

The Comprehensive Study On The Influence Of Chicken Mesh On The Properties Of Concrete

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Abstract- Prefabricated concrete members reinforced with chicken mesh offer enhanced mechanical properties crucial for construction. Chicken mesh integration within the concrete matrix improves tensile strength, increasing ductility and crack resistance. This reinforcement strategy ensures superior performance under tension, mitigating the risk of sudden failure. The study starts with a comprehensive examination of the production process, emphasizing the way chicken mesh is incorporated into the concrete matrix and how this affects structural performance. When compared to conventional concrete members, tensile strength tests demonstrate the superior ductility and crack resistance provided by the chicken mesh reinforcement, resulting in an increased tensile capacity. The composite members' capacity to bear high compressive loads without losing their structural integrity is shown by compression tests. Flexural tests provide insight into how the composite members behave when bent. The members' flexural capacity and ductility are greatly increased by the chicken mesh reinforcement, enabling more deflection before failure. Therefore, when compared to their conventional counterparts, prefabricated concrete members reinforced with chicken mesh show superior mechanical properties in tension, compression, and flexure. These results highlight the potential of chicken mesh reinforcement as an affordable way to improve prefabricated concrete structure performance in a range of construction applications. It is anticipated that additional study and advancement in this field will open up new possibilities for enhancing the functionality and appearance of reinforced concrete components.

[1] INTRODUCTION

Conventional concrete structures frequently have issues with their overall structural integrity, crack susceptibility, and tensile strength under different loading scenarios. To improve the mechanical qualities of concrete components, engineers and researchers have investigated novel reinforcement techniques in response to these difficulties. Because of its great tensile strength, cost-effectiveness, and flexibility, chicken mesh which is primarily used in poultry farming, has emerged as a promising reinforcement material. Chicken mesh serves as a reinforcement layer that is incorporated into the concrete matrix during the prefabrication process, improving the composite members structural performance. The purpose of this study is to comprehensively investigate the mechanical characteristics of prefabricated concrete members reinforced with chicken mesh, with an emphasis on flexure, tension, and compression.

The present investigation aims to shed light on the structural behaviour, durability, and possible uses of these composite members in building projects by analysing their tensile, compressive, and flexural properties. Furthermore, this study intends to demonstrate the benefits of using chicken mesh reinforcement over conventional reinforcement techniques, including increased ductility, cost-effectiveness, and crack resistance. By providing insights into the application of chicken mesh reinforcement in prefabricated concrete elements, the study's findings should advance resilient and sustainable construction practices.

[2] LITERATURE REVIEW

The M30 grade of concrete was used to cast the deep beams, which have dimensions of 700x350x150 mm. Two-point loading was applied to the deep beams during the flexure strength test. Rectangular openings are observed to enhance the load-bearing capacity, help deviate the crack pattern, and disrupt the natural load path based on test results. A maximum ultimate load of approximately 520 kN was noted for the beam featuring a chicken mesh and rectangular opening. The study also attempts to use chicken mesh to stop the flexural cracks that occur on deep beams under loading^[1]. When steel fibres are added to concrete, the ultimate strength of deep beams is significantly increased. Additionally, the failure of fibre-reinforced concrete beams is more gradual and ductile than that of plain and reinforced

concrete beams^[2]. Since concrete struts transfer the majority of the load in deep beams, the effect of concrete strength on the nominal shear strength appears to be more significant than in slender beams^[3].

16 continuous deep beams with rectangular openings were used to test the impact of the size, location, and reinforcement of the web. Specifically, apertures situated within the external or interior shear span were taken into account. The authors discovered that the opening's location primarily determined the failure mode, with the opening inside the interior shear span resulting in the largest reduction in load capacity^[4]. The width and depth of the opening had a significant impact on the deflection after diagonal cracks occurred, but did not affect the mid span deflection during the initial loading stages, according to the study's findings. Because of the web opening, the rigidity of the beams was not significantly impacted by the concrete strength^[5].

The behaviour of RC solid beams is not the same as that of RC deep beams with apertures. The beam's behaviour will change from a simple to a more complex behaviour in response to the reduction of its cross sectional area. Therefore, adding openings to RC beams will result in less stiffness and strength as well as increased deflection and cracking^[6].

Deep beams made of fly ash concrete reinforced with polypropylene fibres: their flexural and shear behaviour. The flexure and shear behaviour of deep beams made of fly ash concrete reinforced with polypropylene fibres is the subject of this paper. The test results show that as the percentage of fibre in concrete increases, so does its compressive strength. The flexural and shear strengths of fly ash concrete reinforced with polypropylene fibres have increased significantly. But in all the beams, the final failure was seen to occur gradually^[7]. If the web opening crosses the force path connecting the load point and the support, it considerably decreased the ultimate strength of a large deep beam^[8].

Behaviour of low shear span-to-depth ratio concrete deep beams with apertures. The findings of this study demonstrate that the location of the hole in the beam affects its effect, and the arrangement of reinforcement affects how beneficial it is^[9].

Transverse rebars and HCWM were used to confine the specimens, and the outcomes were compared to reference specimens that had conventional transverse ties. The results of the experiments showed that the HCWM specimens performed better in terms of energy dissipation, failure modes, ductility, load capacity, and crack control efficiency than the control specimens. When HCWM was applied, the OD specimens' ultimate deformation, ductility, and energy absorption increased by 21%, 50%, and 175%, respectively, over the control specimen^[10].

Examining the effects of partially substituting steel slag for fine aggregate in cement mortar when mixing chicken mesh with varying volume fractions as reinforcement in thin ferrocement laminates was the main objective of the investigation. The following variables were examined: (a) the volume fraction of chicken mesh, which ranged from 0.94% to 3.77%; and (b) the percentage of steel slag substituted by weight fine aggregate, which varied from 0% to 2.82%. The findings indicate that, when compared to other specimens, ferrocement laminates with chicken mesh volume fractions of 3.77% and 30% substitution of steel slag for fine aggregate perform better in terms of load deflection behaviour, first crack load, ultimate load, energy absorption, and ductility ratio^[11].

Tension tests were performed on chicken mesh, which comes in a variety of sizes on the market, including 28, 22, and 20 gauge. The chicken mesh types have the following wire diameters and opening sizes: 0.35 mm and 14.5 mm (28 gauge), 0.70 mm

and 15.59 mm (22 gauge), and 0.80 mm and 17 mm (20 gauge). Three samples of chicken mesh, ranging in gauge from 28 to 22, were subjected to a tensile strength test for each category. Determining the ultimate load carrying capacity and elongation is the study's primary goal^[12].

Hexagonal wire mesh, also known as chicken mesh, was tested in horizontal, vertical, and stirrup configurations. The outcomes were compared to a control mix and the optimal mix that was chosen. By modifying the layers of mesh provided, the percentage of steel reinforcement for the entire volume of the concrete was maintained at 1% in each case. Crack and deflection patterns were examined and contrasted with the control specimen in light of the experimental findings. In comparison to control specimens, the test results showed that the foam concrete, supported by hexagonal wire steel mesh, had greater strength and ductility. Additionally, the admixture-reinforced horizontal alignment offered improved strength and ductility, with a 130% increase in flexural strength and a 3.88 ductility index when compared to controlled^[13].

The mortar is strengthened by the hemp fibre and chicken mesh. Masonry triplets with a 1:4 mortar ratio are used for the test. It has been determined that 2% hemp fibre is the ideal dosage, and mortar joints and chicken mesh are added. The universal testing machine was used to test the bond strength, and the outcomes were compared. According to the study, triplets reinforced with hemp fibre had a bond strength that was 27% higher than that of chicken mesh reinforcement and 73% higher than that of unreinforced mortar masonry^[14].

The experimental findings demonstrate that by dispersing the forces throughout the section, the wire mesh, an extra

reinforcement added to the beam, improved the beam's flexural behaviour. The addition of one layer of expanded metal mesh, welded square wire mesh, and chicken wire mesh increases the flexural resistance of the reinforced concrete by 52.96%, 23.76%, and 22.2%, respectively. In comparison to the other layers, the one-layer hexagonal wire mesh exhibits the highest flexural strength (FS), measuring 29.49 MPa^[15].

[3] METHODOLOGY

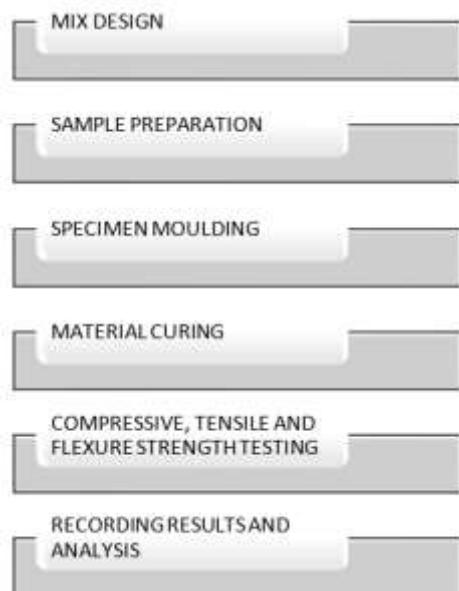


Figure 1. Schematic representation of methodology

1. Mix design: The mix proportions for concrete of grade M35 are 1:1.23:2.24. The amount of cement, sand, and aggregate needed depending on the intended volume of concrete, with a water to cement ratio of 0.41 is calculated.
2. Sample preparation: For the intended concrete specimens, cut the chicken wire mesh into appropriate sizes. Make sure the mesh pieces offer sufficient reinforcement coverage and fit properly inside the specimen molds. In accordance with the requirements of the mix design, prepare the aggregates and other materials. To make sure that the concrete will set evenly and without obstruction, thoroughly grease the mold.
3. Specimen molding: Fill the bottom of the mold with a layer of concrete mix. Place the chicken wire over the top layer of concrete. Top off the first layer of concrete mix with another layer, making sure the reinforcement is completely covered and embedded. To achieve proper consolidation and eliminate any air voids, thoroughly compact the concrete mix.
4. Material curing: Once the concrete has solidified, leave the specimen in the water for 14 or 28 days to cure.
5. Testing: Conduct compressive strength testing using a compression testing machine in accordance with standard testing procedures after the designated curing period. When testing tensile strength, prepare specimens in accordance with the preferred test procedure (such as the split tensile test) and test it. Tests for flexural strength should also be performed on specimens prepared for flexural testing.
6. Results and Analysis: Recording the results of each strength test, including compressive strength, tensile strength, and flexural strength. Analyzing the data to evaluate the effectiveness of the chicken wire mesh reinforcement compared to conventional concrete. Considering factors such as load-bearing capacity, crack resistance, and overall structural performance. Comparing the results with relevant standards and specifications to assess the suitability of using chicken wire mesh reinforcement in prefabricated member.

[4] RESULTS

1. COMPRESSIVE STRENGTH

Table 1. 14 days Compressive strength of conventional concrete

| Sl no | Area in mm ² | Load in kN | Compressive Strength in N/mm ² |
|-------|-------------------------|------------|---|
| 1 | 22500 | 742.63 | 33.01 |
| 2 | 22500 | 739.38 | 32.86 |
| 3 | 22500 | 742.72 | 33.01 |

Table 2. 14 days Compressive strength of concrete with chicken mesh

| Sl no | Area in mm ² | Load in kN | Compressive Strength in N/mm ² |
|-------|-------------------------|------------|---|
| 1 | 22500 | 766.39 | 34.06 |
| 2 | 22500 | 775.02 | 34.45 |
| 3 | 22500 | 773.08 | 34.36 |

Table 3. 28 days Compressive strength of conventional concrete

| Sl no | Area in mm ² | Load in kN | Compressive Strength in N/mm ² |
|-------|-------------------------|------------|---|
| 1 | 22500 | 843.9 | 37.51 |
| 2 | 22500 | 840.2 | 37.34 |
| 3 | 22500 | 844 | 37.51 |

Table 4. 28 days Compressive strength of concrete with chicken mesh

| Sl no | Area in mm ² | Load in kN | Compressive Strength in N/mm ² |
|-------|-------------------------|------------|---|
| 1 | 22500 | 870.9 | 38.71 |
| 2 | 22500 | 880.7 | 39.14 |
| 3 | 22500 | 878.5 | 39.04 |

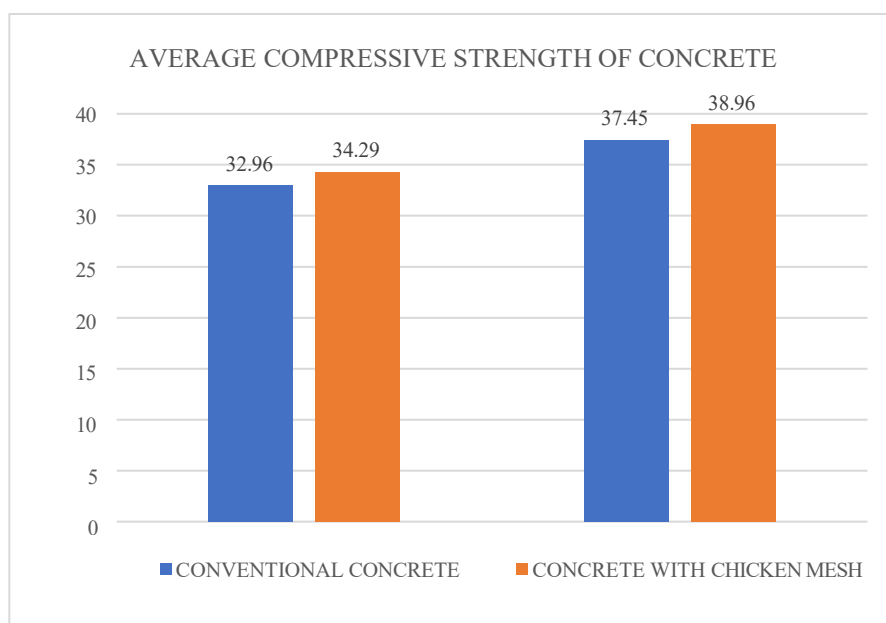


Figure 2. Average compressive strength of concrete for 14 and 28 days.

FLEXURAL STRENGTH

Table 5. 14 days flexural strength of conventional concrete

| Sl no | Length in mm | Width in mm | Depth in mm | Load in tonnes | Flexural Strength in N/mm ² |
|-------|--------------|-------------|-------------|----------------|--|
| 1 | 700 | 150 | 150 | 2.95 | 6.00 |
| 2 | 700 | 150 | 150 | 3 | 6.10 |
| 3 | 700 | 150 | 150 | 2.9 | 5.90 |

Table 6. 14 days flexural strength of concrete with chicken mesh

| Sl no | Length in mm | Width in mm | Depth in mm | Load in tonnes | Flexural Strength in N/mm ² |
|-------|--------------|-------------|-------------|----------------|--|
| 1 | 700 | 150 | 150 | 3.4 | 6.92 |
| 2 | 700 | 150 | 150 | 3.5 | 7.12 |
| 3 | 700 | 150 | 150 | 3.45 | 7.02 |

Table 7. 28 days flexural strength of conventional concrete

| Sl no | Length in mm | Width in mm | Depth in mm | Load in tonnes | Flexural Strength in N/mm ² |
|-------|--------------|-------------|-------------|----------------|--|
| 1 | 700 | 150 | 150 | 4.25 | 8.65 |
| 2 | 700 | 150 | 150 | 4.2 | 8.55 |
| 3 | 700 | 150 | 150 | 4.3 | 8.75 |

Table 8. 28 days flexural strength of concrete with chicken mesh

| Sl no | Length in mm | Width in mm | Depth in mm | Load in tonnes | Flexural Strength in N/mm ² |
|-------|--------------|-------------|-------------|----------------|--|
| 1 | 700 | 150 | 150 | 4.9 | 9.97 |
| 2 | 700 | 150 | 150 | 4.85 | 9.87 |
| 3 | 700 | 150 | 150 | 4.95 | 10.07 |

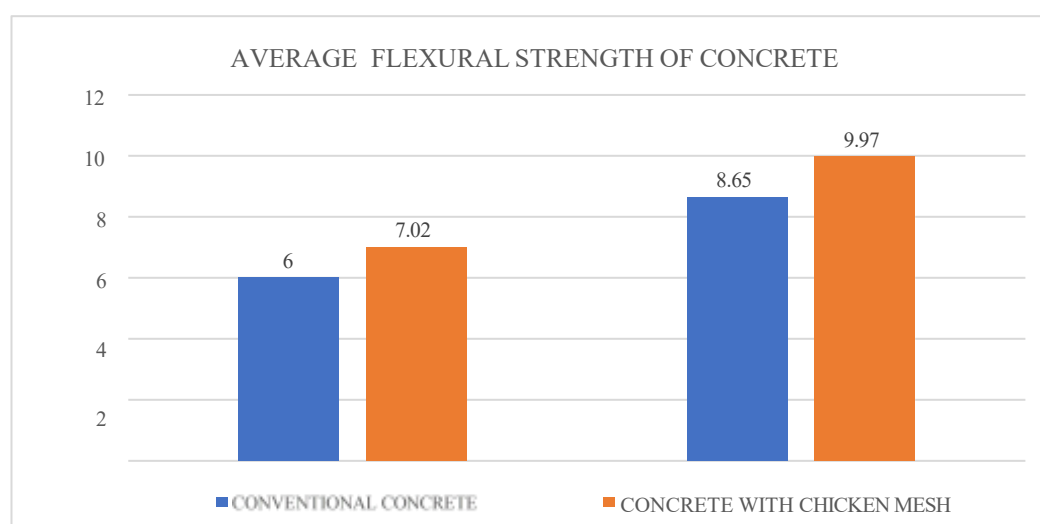


Figure 3. Average Flexural strength of concrete for 14 and 28 days.

SPLIT TENSILE STRENGTH

Table 9. 14 days split tensile strength of conventional concrete

| Sl no | Length in mm | Depth in mm | Load in tonnes | Split Tensile Strength in N/mm ² |
|-------|--------------|-------------|----------------|---|
| 1 | 300 | 150 | 19.2 | 2.66 |
| 2 | 300 | 150 | 18.9 | 2.62 |
| 3 | 300 | 150 | 19 | 2.64 |

Table 10. 14 days split tensile strength of concrete with chicken mesh

| Sl no | Length in mm | Depth in mm | Load in tonnes | Split Tensile Strength in N/mm ² |
|-------|--------------|-------------|----------------|---|
| 1 | 300 | 150 | 22.4 | 3.11 |
| 2 | 300 | 150 | 22 | 3.05 |

| | | | | |
|---|-----|-----|------|------|
| 3 | 300 | 150 | 22.3 | 3.09 |
|---|-----|-----|------|------|

Table 11. 28 days split tensile strength of conventional concrete

| Sl no | Length in mm | Depth in mm | Load in tonnes | Split Tensile Strength in N/mm ² |
|-------|--------------|-------------|----------------|---|
| 1 | 300 | 150 | 27 | 3.75 |
| 2 | 300 | 150 | 27.5 | 3.82 |
| 3 | 300 | 150 | 26.8 | 3.72 |

Table 12. 28 days split tensile strength of concrete with chicken mesh

| Sl no | Length in mm | Depth in mm | Load in tonnes | Split Tensile Strength in N/mm ² |
|-------|--------------|-------------|----------------|---|
| 1 | 300 | 150 | 32 | 4.44 |
| 2 | 300 | 150 | 32.1 | 4.45 |
| 3 | 300 | 150 | 32.1 | 4.45 |

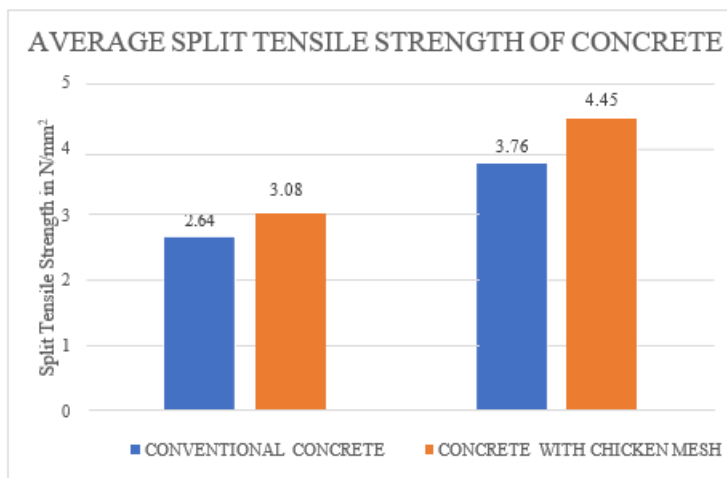


Figure 4. Average Split tensile strength of concrete for 14 and 28 days.

[5] CONCLUSION

The results of a study on concrete reinforced with chicken mesh were positive. Comparing the reinforced concrete mix with chicken mesh to conventional concrete mixes, the results indicated improved tensile strength and crack resistance. The mechanical properties of concrete have significantly improved when chicken mesh has been used as reinforcement. The compressive strength increased by 5%, indicating enhanced resistance to compression forces, which is crucial for structural stability. Additionally, there was 15% increase in flexural strength, which suggests that the concrete is more resistant to bending and cracking and improves its overall durability. Furthermore 20% improvement in split tensile strength was observed, suggesting enhanced resistance to tensile stresses and potential cracking.

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