# EXPERIMENT STUDY ON REACTIVE POWDER CONCRETE BEAMS USING SPIRAL REINFORCEMENT UNDER TORSION

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## ABSTRACT

The construction of buildings and bridges have grown more intricate and asymmetrical, with some beams for example, border beams and curving bridges being vulnerable to significant torques. This presents additional problems to the tensional performance of the beam since it is necessary for the beams must be tall torsion capacity and ductility, particularly in typhoon or earthquake prone locations. In order to increase the members' ductility and capacity, continuous spiral reinforcing (SP) has been shown to be superior to standard stirrups in recent years. The shear performance of beams, the seismic performance and bearing capacity of shear walls, and the energy dissipation and beam-column deformation capacity connections are all greatly enhanced by the necessary spiral reinforcing and the application of reactive powder concrete (RPC). Thus, a study examining the relationship between spiral reinforcement in torsion beams and reactive concrete powder (RPC) has been progressively conducted by developing beams with two different types of spiral reinforcement and investigating the effect of spiral development on the torsion capacity of the beam.

## 1. INTRODUCTION

When the SP was freed, the ductility and torsion capability drastically dropped. It was demonstrated that when stirrup spacing increased, the beams' ultimate torque and rigidity dropped. The torsion durability and performance were decreased as torsion cracks started to show. RPC has better durability and tensile strength than ordinary concrete, which increases the members' cracking load. Torsion experiments were performed on hollow RPC T beams by Khuzaie et al. The findings showed that the beams' cracking torque was increased and that the onset of fractures was delayed. Yang et al. and Zhou et al. demonstrated experimentally that, like to an earthquake, the ultimate torque and cracking torque of ultra-high performance concrete (UHPC) beams increased with the quantity of steel fibers.

## 2. PROBLEM STATEMENT & AIM

### 2.1 Problem Statement:

The most often used building material worldwide is concrete. Where it played a significant part in putting the infrastructure and additional structures. Low-strength concrete is used to make joints and branch roadways, whereas medium-strength concrete is utilized to build buildings, bridges, and similar structures. High strength concrete was utilized to build shear walls, bridge towers, and tall poles. With the exception of a few bridges and certain structural parts like girders, super-strength concrete was not widely employed. The primary driver behind the development and launch of Reactive Powder Concrete (RPC) was the demand for high strength.

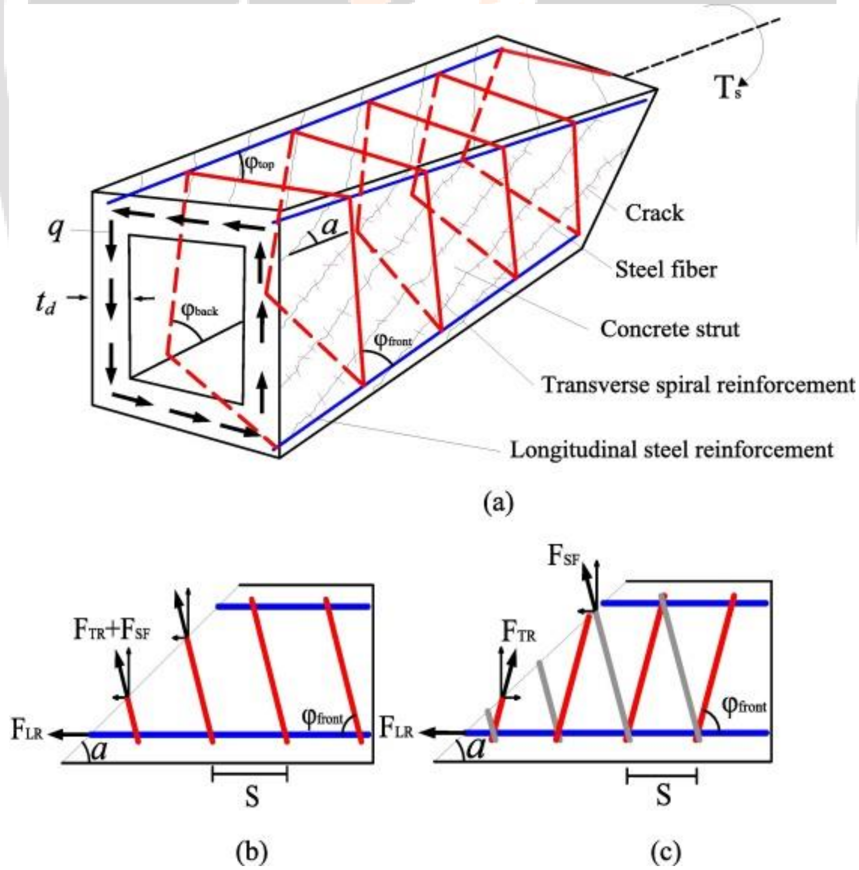


**Fig -1**

**2.2 Objective of the project:**

1. Comparing strength of normal beam with RC (Reactive powder concrete) beam.
2.To evaluate stiffness

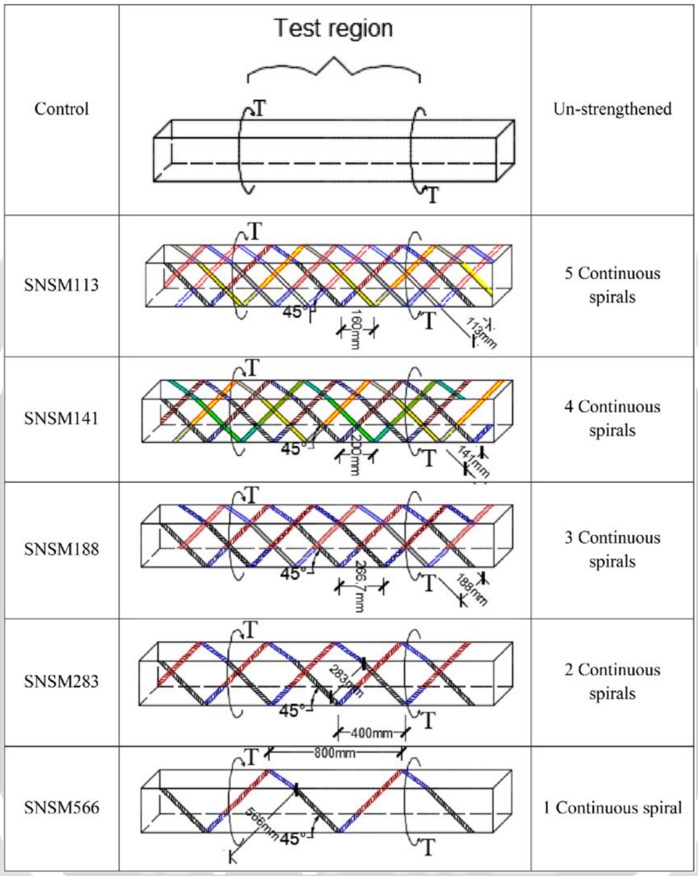


**Fig -2**

## 3. METHODOLOGY:

Properties of materials: Steel fiber, water, superplasticizer, silica fume, cement (PO425), and silica sand are the ingredients needed to manufacture RPC. In this experiment, three RPC combinations were employed; the only difference between them was the amount of steel fiber. Three different diameters of silica sand were initially combined in a mixer for two minutes in order to prepare RPC. Second, two minutes of mixing were spent after the steel fibers were added to the mixer through a steel sieve. Thirdly, after the steel fibers were distributed and mixed for ten minutes, cement and silica fume were added to the mixture. Ultimately, to produce RPC with excellent fluidity and usability, water and a water-reducing admixture were added one after the other and combined for six minutes. The cube specimen and test beams were kept in the same conditions and concreted simultaneously. Using cubic specimens, RPC's tensile and compressive strengths were determined HRB400 steel reinforcements were used for the reinforcements that are transverse and longitudinal. Whole, continuous rebars were used to construct the SP. Used rebar's characteristics are shown.

Investigations and discussions were held about the effects of various spiral reinforcement ratios, spiral reinforcement layouts, and steel fiber composition on the torsional performance of the nine RPC beams. The experiment's findings demonstrated that, although having no effect on the RPC beams' failure mechanism, ultimate torque, torsional stiffness, or energy dissipation, longitudinal reinforcing increased their ductility. The locked spiral reinforcement of RPC beams has more torsional ductility, stiffness, and ultimate torque than stirrups, which are frequently utilized. Nevertheless, the ultimate torque, stiffness, and torsional ductility all decreased with the release of the spiral reinforcement. The locking and unlocking of spiral reinforcing had less of an impact on the beams' pre-cracking torsional rigidity and cracking torque. Higher ratio of spiral reinforcing to steel fiber content in reinforced cement concrete, swerving was reduced when the primary reinforcement was replaced with a spiral form, boosting the shear, ductility, bending moment, and torsion moment. This also leads to improvements in earthquake performance. The major goal is the mathematical modeling and testing of RCC beams and columns with primary spiral reinforcement.

### 3.1 Material and design study of the project

1. The combination design for M20 grade concrete will be finished utilizing the IS-code method.
2. For the following cases, 150 mm by 150 mm by 700 mm typical RCC beams will be cast in a lab and tested separately for shear and flexure after 28 days of curing. Conventional RCC beams with little shear reinforcing. The RCC beams reinforced with spiral shear
3.The typical short RCC columns and RCC columns with main spiral reinforcement will be cast in a lab and tested solely for axial loads following a 28-day curing period.

### 3.2 Procedure -

Grip one end of the attachment in the top section and one end in the lower area after positioning the specimen.

- Flip on the main switch of the universal testing machine.
- Holding the drag indicator parallel to the primary indicator.
- Select the suitable load range, insert the corresponding weight into the pendulum, and use tiny balancing weights to correct the balance as necessary.
- To activate the pump's motor, press the buttons.
- Until the specimen cracks, gently shift the head control level to the left.
- Turn off the machine, remove the specimen, and record the load at which it breaks.

## 4. PROBABLE CONCLUSIONS

This experimental investigation examined the behavior of spirally reinforced reactive powder concrete (RPC) beams under torsional strain. Based on the analysis and findings of the experiment, the following deductions may be made: Enhanced Torsional Resistance: The torsional resistance of RPC beams was greatly increased by the addition of spiral reinforcing. In comparison to the plain RPC beams, the spirally reinforced beams showed better ultimate strength and torsional stiffness. Crack Control and Ductility: Under torsional stress, the RPC beams' ductility was enhanced and the effective propagation of cracks was managed by the spiral reinforcement. As a result, the failure process became more gradual, allowing for increased deformation capacity and warning indications before to failure.

**Load Redistribution:** By efficiently transmitting torsional stresses and reducing localized failure modes like shear cracking and spalling, the spiral reinforcement promoted load redistribution within the beams.

**Optimized Spiral Configuration**: According to the experimental findings. improving the torsional behavior of RPC beams requires careful consideration of the placement and spacing of the spiral reinforcement. It might be necessary to do more optimization research to determine the optimal spiral shape for optimizing torsional resistance.

**Design Suggestions:** Design suggestions for the usage of spiral reinforcement in RPC beams subjected to tensional loading can be developed based on the study's findings. These suggestions could include specifications for the diameter, spiral spacing, and details in order to guarantee the best possible performance and structural integrity.

## 6. REFERENCES

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