



## A REVIEW ON RETROFITTING OF DETERIORATED WITH CARBON WRAPPING & STEEL PLATE JACKETING.

**Suraj B.Dahegaonkar**, Student, Dept. Of Civil Engineering, Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur University.

**Dr.P.L.Naktode**, Principal, Dept. Of Civil Engineering, Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur University.

### Abstract

Retrofitting deteriorated structures with carbon wrapping and steel plate jacketing has gained substantial attention due to its efficacy in reinforcing and enhancing the structural integrity of buildings and infrastructure. This abstract explores the principles, methodologies, and advantages of employing these techniques in the retrofitting process. Carbon wrapping involves the application of carbon fiber reinforced polymer (CFRP) sheets to the deteriorated structural elements. The high tensile strength and corrosion resistance of CFRP offer exceptional reinforcement, effectively restoring the load-bearing capacity and enhancing durability. Additionally, CFRP's lightweight nature minimizes additional stress on the structure. Steel plate jacketing, another prevalent retrofitting method, entails the installation of steel plates around weakened or damaged structural elements. The robustness and ductility of steel plates provide substantial support, redistributing loads and augmenting the structural resilience against various stresses, including seismic forces. This abstract further delves into the application scenarios, structural considerations, and performance assessments associated with retrofitting using carbon wrapping and steel plate jacketing. Comparative analyses of cost-effectiveness, environmental impact, and long-term durability are also discussed, highlighting the sustainability and efficiency of these retrofitting techniques.

In conclusion, retrofitting deteriorated structures with carbon wrapping and steel plate jacketing presents a viable and innovative solution to address structural deficiencies, extending the lifespan of buildings and infrastructure while ensuring enhanced resilience against diverse environmental and operational challenges.

**Keywords:** Retrofitting, Deterioration, Structural Rehabilitation, Carbon Wrapping, Carbon Fiber Reinforced Polymer (CFRP), Steel Plate Jacketing.

### I. Introduction

The retrofitting of deteriorated structures stands at the forefront of modern engineering, offering innovative solutions to address the challenges posed by aging infrastructure. This paper explores the application and efficacy of two prominent techniques—carbon wrapping and steel plate jacketing—in reinforcing and restoring the structural integrity of deteriorated buildings and infrastructure.

Structures worldwide face the inevitable effects of aging, exposure to environmental factors, and increased load demands beyond their original design parameters. These conditions often lead to deterioration, compromising the safety and functionality of buildings and infrastructure. Retrofitting emerges as a proactive strategy to fortify and revitalize these structures, ensuring their continued serviceability and safety.

Carbon wrapping, utilizing carbon fiber reinforced polymer (CFRP) sheets, and steel plate jacketing represent advanced methods in structural rehabilitation. They offer distinctive advantages in enhancing load-bearing capacities, resisting corrosion, and mitigating the effects of degradation. By strategically applying these materials to compromised elements, engineers can effectively restore structural strength and integrity.

This paper delves into the fundamental principles underlying carbon wrapping and steel plate jacketing, elucidating their mechanisms, structural considerations, and application methodologies. It explores case studies, technical analyses, and comparative evaluations to underscore the effectiveness, feasibility, and limitations of these retrofitting techniques.



Moreover, the paper discusses the broader implications of employing these methods, including cost-effectiveness, sustainability, and long-term performance. By comprehensively examining the practical aspects and outcomes of retrofitting with carbon wrapping and steel plate jacketing, this paper aims to contribute to the body of knowledge guiding modern structural rehabilitation practices.

Ultimately, this exploration endeavors to illuminate the significance of adopting innovative retrofitting techniques to prolong the lifespan, enhance the resilience, and ensure the safety of deteriorated structures in our built environment.

## II. Literature

**1) Abhishek Jodawat, Arihant Parekh & Bhushan Marathe[1]**, Fortified touchable structures frequently expect to reinforce to expand their subjects to support save stacks because of transpiration being used that brought about extra live loads, weakening of the heap conveying components, precious stone blunders, development issues during erection, white-haired of the structure itself or moving up to adjust to current lawmaking prerequisites. These circumstances may require to save touchable components or the unshortened touchable structure to be fortified, fixed, or retrofitted. Every one of these strategies has been appeared to intensely expand the midmost burden subjects of segments. The stacking conditions are chosen dependent on the disappointment burden to prompt splits in the post under 85% stacking of the disappointment load. The wile talked framework ends up being the biggest contrasted with full plate retrofitting as far as burden conveying themes and upgrading the isolation impact.

**2) Vijayakumar Amulya & A. Dattatreya Kumar[2]**, In this paper, Strengthen of existing reinforced Column in old structures is turning into a note worthy issue during repair and supports. Economical reasonable materials such as Steel angle section are used for retrofitting a reinforced concrete of the Column under loading is observation. Installation of these angle sections is very easy and skilled labour is not required. The simulated model of these column were generation in finite element based software ANSYS and the behavior of these column were observed under same loadings and compare. The result of both experimental analysis and software analysis were also compared.

**3) N. Lakshmanan, K. Muthumani & T.S. Krishnamoorthy[3]**, Pre-disaster prepared strategies lead to the repair/retrofitting of reinforced touchable structure for ensure satisfactory performance during earthquakes. The repair can be lead to be increase stiffness, strengthen, and failure deformation. There is a needs to quantify the performance of the structure without a repair has to be carry out. The study have revealed that repair and retrofitting of structural elements with inherent. Beam-column joint which had largest detailing through the inclusions of corner bar perform better. When these were strengthen with CFRP, there was a significant resurgence in load-carrying topics without loss of the failure deformation. detailing deficiencies would require greater super in tendency and attention.

**4) Prathamesh Dingorkar and Ayush Srivastava[4]**, Structure get dilapidateds with time for which repair are not feasible. Some structures cannot be kept sealed for longer reviviscence required for reconstruction. Retrofitting is an efficient method that can be unexplored to gainsay all these defiances. This vendible appends a comparative study of the percentages increase in strength without raise RC jacketing and FRP wrapping. Percentages increase in strength unzip without the RC jacketing and FRP wrapping is unswayable and compared. This study is the fruitful to gauges the suitability of the retrofitting method for weakened structure member. The study will be handy to help the structural engineer to decide which method of the retrofitting should be unexplored to reap the required increase in the strength.

**5) Chetan Yalburgimath, Akash Rathod & S Bhavanishankar[5]**, The using of CFRP fabrics whenever need, taking into consideration the zone of the CFRP fabric, rigid, and stiffness does result an increase of the strength of beams and provides spare load delivering capacity. A unconfined deal of the research is current stuff conducting concerning the used of the fiberreinforced polymer fabric wraps, laminates, and sheets in the repairs and strengthening of reinforced touchable members. Fiber-reinforced polymer using is a very constructives way to repairs and strengthen structure that have will



structural weakens over their life span. FRP is a repair system provided an economical viable volitional to traditional repairs system and material.

**6) Tabish Rasool Sheikh, Mohd Kashif Khan & Tabish Izhar[6]**, A thorough writing audit of the stir cleaned up in the past was concentrated to get the biggest thought of the key issues pertinent to the fortifying of RC sections with traditional fortified touchable jacketing. Besides, in contrast to another strategy, the current examination to have uncovered that the old-style RC jacketing leads to a uniform conveyance increment in quality and firmness of segments and, by and large, plane permits the structure to siphon the substantial seismic burdens. In wings of the first post is also improved. With the expanded interest for fixes and restoration in the field of auxiliary designing, Traditional RC jacketing will extend to develop as an affordable and durable retrofitting method.

**7) Saim Raza , Muhammad K. I. Khan & Scott J. Menegon[7]**, Weakening in the subjects of fortified touchable (RC) foundation may result from relinquishment supported during lattermost stacking situations, for example, seismic tremors. Additionally, factors, for example, the erosion of rebars or white-haired may fall apart or depose the subjects of a RC segment, along these lines requiring firsthand fortifying to either proffer or guarantee its precious stone life isn't constrained. This paper plans to give the express a workmanship survey of different fortify and fix techniques for the RC section proposed by the variegated specialist over the Latest two decades. The adjustable of this survey paper is constrained to the jacketing strategy for fortifying and fixing the two normals and high quality RC sections. The paper in addition distinguishes potential research hole and layout the future course of investigation into the solid and fixes of RC sections.

**8) R. Nandhini, Dr. M. M. Saravanan & Karunya Grace .A[8]**, Retrofitting of structure got famous in the fields of designing for fix and restoration of existing harm and news building which are deficient to withstand the heaps vicarial on them. The touchable structures can, also, be harmed because of maturing, exorbitant burdens, higgledy-piggledy loads, temperature, erosion, synthetic compounds, and different conditions. Crushing and remaking those structures need progressively time and uneconomical thus fortifying was finished. Utilizing FRP for reinforcing touchable structure is one of the useful techniques for fortifying because of its favorable circumstances like lightweight, profoundly impervious to consumption and synthetic concoctions, upper elasticity, upper firmness, and it is hands unromantic to structures. were also utilized. Various contemplated were direct to discover its viability in different conditions like marine, fire, destructive, and other warlike conditions. In this paper, trial chips away at FRP were survey and their decision was talked about quickly.

**9) Mansoor Ahmad Bhat & Er. Gurpreet Singh[9]**, It is important to modify, repair, rehabilitation, or reconstruction of existing structures considering of various factors like yoke failure between and post joint, corrosion which leads to deterioration, natural disasters, etc. These factors result in cracking of our structures, i.e. the structures wilt unserviceable. Hence the modifications of these structure is required. This paper show an experiment study on RC beam retrofitted using unidirectional and bi-directional CFRP sheets. The mains objectives of the study is to investigation the policies of RC beam without retrofitting with CFRP sheets.

**10) Renjith Raju & Dr.Vasudev R[10]**, Reinforced touchable is the most widely used to the construction material. Columns are one of the important structural elements in the structures. Retrofitting refer to the wing of new technology or feature to older system to restore the required strength. Jacketing constructions is one of preferred method of retrofitting. Ferrocement solitude for retrofitting of structural element is one of constructive techniques. As considering of the notable properties of fibro cement, wider applications such as fire resistance, low self-weight, waterproof, durability, one-liner resistance, etc make it an platonic material. Fiber-reinforced polymer have to be been extensive used to strengthen touchable columns. The advantages of FRP technique compared to other similar techniques include lightweight, upper strength, good environmental resistance, etc. This paper presents the compilation of the literature review of fibro glue and FRP jacketing for re-strengthening the touchable column. All the caste specimen are test by applying load. Axial load,



lateral bulging, one-liner pattern, etc of the post will be measured for the effectiveness of all two types of jackets.

**11) Aamir Mushtaq, Er Shivani Bhardhwaj & Er Sourabh Lalotra[11]**, To increase flexural powers, the HFRECL should to the member in the ways that fiber are parallel to the directions of the principal stress. The technique involve gluing steel plate and fibers reinforced polymer (HFRECL) plate to the surfaces of the concrete. The plate then acts composite with the touchable and help to withstand the load. Each material has its specific advantages and disadvantage. Steel plates have to be use for many year and are very successful to use as bonding reinforcement. However, they are heavys to transports and install, prone to corrosion, and wordage length of plates is limited. The present work aims to study the policies of reinforced touchable columns strengthened use Glass Fibers Reinforced Polymer (GFRP) and Carbon Fibers Reinforced Polymer (CFRP) subjected to midmost loading. The vital conceptual idea is to use HFRECL only in those zones of the structure where the outstanding HFRECL properties in terms of tautness and strength are fully exploited. The energy undivided by the post wrapped with both GFRP and CFRP was much superior to the post without FRP wrapping.

**12) Komal Bedi[12]**, The retrofitted process is a unstipulated terms that may consists of variety of treatment, including preservations, rehabilitation, restoration, and reconstruction. Selecting the towardly treatment strategy is a unconfined rencontre involved in the retrofit process and must be unswayable individually for each project. Depending on project objective, preservation and renovated of building may involve an variety of diverse technical consideration, such as fires life safety, geotechnical hazard and remedie, weatherings and water infiltration, structure performances under earthquake and winds load.

**13) Iffat Hussain Shah & Mohammad Zakir [13]**, In various part of the world, Reinforced Touchable (RC) structures, plane in seismic zones are still stuff designed only for gravity loads. Such structure, though performing well under convention gravity load cases, could lead to a questionable structural performance under seismic or wind load. In most cases, those structures are highly vulnerables to any moderate or a major earthquake. The earthquake has moreover been seen at the places believed to be seismically not-so-active Therefore, in the diamond of the reinforced touchable beam-column joints versus seismic load, it is desirable to limit joint strength ousting until the ductility topics of the reaches the designed capacity.

**14) Kushlendra Lal Kharwar[14]**, Many of the towers structures or any reinforcement touchable structure (superstructure) damaged due to the uneaten load or frequent earthquakes. Retrofitting is used for small crack and small forfeiture of beam, column, slab, and other RCC structure. Retrofitting prevent the well-constructed replacement for existing structure using external materials. Mild steel plate with connections (bolt, rivet, welding) used in retrofitting, plate used 1,2and 3 layers in all squatter of beam. The earthquake is a serious problems for any structure. The towers damages due to ground motion of soil by the earthquake, settlement of the foundation, improper maintenance, touchable related problems, increase loads at the structure, etc. The forfeit of well-constructed replacement of towers very upper and if the towers is historical reconstruction is not a possible solution, in this case, we used retrofitting. For retrofitting diamond three beams.

**15) Uttam Wayadande, Dr. C. B. Pol[15]**, Fortifying fortified touchable basic individuals is through outer wrapping with upper-quality webbing composites. In this paper to consider the approaches of RC section wrapped webbing sheets. The analysis comprises an aggregate of 54 sections that incorporates 18 round segments, 18 square segments, and 18 rectangular segments. In the roundabout section, 3 segments for 7-day testing, 3 segments for the standard segment, 3 segments for 1-week decays, 3 segments for 4-week disintegrations, 3 segments wrapped with 1 layer of CFRP, 3 corrupted segments wrapped with CFRP sheets.

**16) N.Murali, M.Praveenkumar & R.Srinath[16]**, The present studys investigation the effects of jacketings on the flexurals strength and performance of beam. First, slant shears test are conduction to study the interfaces between old and news concrete. Second, specimen are test to study the effects of jacketing on the positive limp of the span region. Third, beam-column-joint sub-semblage specimens





are tested to study the effect of jacketing on the positive limp of the beams proximal to the joint. Further, tampering investigations are carry out to predicts the experimental results. A layered tideway is used for the prediction of the moments versus rotation curve for the retrofitted specimens. Incremental nonlinear wringer is unexplored to predict the lateral load versus ostracism policies for the retrofitted sub-assembly specimens. Finally, guideline are provide for the retrofitting of the beam by touchable jacketing.

**17) Kalpesh R. Kolhe, Manish D. Mata[17]**, Huge capital is put resources into development, arranging, and keeping up the nature of another structure. With time, old structures lose their quality and quality and in this way, they require limiting. Retrofitting helps in the limiting of olds structures by reestablishing their current highlights and improving their structure capacities. Legitimate towage of the harmed towers to execute retrofitting methods may help in reestablishing the quality and nature of old structures at lower relinquish and time. This paper, for the most part, focuses on the towage of harm working by utilizing variegated retrofitting strategies. Two variegated instances of retrofitting are introduced here. The examination, generally, centers around whether the all-out news structure is salubrious for the retrofitting of any current structures.

### III. Conclusion

Using the tension model, we can make deep models with dimensions and focus.

Optimum performance can be achieved by finding a small structure in the pedestrian crossing design and adjusting the number of tension and compression elements in directions where the load models are balanced. Research on tension models has shown that they are economical, practical, useful and durable. In bridges designed to carry light, tense structures such as pedestrian bridges should be used. Tension design is a difficult task due to geometric complexity and rigid behavior. Additional work includes the construction and monitoring of the pentagonal tension bridge model.

### References

1. Abhishek Jodawat, Arihant Parekh & Bhushan Marathe “Retrofitting Of Reinforced Concrete Column by Steel Jacketing” by Int. Journal of Engineering Research and Application July 2016.
2. Vijayakumar Amulya & A. Dattatreya Kumar “Behaviour of RCC Column Strengthened using Steel Jacketing” International Journal for Research in Applied Science & Engineering Technology (IJRASET) September 2017.
3. N. Lakshmanan, K. Muthumani & T.S. Krishnamoorthy “Retrofitting Of Reinforced Concrete Structures Using Wrapping Technique” 4th International Conference on Earthquake Engineering, October 2006.
4. Prathamesh Dingorkar and Ayush Srivastava “Retrofitting – Comparative Study Of Rc Jacketing And Frp Wrapping” International Journal of Civil Engineering and Technology (IJCIET) September-October 2016.
5. Chetan Yalburgimath, Akash Rathod & S Bhavanishankar “ Retrofitting of Reinforced Concrete Beam Using Carbon Fiber Reinforced Polymer Fabric” International Research Journal of Engineering and Technology (IRJET) Oct 2007.
6. Tabish Rasool Sheikh, Mohd Kashif Khan, Tabish Izhar “ A review on Strengthening of RCC square columns with Reinforced Concrete Jacketing” International Research Journal of Engineering and Technology (IRJET) March 2004.
7. Saim Raza , Muhammad K. I. Khan & Scott J. Menegon “Strengthening and Repair of Reinforced Concrete Columns by Jacketing: State-of-the-Art Review” International Research Journal of Engineering and Technology (IRJET) May -2015.
8. R. Nandhini, Dr. M. M. Saravanan & Karunya Grace .A “ Retrofitting Of Concrete Structures Using Fiber-Reinforced Polymer (FRP): A Review” International Journal Of Scientific & Technology Research Volume 9, Issue 02, February 2016.



9. Mansoor Ahmad Bhat & Er. Gurpreet Singh “Retrofitting of reinforced concrete Beams by using carbon fibre reinforced polymer sheets” International Journal of Civil Engineering and Technology (IJCIET) September 2012.
10. Renjith Raju & Dr.Vasudev R “A literature review on the effect of fibrocement and frp column jacketing” International Journal of Civil Engineering and Technology (IJCIET) 2018.
11. Aamir Mushtaq, Er Shivani Bhardhwaj & Er Sourabh Lalotra “Column Retrofitting By Using Hybrid Fibre Reinforced Epoxy Composite Laminates (HFRECL)” IJEDR 2011.
12. Komal Bedi “Study on Various Methods and Techniques of Retrofitting” International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol. 2 Issue 9, September – 2013.
13. Iffat Hussain Shah & Mohammad Zakir “Effect of different wrapping techniques on retrofitting of constructional joints using ferrocement and conplast” International Research Journal of Engineering and Technology (IRJET) JUNE 2015.
14. Kushlendra Lal Kharwar “Retrofitting of RCC Beams using Steel Plates” IJSRD -International Journal for Scientific Research & Development| Vol. 4, Issue 03, 2016.
15. Uttam Wayadande, Dr. C. B. Pol “CFRP application in retrofitting of rcc column” International Research Journal of Engineering and Technology (IRJET) June 2017.
16. N.Murali, M.Praveenkumar & R.Srinath “Retrofitting of earthquake damaged RCbeams” Int. Journal of Engineering Research and Application July 2015.
17. Kalpesh R. Kolhe, Manish D. Mata “Assessment of Damaged Building by Using Retrofitting Techniques- Case Study” International Journal of Engineering and Techniques -Volume 3 Issue 3, May-June 2017.
18. IS 456: 2000, “Indian Standard Plain and Reinforced Concrete - code of Practice”, BIS, New Delhi, 2000.
19. IS 800:2007, “Indian Standard General Construction in Steel - code of Practice”, BIS, New Delhi, 2007.