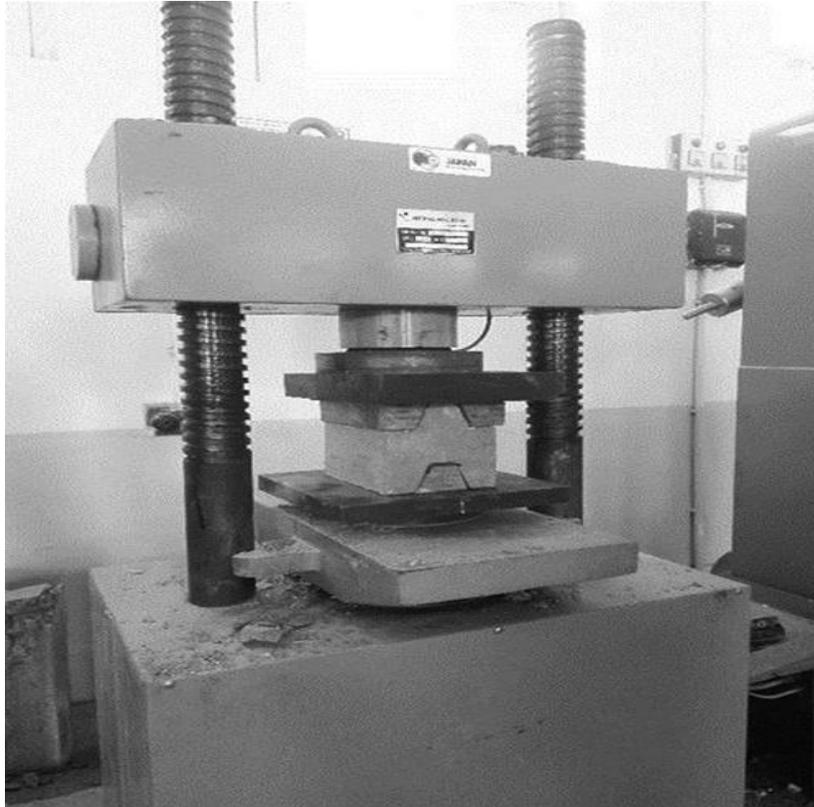


Fig: 6 Compressive strength test of 5 blocks in ASTM

3. Result and Discussion

In this research, we first detected the result of structure without using a cover block, we got a result as shown in figure (Fig 5) . Due to the frequent slip or unstability of rebar in absence of cover block , these types of problem occurred on a slab. And, the stain formed due to the presence of moisture on rebar which corroded the rebar frequently. Due to this, the structure couldn't be long lasting and the structure might totally damage vigorously.



Fig 7: Structure devasted in absence of cover block

Similarly, when we used cover block according to the requirement on structure, we got the result which has shown in below figure(Fig 7). On this structure, cover block helped in maintaing a certain space between the shuttering and the rebar. In

this way, the concrete flow everywhere and attached with the rebar which also prevented the moisture contact with rebar and made the fire resistive rebar. It didn't allow the rebar to slip unnecessarily. From these mentioned result, the structure became more stable and stronger as well as long lasting.



Fig 8: Structure formation in presence of cover block

4. Conclusion

Rebar plays a most significant role on a building structure in bearing the load over it as a beam. There is certain method of adjustment a rebar. i.e. using a concrete cover block. This study was done on the purpose of finding the consequences of rebar structure after and before using a concrete cover block in a rebar. The result was obtained after and before kept a concrete cover block in contact with a reinforcement bar. Here we can see figure (5) and (6) as a result before using cover block and after using a cover block in a reinforcement bar.

According to this result, In absence of concrete cover block, the rebar becomes stable initially but after some time, it made the slab weaker frequently, which led in devastating the whole building structure because in absence of concrete cover block, the was no proper space between rebar and shutter and no proper fillup the concrete in a structure nad permit the moisture in a rebar which corroded the reinforcement bar easily within a short period of time..

Then when we used the concrete cover block in a rebar, the slab became more stable as well as long lasting and made a building structure more stronger because it helped in maintaining a space between the rebar and shutter where concrete fully occupied the space and bonded and avoided the moisture.

5. Recommendation

- According to this research, it is recommended to all construction workers that the use of stone, brick, and iron should be avoided and should use the concrete cover block because the concrete cover block has fixed stable size as well as compressive strength.
- It is recommended that the specific size cover block should use in a specific structure.
- It is recommended that the dimension should test while forming a cover block.
- It is recommended that the fixed dimension cover block should use cover block in a building structure.

REFERENCES

- 1.Kapil, A., Gupta, T., & Kumar, S. (2021). *Utilization and Testing Of Materials Using Concrete Block Technology* (Doctoral dissertation, Jaypee University of Information Technology, Solan, HP).
2. Chu SH, Kwan AK. A new method for pull out test of reinforcing bars in plain and fibre reinforced concrete. *Engineering Structures*. 2018 Jun 1;164:82-91.
3. Parsekian, Guilherme, Humberto Ramos Roman, Cláudio Oliveira Silva, and Marcio Santos Faria. "Concrete block." In *Long-term performance and durability of masonry structures*, pp. 21-57. Woodhead Publishing, 2019.
4. Parsekian, Guilherme, et al. "Concrete block." *Long-term performance and durability of masonry structures*. Woodhead Publishing, 2019. 21-57.
5. Chu, S.H. and Kwan, A.K.H., 2018. A new method for pull out test of reinforcing bars in plain and fibre reinforced concrete. *Engineering Structures*, 164, pp.82-91.

BIOGRAPHIES



Er. Ajay Yadav, a **university topper and Dean's List honoree**, is a dedicated researcher and author of multiple engineering textbooks. Recently, he received a fully funded scholarship through ICCR to pursue an M.Tech in Geotechnical Engineering at **IIT Roorkee**. He was also honored with the prestigious **Geo-Tech Award** during his undergraduate studies.



Mr. Hemant Basnet, from Ghorahi Dang currently studying "Civil Engineering" in Pokhara University.