Performance Evaluation of Jacketing Technique for Strength Enhancement of Damaged RCC Columns

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Abstract - Reinforced Cement Concrete (RCC) has been widely used as a construction material globally for the past century, and in India, its utilization has significantly increased over the last 50–60 years. During this period, a large number of infrastructural assets, including bridges, buildings, and stadiums, have been constructed, serving as lifelines for society. However, RCC structural elements are often subjected to damage during their service life due to overloading, faulty design, poor workmanship, chemical attacks, and adverse environmental conditions. Repairing and rehabilitating such damaged structures without demolition is crucial for extending their service life and ensuring safety.

This study investigates the strengthening of damaged RCC columns using jacketing techniques, incorporating both mineral admixtures (silica fume) and chemical admixtures. Silica fume, used as a supplementary cementation's material at 25 % replacement by weight of cement, was incorporated into the concrete mix to enhance mechanical properties and durability. Concrete specimens were cast and tested to evaluate compressive strength, split tensile strength, and flexural strength, and the results were compared with conventional concrete.

Additionally, non-destructive testing (NDT) was performed on structural elements before and after rehabilitation to assess the effectiveness of the strengthening methods. The results indicate that the inclusion of silica fume significantly improves the mechanical performance of the concrete on Cubes, cylinders and prisms. While the jacketing techniques effectively restore the structural capacity of damaged RCC members. This research demonstrates a practical and economical approach for the repair, retrofitting, and rehabilitation of RCC structures**,** ensuring enhanced durability and service life without the need for demolition.

Keywords: *RCC, Jacketing, Silica fume, Compressive strength, Flexural strength, Non-destructive testing, Structural rehabilitation.*

1.INTRODUCTION

Concrete is the most widely used and versatile construction material possessing several advantages over steel and other construction material. Very often one comes across with some defects in concrete they are in the form of cracks, spalling of concrete, exposure of reinforcement, excessive deflections or other signs of distress. Corrosion of reinforcement may trigger off cracking and spalling of concrete, coupled with deterioration in the strength of the structure such situations call for repairs of affected zones and sometimes for replacements of entire structure. Reinforced concrete (RCC) has been widely used in construction over the pas thundred years, and its application has substantially grown in India since the late 1950s.Underthese circumstances, numerous vital infrastructural assets that society depends on were constructed, which included bridges and buildings and stadiums. The RCC structures are also vulnerable to damage when they are confronted with more weight than what they can accommodate, badly designed or constructed, poor chemical attacks, or extreme environmental conditions. The main methods that can be used to support them in an extended period are repairs and rehabilitation without destroying the structure.

1.2 Causes of Damage in Buildings:

1.2.1. Structural causes:

Design errors or inadequate load-bearing capacity
Excessive deflection, settlement, or vibration
Overloading of floors or columns
Poor detailing of reinforcement

1.2.2. Material-related causes:

Poor-quality concrete or improper mix design
Corrosion of reinforcement due to ingress of chlorides or carbonation
Cracks due to shrinkage, creep, or thermal stresses

1.2.3. Environmental causes:

Exposure to aggressive chemicals or marine environment
Moisture infiltration and freeze–thaw cycles

Seismic events or wind-induced movements

1.2.4. Construction and maintenance causes:

Poor workmanship Inadequate curing

Lack of regular inspection

Preventive maintenance

1.3 Effects of Damage on Buildings

Reduction in load-carrying capacity.

Loss of stiffness and excessive deformation.

Corrosion and bond failure between steel and concrete.

Instability leading to partial or total collapse.

Reduced durability and service life.

1.4 Repair , Retrofitting and Rehabilitation

1.4.1 Repair

Repair is the process of restoring something that is damaged or deteriorated or broken to good condition. Repairs are performed on damaged buildings to restore the strength after disaster.

1.4.2 Retrofitting

Retrofitting means to replace or correct deteriorated, damaged or faulty materials, components or elements of a structure. Retrofitting can also be stated as preservation of an existing state

1.4.3 Rehabilitation

Rehabilitation means the process of repairing / modifying a structure to a desired useful condition. Rehabilitation means to increase the mechanical strength (tensile strength, compressive strength, flexural strength, shear strength) and durability. Assessing the existing condition of the structure and deciding which component of the structure should be repaired or restored based on all future requirement of the structure

1.5 Repair Techniques

Repair techniques in buildings are the methods and processes used to restore damaged, deteriorated, or defective parts of a structure so that it regains its original strength, stability, safety, functionality, and appearance.

1.5.1. Crack repair:

Epoxy injection for structural cracks Polymer sealant for non-structural cracks

1.5.2. Concrete repair

Remove loose concrete and clean reinforcement

Apply anti-corrosive coating on steel Recast with polymer-modified mortar or micro-concrete

1.5.3. Strengthening methods

Jacketing of columns and beams (using RCC or steel jackets)

External plate bonding or FRP wrapping

Addition of shear walls or bracings for lateral stability

1.5.4. Leakage and waterproofing

Use crystalline waterproofing coatings

Injection grouting to seal leaks Membrane or surface coatings on roofs and basements

1.6 Common Repairing Materials

Cementitious repair mortars

Polymer-modified mortars (SBR, acrylic)

Epoxy resin adhesives

Fiber-reinforced polymers (FRP)

Micro-concrete for jacketing

Grouts (cement or epoxy based)

1.7 Preventive Measures

Proper design and detailing

Quality construction practices

Adequate cover to reinforcement

Use of durable materials

Periodic maintenance and monitoring

1.8 Objectives of The Work

To identification of defects in the structure.

To prepare detailed documentation of damages in a structure.

To conduct various tests on structural members and analyze the damages.

To treat the damaged cubes and regain its old strength.

To increase the service life of structure & maintain its value.

To ensure the safety of Occupants & reduce outgoing expenses.

1.9 Scope of The Work

It helps us to identify the various factors that contribute to damages, which enforces us to take precautionary steps to avoid such kinds of failure in the future Damaged structures can be restored to a proper condition through

2.0 Literature Review

Repairs & Rehabilitation of RCC Structures PPAMBEDKAR, ME CIVIL; International Conference on Earthquake Engineering, 2010. Rehabilitation of structures embroils contribution of high end technology, advanced skills and calculations. This is a very responsible job to be done to save hazardous failure of structures due to deterioration. The success of this subject totally depends on gaining expertise in the field and day to day advancements. Rehabilitation is highly recommended for age-old buildings showing signs of decent and save human lives from failures.To modify/improve the properties of concrete or mortar, a large number of polymers/admixtures have been tried and extensively used in other countries. World over polymers/admixtures have been in use for over 45-50 years and their long term behaviour patterns are known.

The superiority of polymer modified mortars/concretes over normal mortars/concretes in repair/rehabilitation field is established beyond doubt.

Steel Jacketed Concrete Stub Columns (2024)Authors: Apisith Waenpracha et al. (Cold-Formed Steel Jacketed Concrete Stub Columns). The research tested cold-formed steel jackets to strengthen concrete columns under sustained axial compression.Jackets made of cold-formed steel sections enhanced axial load capacity by approximately 40–65% over unconfined specimens. The confinement action of steel jackets significantly improved axial performance, even when preload (initial load) was applied.The study compared results with standard predictive models, validating the concept.

Lateral Strength Enhancement by Concrete Jacketing (2025)Authors: V. D. Cruz & S. M. Alcocer (Concrete Jacketing Performance). This work evaluated traditional concrete jacketing of RC columns, focusing on seismic-relevant strengths, flexural and shear capacities. Concrete jacketing effectively increased shear and flexural strength, not just axial capacity. The study provided recommendations on surface preparation, reinforcement ratios, and hoop configuration to achieve composite behavior. Data was compared with design provisions from widely accepted codes (e.g., ACI 318) Corrugated Steel Jacket Strengthening of RC Columns (2025)Authors: Yang Fan et al. (Experimental study on square RC short columns strengthened with corrugated steel jacket under axial compression)

This paper investigates a novel type of jacketing where corrugated steel sleeves were used as external confinement around square RCC short column specimens .v The steel jacket provides lateral confinement, significantly increasing the axial load capacity and ductility of the columns. Columns strengthened this way achieved 34.6–67.3% increases in ultimate bearing capacity compared to un-strengthened columns. The study also developed a predictive model for ultimate bearing capacity under axial loads

Thin HPFRC Jackets for RC Columns (2026)Authors: Maria Dolores Criado Fernández et al. (Thin HPFRC Jackets for Axially Loaded RC Columns). This research focused on using High-Performance Fiber-Reinforced Concrete (HPFRC) as a thin external jacket for strengthening columns under axial load. Jackets were very thin (<30 mm) but provided significant strength gains without additional reinforcement. Axial capacity improvements ranged up to 105% in square sections and 87% in rectangular columns compared to un-strengthened columns. The method required simple surface preparation such as sandblasting

3.0 Methodology:

3.1.1 Factors For Selection of Repair Methods:

- ☐ Type and extent of distress
- ☐ Location of distress
- ☐ Environmental exposure
- ☐ Availability of time and access for repairs
- ☐ Appearance
- ☐ Cost

3.2 Repair and Rehabilitation of Structural Elements

3.2.1. Structural Analysis (Assessment Phase)

The analysis phase aims to determine the extent, cause, and impact of deterioration on the structural performance.

3.2.1.1 Condition Assessment

A) Visual Inspection:

To conduct the physical investigation on the structural elements to indetitify the damage

B) Non-Destructive Tests (NDT):

- ☐ To conduct the Non Destructive test on damaged structural elements to determine the Properties.
- ☐ Rebound Hammer Test – surface hardness
- ☐ Ultrasonic Pulse Velocity (UPV) – internal defects
- ☐ Half-Cell Potential Test – corrosion activity
- ☐ Cover meter, core tests, carbonation depth, etc

2.2.1.2 Structural Evaluation

Determine remaining load-carring capacity.

Perform structural analysis using the results of tests and material properties.

Identify whether damage is cosmetic, functional, or structural.

3.2.1.3 Diagnosis

Establish root causes (e.g., corrosion due to chloride ingress, overloading, design fault). Classify severity: Minor / Moderate / Major / Critical

3.2.2. Strategy for Repair and Rehabilitation

The repair strategy is a systematic plan to restore or improve performance, based on the type and extent of damage.

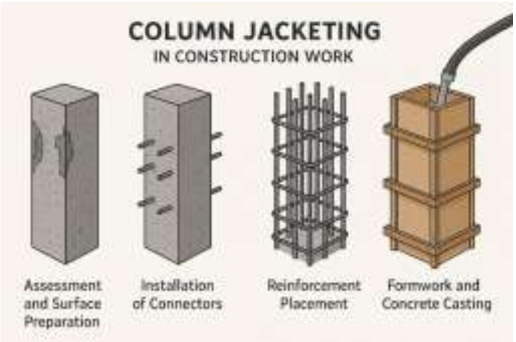
3.2.2.1 Planning Steps

1. Identify objectives: Restore strength, improve durability, or upgrade capacity.
2. Select appropriate method: Repair, strengthening, or retrofitting.
3. Choose suitable materials: Cementitious, polymer-based, epoxy, or FRP.
4. Decide sequence of works: Surface preparation, protection, finishing.

3.3.1 Jacketing Method

3.3.1.1 Definition

Jacketing is a technique of strengthening as well as rehabilitating that is employed in the recovery or enhancement of the strength of the damaged structural elements such as the columns, beams, or slabs. It entails installing a new layer (jacket) made of concrete, steel, or composite material to encase the existing member.



3.3.1.3 Types of Jacketing

1. Reinforced Concrete Jacketing (RC Jacketing): A new reinforced concrete layer is added around the existing member with proper bonding and dowel bars. Common for columns and beams

2. Steel Jacketing: Steel plates or angles are placed and bolted/welded around the member. Used for rapid repair and seismic strengthening.

3. FRP (Fibre Reinforced Polymer): Fiber sheets of carbon or glass are wrapped around the member by epoxy resin. They are also low weight, corrosion-resistant and perfect to be used in columns and bridges

3.3.1.4 Steps in RC Jacketing Process

1. The surface should be prepared: loose concrete should be removed and the rebar should be cleaned.
2. Repair reinforcement: Clean rusted bars and add new steel if needed.
3. Fix additional reinforcement: Provide dowel bars and new ties/stirrups.
4. Formwork: Place shuttering around the member with proper spacing.
5. Concrete placement: Pour non-shrink or micro-concrete jacket.
6.Curing: Correct curing should be done to develop strength

3.3.2 Corroded Steel Cleaning, Repair and Protection

When repairing reinforced concrete structures, corroded reinforcement bars (rebars) must be properly treated to restore strength and prevent further corrosion. To improve the durability of a reinforced concrete structure when making repairs, it is necessary that any corroded reinforcement bars (or rebars) be protected from future corrosion to restore strength and extend the life of the structure. Rust removal and applying polymer coatings are the two main methods used to achieve this goal. Two important techniques are

1. Rust Eimination
2. Polymer coating.

3.3.2.4. Steps Involved

1. Exposure of Reinforcement

Remove all loose and deteriorated concrete around the corroded bar until sound concrete is reached.

Maintain adequate clearance for cleaning and coating (usually 20–25 mm around the bar).

2. Cleaning of Reinforcement

Cleaning is done to remove Rust, scale, and contaminants completely

3. Inspection and Repair of Reinforcement

Check for loss of cross-section area:

If loss ≤ 10 % → bar may be retained after coating.

If loss > 10 – 25 % → splice or weld new reinforcement.

If loss > 25 % → replace bar completely.

Lapping / Splicing: Provide proper development length according to IS 456 or IS 13920.

Anchorage and Cover: Ensure correct bar alignment and maintain specified cover before recasting repair concrete.

4. Application of Protective Coatings

After cleaning, apply protective coatings or primers to prevent further corrosion.

3.3.2.5 Rust Eliminators

Purpose: Cleaning and removing rust from steel surfaces before repair.

Working Principle: Rust eliminators react chemically with iron oxides (rust) on the surface of rebar, turning them into stable, non-corrosive compounds.

Common Materials Used:

Phosphoric acid-based solutions: dissolve and convert rust into iron phosphate.

Tannic acid-based compounds: convert rust into a protective bluish-black coating.

Procedure:

1. Mechanically clean the rebar using a wire brush or sandblast.
2. Brush or spray the rust eliminator on the rebar.
3. Allow adequate reaction time according to the manufacturer's instructions.
4. Rinse or wipe off loose residues before applying coatings or concrete.

Advantages:

1. Effective removal of corrosion products.
2. Enhances the bond between rebar and repair material.
3. Prevents new corrosion initiation sites.

3.3.2.6. Polymer Coatings for Rebars:

Purpose: Protecting steel rebar from new corrosion initiation by applying a barrier coating. Types of Polymers Used:

1. Epoxy coatings
2. Polyurethane coatings
3. Acrylic coatings

Application Procedure:

1. Thoroughly clean the rebar (free from rust and moisture).
2. Apply a primer coat if necessary.
3. Brush, spray, or dip the rebar into the polymer coating material.
4. Allow adequate curing or drying time before embedding in concrete.

Advantages:

High corrosion resistance.

Good adhesion to steel surface.

Increases durability of repaired structures.

Reduces maintenance requirements.

4.2.1.1 Parameters of Damaged Column

4.2.1.1 Parameters of Damaged Column

Table No : 4.2.1.1 Parameters of Damaged Column

S.No	Parameter	Dimensions
01	Shape of the Colum	Square
02	Size of Colums	300 X 300 mm
03	Length of Colums	2500 mm.
04	Diameter of steel bar	12 mm Dia
05	No. of Bar in Colums	4
06	Dia of letral Ties	6 mm
07	Spaceing of letral Ties	300 mm Centre to centre

4.2.1.2 Damages detected by Visual Investigation

Table No : 4.2.1.2 Damages detected by Visual Investigation

S.No	Damage	Causes
01	Partial Buckling	Faulty Design, Over loading, Improper Steel
02	Spalling of concrete	Poor quality material, laoding, Bonding b/w materials
03	Cracks	Shrinkage, Improper workmenship and curing, Accedental over loding
04	Corrosion.	Insuffient cover, Pores and cracks, Water leakages,

4.2.2 Non-Destructive Tests (NDT) on Damaged Column:

4.2.2.1 The Rebound Hammer Test (Schmidt hammer test)

Purpose: To Findout the compressive strength and surface hardness of concrete

The rebound hammer test is conducted on damaged column on several location. Every 500 mm consider as a interval, and in every interval take the multiple reading

Table No: 4.2.2.4 R H Test Conducted on Damaged columns

The Rebound Hammer Test Values				
S.No	Ponit	Distance	R H Value	Quality of concrete
01	A	0.50 m	21	Poor
			20	
			20	
02	B	1.0 m	24	Fair
			26	
			25	
03	C	1.5 m	26	Fair
			28	
			29	
04	D	2.0 m	30	Good
			31	
			33	
05	E	2.5 m	20	Poor
			18	
			19	
Avg. R H Number			24.6	Fair

4.2.2.2 Ultra sonic pulse velocity test as per IS13311(Part-I)

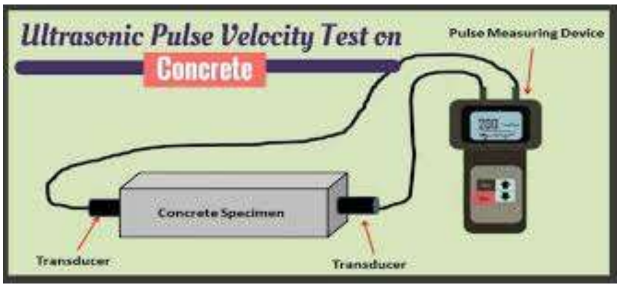


Table No: 4.2.2.2.3 Ultrasonic pulse velocity test conducted on column

Ultrasonic Pulse Velocity Test Values				
S.No	Ponit	Distance	UPV Test Value	Quality of concrete
01	A	0.50 m	2.20	Doubtful
02	B	1.0 m	2.27	Doubtful
03	C	1.5 m	2.41	Doubtful
04	D	2.0 m	2.38	Doubtful
05	E	2.5 m	3.00	Medium
Avg. UPV Test Value			2.45	Doubtful

4.3 Selection of suitable materials for RCC Jacketing Method

A strengthening method called RCC (Reinforced Cement Concrete) jacketing is used to improve the stiffness, durability, and load-bearing capacity of existing structural elements such as footings, beams, and columns. Selecting the right materials is essential to guaranteeing composite action between new and old concrete.

4.3.1.1.5 Test Results of Cement

Table No: 4.3.1.1.5 Test Results of Cement

Test Results of Cement			
S.No	Characteristics	Test results	IS:12269-1897 specifications
01	Fineness (IS sieve No: 90 μm)	3.5%	<10%
02	Consistency	30%	-
03	Initial setting time (minutes)	35min	>30 minutes
04	Final setting time (minutes)	230min	<600 minutes
05	Specific gravity	3.14	3.15

4.3.2.1.4 Test Results of Fine Aggregates

Table No: 4.3.2.1.4 Test Results of Fine Aggregates

S.No	Property	Test results	IS:2386-1963 Specifications
01	Fineness modulus	2.76	-
02	Specific gravity	2.60	2.6 – 2.8
03	Water absorption	2.09 %	-
04	Bulk density	1475kg/m^3(untraded)	-
		1624kg/m^3(ridded)	-

4.3.3.1.4 Test Results of Coarse Aggregates

Table No: 4.3.3.1.4 Test Results of Coarse Aggregates

S.No	Property	Test results	IS:2386-1963 Specifications
01	Fineness modulus	7	-
02	Specific gravity	2.7	2.6-2.8
03	Abrasion test	34%	40%
04	Crushing value	22%	<30%
05	Bulk density	1483kg/m^3(untraded)	-
		1563kg/m^3(ridded)	-

4.3.5 Silica Fume Micro Scopic view

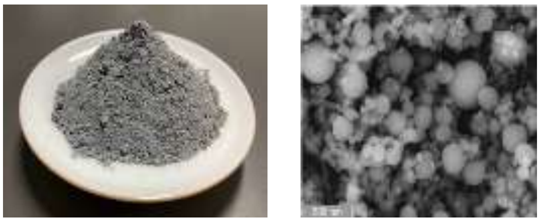


Table No: 4.3.5.5.3 Test results of Silica Fume

S.No	Property	Result	Standard Range
01	Sieve Analysis	93%	>85%
02	specific gravity	2.50	2.2 – 2.6

4.3.6 Chemical admixture

4.3.6.1 High-range water reducer- (CornPlast SP 430)

4.4Mix Design

M30 Grade designed as per IS 10262:2009 & IS 456:2000

Mix Proportions

Cement = 270 kg/m^3

GGBS = 90 kg/m^3 (25% By Total weight of Cement)

Water = 158 l/m^3

Fine aggregate = 798 kg/m^3

Coarse aggregate 20mm = 882 kg/m^3

12mm = 223 kg/m (20% By Total weight of Coarse Aggregate)

Chemical admixture = 1.34 kg/m (0.4% by the weight of cement)

Density of concrete = 2430 kg/m

Water-cement ratio = 0.47

Mix Proportion By weight = 1: 2.2 :3.09

5.2 Tests on concrete

5.2.1.1.2 Test Results of Slump Cone

Table No: 5.2.1.1.2 Test Results of Slump Cone

Table No: 5.2.1.1.2 Test Results of Slump Cone

S.No	Type of Concrete	Slump Value (mm)
01	Conventional Concrete	80 mm
02	Silica Fume Concrete	60 mm

5.2.1.2.2 Test Results of Compaction Factor Test

Table No: 5.2.1.2.2 Test Results of Compaction Factor Test

S.No	Type of Concrete	Compaction Factor
01	Conventional Concrete	0.87
02	Silica Fume Concrete	0.91

5.2.2.1.3 Compressive strength Test Results

Table No : 5.2.2.1.3 Compressive strength Test Results

S.No	Type of Concrete	Compressive strength (Mpa)		
		7 Days	14 Days	28 Days
01	Conventional Concrete	24.86	32.72	38.50
02	Silica Fume Concrete	26.20	37.50	43.20

5.2.2.2.3 Split Tensile Strength Test Results

Table No: 4.3.5.5.3 Test results of Silica Fume

S.No	Property	Result	Standard Range
01	Sieve Analysis	93%	>85%
02	specific gravity	2.50	2.2 – 2.6

5.2.2.3.3 Flexural Strength Test Results

Table No : 5.2.2.3.3 Flexural Strength Test Results

S.No	Type of Concrete	The flexural strength Test (Mpa)		
		7 Days	14 Days	28 Days
01	Conventional Concrete	5.20	6.50	7.65
02	Silica Fume Concrete	6.75	8.10	9.10

5.3 Design of RCC Column Jacketing

Existing column size = 300 mm × 300 mm

Jacketed (final) size = 400 mm × 400 mm

1. Design Considerations

Grade of concrete (Old) = M20

Grade of concrete (new jacket) = M30

Grade of steel = Fe500

Clear cover = 40 mm

2. Calculations of Area

Existing column area =A_1= 300*300= 90,000 mm^2

New column (jacketed) area =A_2 = 400*400 = 1,60,000 mm^2

Additional concrete required by Jacketing method

= 1,60,000-90,000

= 70,000 mm^2

3. Design Reinforcement

Minimum longitudinal reinforcement = 0.8% to 6% of gross area (as per IS Code 456:2000)

1. Minimum steel required jacketing column for 400 × 400.

Consider 0.8% of Gross Area

Ast = 0.8% X 1,60,000 = 1280 mm^2

Minimum Area of steel reinforcement is Ast = 1280 mm^2

2. Selecting steel reinforcement

Choose 16 mm Diabar , Area of single bar = 201.06 mm^2

Number of bars = N = 1280 /201.0, = 6.36 Let us consider 8 bars Provided Ast = 8 X 201.06= 1608 mm^2 Provide 8 number of 16 mm diabar as a main steel reinforcement Provided Ast is more than Minimum Ast, , Hence the steel reinforcementis safe.

3. Transverse Reinforcement (Letral Ties)

Provide 8 mm diameter ties, Spacing = 150 mm c/c

4. Final Reinforcement Details

Column size: 400 mm × 400 mm

Longitudinal steel: 8 bars – 16 mm dia (Fe500)

Letral Ties: 8 mm @ 150 mm c/c

Clear cover: 40 mm

5.4 Jacketing method for strengthening of RCC Columns

Inspection and Assessment

Surface Preparation

Rust Eliminators

Polymer Coatings for Rebars

Apply Bonding Agent

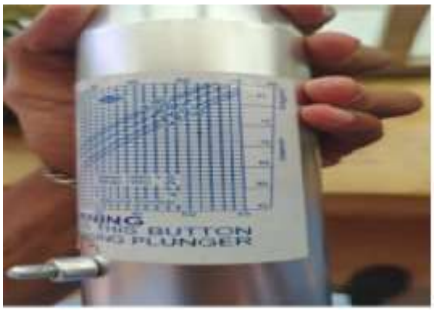
Placement of Additional Reinforcement

Arrangement of Formwork

Concreting

Curing

Final Inspection



5.5 Non-Destructive Tests (NDT) on Concrete after jacketing Method

Table No: 5.5.1 The Rebound Hammer Test after jacketing method

The Rebound Hammer Test Values				
S.No	Ponit	Distance	R H Value	Quality of concrete
01	A	0.50 m	32	Good
			33	
			30	
02	B	1.0 m	35	Good
			32	
			30	
03	C	1.5 m	33	Good
			32	
			33	
04	D	2.0 m	35	Good
			36	
			34	
05	E	2.5 m	30	Good
			31	
			32	
Avg. R H Number			35	Good

Table No : 5.5.2 Ultrasonic Pulse Velocity Test after jacketing method

Ultrasonic Pulse Velocity Test Values				
S.No	Ponit	Distance	UPV Test Value	Quality of concrete
01	A	0.50 m	3.3	Good
02	B	1.0 m	3.6	Good
03	C	1.5 m	3.5	Medium
04	D	2.0 m	3.8	Good
05	E	2.5 m	3.5	Good
Avg. UPV Test Value			3.8	Good

6.0 RESULT ANALYSIS

6.2.1.1 Slump Cone Test

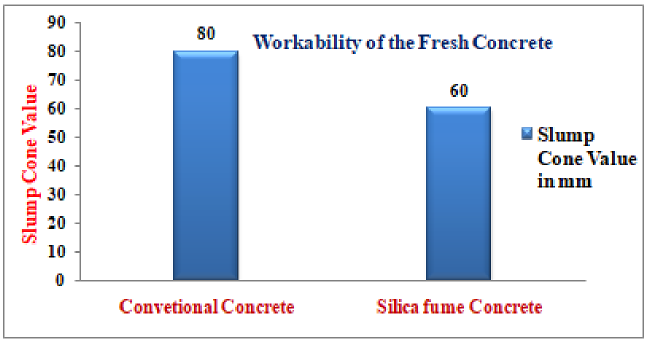


Fig. No: 6.2.1.1 Result analysis of Slump Cone Test

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6.2.1.2 Compaction Factor Test

Fig. No: 6.2.1.2 2 Result analysis of Compaction Factor Test

6.2.2.1 Compressive Strength Test

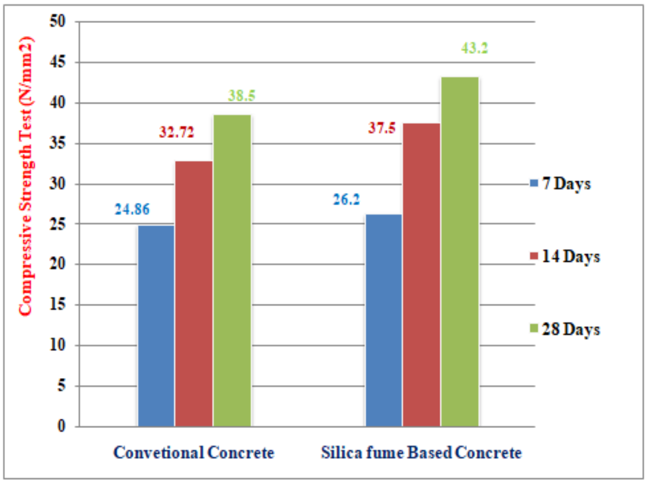

Fig. No: 6.2.2.1 Compressive Strength Test Result of Different Conrete

6.2.2.2 Split Tensile Strength Test

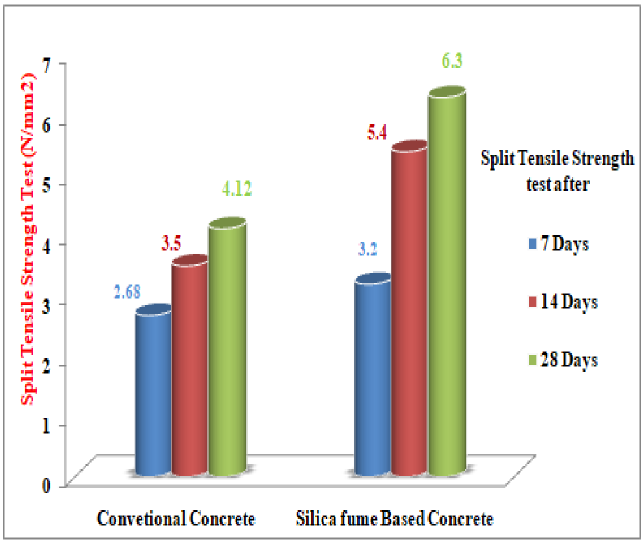

Fig. No: 6.2.2.2 Split Tensile Strength Test of Different Conrete

6.2.2.3 Flexural Strength Test

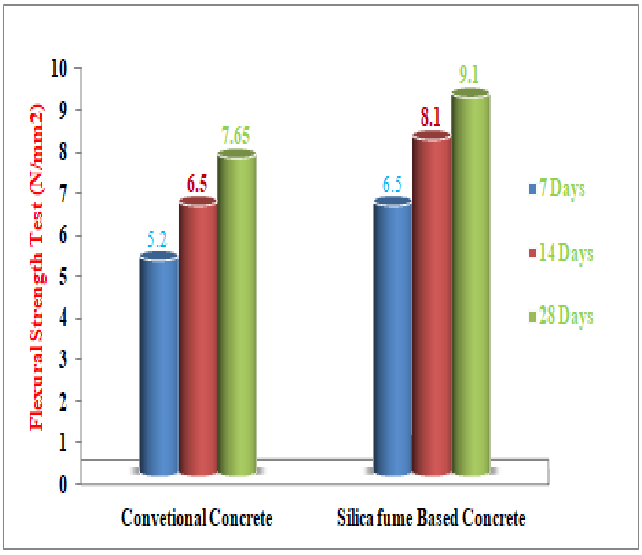

Fig. No: 6.2.2.3 Flexural Strength Test of Different Conrete

6.2.3 Non Destrcutive Tests

6.2.3.1 Rebound Hammer Test

Table No : 6.2.3.1 Result Analysis of Rebound Hammer Test before & After Jacketing

The Rebound Hammer Test Values						
Jacketing Method			Before		After	
S.No	Ponit	Distance	Value	Quality of concrete	Value	Quality of concrete
01	A	0.50 m	21	Poor	32	Good
			20		33	
			20		30	
02	B	1.0 m	24	Fair	35	Good
			26		32	
			25		30	
03	C	1.5 m	26	Fair	33	Good
			28		32	
			29		33	
04	D	2.0 m	30	Good	35	Good
			31		36	
			33		34	
05	E	2.5 m	20	Poor	30	Good
			18		31	
			19		32	
Avg. R H Number			24.6	Fair	35	Good

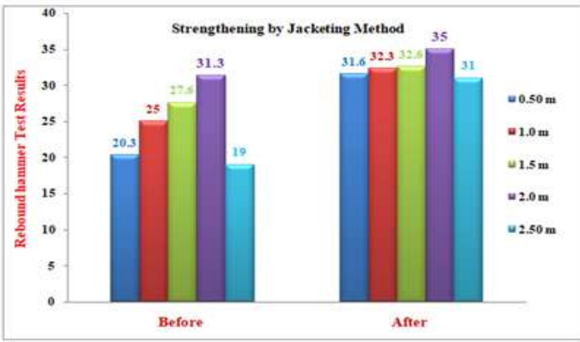

Fig. No: 6.2.3.1 Rebound Hammer Test Results on Concrete before and after Jacketing method

6.2.3.2 Ultrasonic Pulse Velocity Test

Table No: 6.2.3.2 Ultrasonic Pulse Velocity Test Results before and after Jacketing method

Ultrasonic Pulse Velocity Test Values						
Jacketing Method			Before		After	
S.No	Ponit	Distance	UPV Test Value	Quality of concrete	UPV Test Value	Quality of concrete
01	A	0.50 m	2.20	Doubtful	3.3	Good
02	B	1.0 m	2.27	Doubtful	3.6	Good
03	C	1.5 m	2.41	Doubtful	3.5	Medium
04	D	2.0 m	2.38	Doubtful	3.8	Good
05	E	2.5 m	3.00	Medium	3.5	Good
Avg. UPV Test Value			2.45	Doubtful	3.8	Good

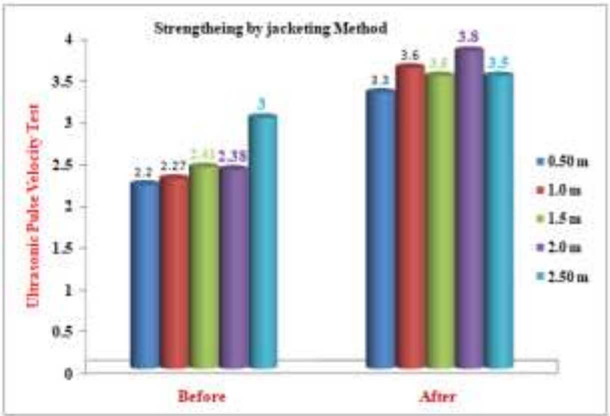

Fig. No: 6.2.3.2 Ultrasonic Pulse Velocity Test Results before and after Jacketing method

7.1 Conclusion

1. While after using 25 % silica fume in conncrete, it is observed that the slump value is obtained 60mm which falls under the range of (20 mm), it will reduce the slump value and reduction water content in the concrete
2. The compressive strength of the normal cubes is obtained 38.25 N/mm2 whereas using 25% silica fume, the compressive strength of the cubes is obtained 43.20 N/mm2.Hence, the compressive strength of the cubes is increased by 10.33 % of Conventional concrete strength.
2. The Spilt Tensile strength of the normal cylinder is obtained 4.12 N/mm2 whereas using 25% silica fume, the Spilt Tensile strength of the cylinder is obtained 6.30 N/mm2. Hence, the Spilt Tensile strength of the cylinder is increased by 53.00 % of Conventional concrete strength
3. The flexural strength of the beams is obtained 7.65 N/mm2 where as, the flexural strength of the beams is obtained 9.10 N/mm2. Hence, the flexural strength of the beams is increased by 24.60 % of Conventional concrete strength
4. The average value of the rebound hammer obtained from the different columns without jacketing is 24.6 which is Fair whereas, the average value of the rebound hammer obtained from the column with jacketing is 35 which is good. As per IS code IS 13311 Part 2
5. The average value of the UPV Test results obtained from the different columns without jacketing is 2.45 which is Doubt full whereas, the average value of the rebound hammer obtained from the column with jacketing is 3.8 which is good. As per IS code IS 13311 Part 1

7.2 Future Scope

1. By varying the mix proportions, further research works may be done in this area.
2. The industrial by products are used as admixture in concrete, to reduce the by-product content in environment.
3. By varying the admixture percentage, the strength and durability characteristics can be studied
4. Improve the load carrying & bearing capacity of damaged column without any destruction.
5. Increasing strength, life span and durability properties of Structural Element

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