

# Experimental Investigation on Special Concrete Using Steel Nail

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**Abstract:---** Steel nail plays an important role in people's daily lives and joins wooden materials, brush and construction structures. This paper examines the prospective directions of using steel nail in concrete composites for structures. The samples are cast to assess the compressive strength and flexural strength by adding steel nail to the concrete matrix. In this investigation, five different proportions of steel nails in varying percentage of 3%, 6%, 9%, 12% and 15% was used. The results showed that the effect of the steel nail on concrete increases compressive and flexural strength significantly. The study aims to optimize the use of concrete steel nails.

**Key words:---** Compressive strength, Flexural strength, Steel nail.

## I. INTRODUCTION

Steel nail concrete (SNC) is a concrete that contains nails distributed randomly. A nail is a small, discreet material made of different shapes and sizes. It is newer composite material provides excellent compressive strength and flexural strength. It increases toughness, resistance to shock and plastic shrinkage crack occurring in mortar. These nails improve the strength of the structure to reduce the need for heavy steel strengthening. Improved thermal resistance to freezing thaw and durability of concrete reduces crack width. The normal concrete fails suddenly due to deflection which arises due to the ultimate flexural strength is exceeded whereas on steel nail concrete continue to sustain the loads even due to deflection. Numerical parameter describes the nail with aspect ratio.

## II. OBJECTIVE

- To assess the compressive strength and flexural of the concrete by using steel nail in different proportions.
- The comparison is made between steel nail concrete and normal concrete with different percentages.
- To estimate the optimum percentage of steel nail.

## III. EXPERIMENTAL INVESTIGATION

In the present investigation, the materials used were presented below such as

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- OPC of 53 Grade.
  - Fine aggregate.
  - Coarse aggregate.
  - Steel nail.
  - Water.
- a. **Cement:** For experimental work, 53 Grade Ordinary Portland cement is used. The physical characteristics of cement tested in Table 1.

## IV. EXPERIMENTAL RESULTS

Table 1 Physical properties of cement

S.No.	Properties	Values
1	Normal consistency	31%
2	Initial setting time	100 min
3	Final setting time	282 min
4	Fineness test	6 %
5	Specific gravity	3.15

- b. **Fine aggregate:** For experimental investigation, river sand is used. The physical properties of fine aggregate in Table 2.

Table 2 Physical properties of fine aggregate

S.No.	Properties	Value
1	Specific gravity	2.62
2	Water absorption	1.50%
3	Fineness modulus	2.4

- c. **Coarse aggregate:** Table 3 shows the tested physical properties of coarse aggregates.

Table 3 Physical properties of coarse aggregate

S.No.	Properties	Value
1	Specific gravity	2.70
2	Water absorption	1.20%
3	Bulk density	1560 kg/m <sup>3</sup>

- d. **Water:** Potable water from the laboratory was used for mixing the concrete and also for curing the specimens.
- e. **Steel Nail:** By adding steel nails in concrete, concrete provides flexural strength, abrasion, spalling and impact resistance with long - lasting, high flexural strength and fatigue. The removal of reinforcement from conventional concrete reduces the section thickness. Steel nails lead to significant cost savings, reduced volume of materials, rapid construction at lower labor costs. The allocation of steel nails in concrete randomly ensures that

the concrete is free of micro cracks. Fig.1.



Fig.1 Steel Nail

**V. MIX PROPORTIONS**

Design of concrete mixture developed for concrete grade M30 according to 10262:2009.

**VI. HARDENED CONCRETE**

**a. Compressive Strength:** After the curing period, the strength of concrete is tested for compressive strength by testing in the compression testing machine. Table 4 shows the results obtained for the compressive strength at 28 days.

**Table 4** Compressive strength of concrete reinforced with steel nail

S.No.	% of steel nail	Compressive strength at 28 days, N/mm <sup>2</sup>
1	0	34.89
2	3	37.57
3	6	42.24
4	9	44.61
5	12	47.98
6	15	45.62

**b. Flexural strength**

Due to steel nail in concrete increases the flexural strength. The results that are obtained for the flexural strength at 28days in Table 5.

**Table 5** Flexural strength of concrete reinforced with steel nail

S.No.	% of steel nail	Flexural strength at 28 days, N/mm <sup>2</sup>
1	0	5.65
2	3	6.13
3	6	6.5
4	9	6.68
5	12	6.93
6	15	6.75

**VII. CONCLUSIONS**

The research investigation concentrates on addition of steel nail for strengthening reinforced concrete established some general facts related to composite strengthening.

1. The experimental tests revealed that the strength properties of concrete improved by adding steel nails to the concrete.

2. The addition of steel nails significantly increased the strength characteristics of concrete, mainly compressive strength and flexural strength.
3. The compressive strength and flexural strength of concrete gradually increased the addition of steel nails to 12 percent and showed a gradual decrease in strength beyond that percentage.
4. The escalation in compressive strength was 7.68, 21.07, 27.86 and 37.52 % with addition of 3, 6, 9 and 12% respectively with steel nail when compared with reference concrete at 28 days.
5. Increase of 8.50, 15.04, 18.23 and 22.65% with addition of 3, 6, 9 and 12% respectively with steel nail when compared with reference concrete at 28 days for flexural strength.

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