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Prefabricated Ferrocement Jacket for Repairing and Strengthening Axially Loaded Square Sub-Standard Concrete Stub Columns

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Abstract: For decades, ferrocement has been used to repair, strengthen, and even build structural components because it is a long-lasting and reasonably priced material. However, onsite ferrocement jacketing is time-consuming and labour-intensive. Alternatively, prefabricated ferrocement jacket installation eliminates these shortcomings. Therefore, this study utilises wearable prefabricated ferrocement jackets to repair and strengthen axially loaded sub-standard low-strength concrete elements. In order to repair cracked specimens and strengthen existing intact specimens, two types of wearable prefabricated jackets are proposed, 'L' shape and 'U' shape. Besides a control specimen, two preloaded and two unloaded square concrete specimens were utilised to repair and strengthen using the Prefabricated Ferrocement Jacketing system. The test results and crack patterns show that all the jacketed specimens performed better than the control specimens in terms of load-bearing capacity, ultimate axial and lateral deflection, and ductility. In terms of load-bearing capacity, the unloaded strengthened specimens showed significant results consistently. Based on the results, the proposed solutions were found to be effective in solving the problem of typical square ferrocement jackets.

Keywords: prefabricated ferrocement jacket (PFJ); repair; strengthening; concrete column

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1. Introduction

One of the most critical structural components is the column, which is normally built to withstand compressive loads [1]. It is possible for a frame-structured building to collapse completely if its most dominant structural member, such as a column, fails [2]. Reinforced square columns are commonly used to support infrastructures such as buildings and bridges because of their low cost and ease of construction. This component's strength and rigidity may deteriorate over time [3]. Engineers have used a variety of methods to modify, reinforce, and repair older structures over the past few decades. Reinforcing square concrete columns with square jacketing [4] is common. Square jacketing saves time and money by not requiring any formwork or modification that is time-consuming and costly [5]. Only a small portion of the cross section is effective because square jacketing generates confinement pressure only at the corners. Cementitious composites should be developed to improve the square jacketing procedure as a result of this research.

Cementitious composites are one of the most widely used materials in infrastructure development worldwide due to their abundant resources, mature manufacturing process, and high flexibility [6]. Cementitious composites such as Ferrocement, Fibre reinforced cementitious composites (FRCC) and engineered cementitious composites (ECC) are being

widely used in different site conditions as a jacketing material [7]. The ferrocement jacketing method is a state-of-the-art technique that has been used for many years as an effective, cost-efficient, and widely available material [8]. It is constructed of mortar and steel wire mesh and is generally cast in extremely thin layers to give it whatever shape is required. This jacketing is simple to apply to an RC column and does not need any sophisticated methods [9]. Strength, toughness, fracturing, crack control, and fatigue resistance are a few of the many improved technical properties that can be attributed to the uniform distribution of reinforcement [10]. Kaish et al. utilised a ferrocement jacket to strengthen square RC column specimens under axial compression [3,4]. They also tested the jacketed RC column under eccentric loading to evaluate its performance [3]. The application of ferrocement jacketing systems to strengthen axially loaded unreinforced concrete cylinders was also reported later [11]. Several types of improved ferrocement jacketing systems to strengthen square RC columns were also proposed [12]. However, the fabrication of the ferrocement jacket presents numerous challenges. The time-consuming nature of this is one of the most critical concerns. It takes more time to cast and also around 4 weeks to cure in order to create a hard and dry surface, and many activities are disrupted, particularly in the workplace for safety concerns [13]. In this case, the prefabricated jacketing system could effectively mitigate the issues of using the conventional jacketing method. Kai et al. [1] investigated the application of prefabricated cementitious composites to construct cylindrical concrete composite column stubs. They utilised the glass fabric mesh to prepare the prefabricated cementitious composite. Prefabricated engineered cementitious composite tubes were also utilised for the seismic strengthening of RC columns [14]. However, prefabricated ferrocement jackets were not investigated in detail to repair or strengthen axially loaded concrete members.

The prefabricated jacketing system is a part of automation in the construction industry [14]. In this method, components are prefabricated and prepared in the factory which are later assembled as a jacket for the structural element [15]. This ensures uniform quality, improved working environment, increment in productivity and work efficiency with reduced costs, replacing humans in dangerous environments, and automation, which reduces waste and factory lead times [13]. Although Fibre-Reinforced Polymer (FRP)-based prefabricated jackets have been used from as early as the 1990 s in Japan [16], their lack of good bonding [17], the possibility of brittle failure modes [16], their inability to allow the detection of possible damage on the reinforced concrete substrate over time [18], and lack of design code [19] puts into question its practical usability. Moreover, the adhesive needs a temperature above 10 °C to start the hardening process [20]. Therefore, the hardening process delays in cold weather [21]. On the contrary, utilising cementitious composites like ferrocement in the prefabrication method would produce an inexpensive material less sensitive to high-temperature that needs an expansive agent, in particular, to establish the bond between the interstice of ferrocement and the underlying substrate [22]. However, due to a lack of proper design, installation techniques, and relative research, this prefabrication technique has yet to be adopted by the construction industry. The proper design of the prefabricated jackets consists of the size, shape, connection method, and the mortar that connects the jacket with the existing column [23].

Prefabricated ferrocement has been used as early as the 1970s in order to build structures such as water tanks, sunshades, secondary roofing slabs, and shell elements [24]. Eventually, prefabricated ferrocement was utilised for constructing hydraulic flumes, roofing, and developing low-cost housing [25,26]. However, very few researchers experimented with the usage the prefabricated ferrocement as a repairing and strengthening material. Due to the availability and physical characteristics of ferrocement, combined with the ease of handling and workability of prefabrication, prefabricated ferrocement jackets are able to strengthen structural components effectively and efficiently.

Concrete elements built 30–40 years ago are mostly low-strength concrete, especially when brick chips are used as coarse aggregates [3,4]. These concrete columns may need strengthening when they deteriorate due to various factors such as corrosion, earthquakes,

and floods [27], structural factors such as overload, as well as other environmental factors [28]. In this study, prefabricated ferrocement jackets (PFJ) are developed and the performance of a PFJ confined column is compared with non-jacketed concrete specimens. The goal of this research is to understand the behaviour of precast ferrocement jackets when used for repairing and strengthening sub-standard low-strength concrete stub columns. The progression of cost-effective and resilient retrofitting procedures may greatly reduce maintenance needs [29], enhance life-saving protection, and extend the service life of concrete structures [30].

Novelty of This Research

Ferrocement has been used for decades as a sustainable and affordable material for repairing, strengthening, and even constructing structural components. However, applying a cast-in-place ferrocement jacket for the repair and strengthening of concrete columns is time-consuming and labour-intensive. Previous research on ferrocement jacketing does not provide an answer to this aspect. The installation of prefabricated jackets to repair/strengthen diminishes the drawbacks of using ferrocement jackets cast in situ. Therefore, in this study, wearable prefabricated ferrocement jackets have been investigated for the structural repair and strengthening of square concrete stubs. The jackets differed based on the shape ('L' and 'U') in order to repair the damaged specimens and strengthen the undamaged specimens. The results from this study will help to assess the applicability and feasibility of using prefabricated jackets as suitable repairing and/or strengthening techniques.

2. Methodology

An experimental investigation was conducted on normal non-jacketed concrete column stubs and wearable prefabricated ferrocement jacketed concrete column stubs in order to determine the effect of PFJ in comparison with the non-jacketed specimens in terms of bearing capacity, axial load, and lateral load capacity. For conducting the experiment, ten column specimens with dimensions of 150 mm × 150 mm × 300 mm, and eight precast ferrocement jackets with 25 mm thickness, have been constructed, four being L-shaped and the other four as U-shaped. Furthermore, the jackets were connected using 5 mm thick steel spokes and tested for load-bearing capacity, deflection, and stress capacity. Among all the tested specimens, two specimens were non-jacketed and denoted as control specimens. Moreover, among all the jacketed specimens, four were loaded until the first crack appeared before conducting the experiment, to represent damaged concrete specimens. Figure 1 illustrates a graphical research plan of the methodology used in this investigation.

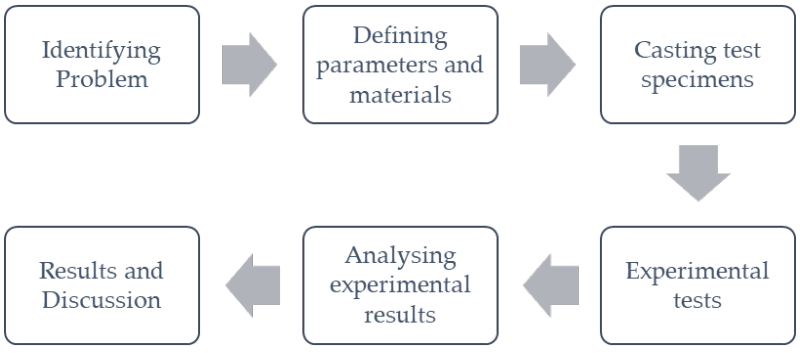


Figure 1. Graphical research plan.

2.1. Materials

In order to prepare the columns and jackets, Ordinary Portland Cement (OPC) grade 32.5 was utilised. The concrete mixture was prepared with river sand with a specific gravity of 2.64. The coarse aggregate was 10 mm in size and of an uneven angular shape with a specific gravity of 2.62 and was sourced from a local quarry. To reinforce the specimens of

precast ferrocement jackets, a wire mesh with a grid size of 10 mm × 10 mm and a diameter of 1 mm was used. In order to ensure that the prefabricated jackets are connected properly, steel spokes were used that are 5 mm in diameter and 150 mm in length. Using the non-shrinking cementitious composite Sikagrout-215, concrete specimens and prefabricated ferrocement jackets were bonded together.

2.2. Concrete and Grout Mix Design

Concrete mix design determines the strength and longevity of the concrete specimen and precast ferrocement jackets. The mix design for the column was performed with a water–cement ratio of 1:2, sand-to-aggregate ratio of 0.88, and air content of 2%. Moreover, river sand was used as fine aggregate while normal municipal water was used to create the mixture. This mix design, as shown in Table 1, was designed for 25 MPa of compressive strength at 28 days, as is normally practiced to cast reinforced concrete specimens. Cementitious composites, such as ferrocement, have been used in order to construct the precast ferrocement jacket. A cement–sand ratio of 1:1 with half the amount of water has been used to produce the mixture of the jackets. In order to make the grout that has been used to connect the concrete specimen and precast ferrocement jacket, a cement–sand ratio of 2:1 and water ratio of 0.5 have been considered. A cementitious paste bonds the surface of the concrete specimen with the external precast jacket, which transfers the compressive load and increases the load-bearing capacity.

Table 1. Concrete mix design.

Material	Quantity (kg/m^3)
Cement	240
Water	120
Fine aggregate	804
Coarse aggregate	906

2.3. Preparation of Concrete Specimen

Each concrete specimen consists of a dimension of 150 mm × 150 mm with a height of 300 mm. All the tested specimens were reinforced using four 12 mm longitudinal mild steel bars with a spacing of 150 mm, which were tied using six 6 mm tie bars, consisting of a spacing of 100 mm. Due to usage of normal grade concrete, the mould thickness was limited to 5 mm to confine the specimen. According to the mix design, all of the materials and water for the concrete were combined by hand. Slump testing was used to determine the concrete's workability which was tested as 45 mm. Afterward, the mould was filled with the mixture and compacted in two layers with a 10 mm diameter steel rod. This manual casting process was selected because of the small-scale investigation. All the specimens were demoulded after 24 h and were water cured for 28 days, as is common practice in concrete casting procedures. The preparation of specimens is shown in Figure 2.

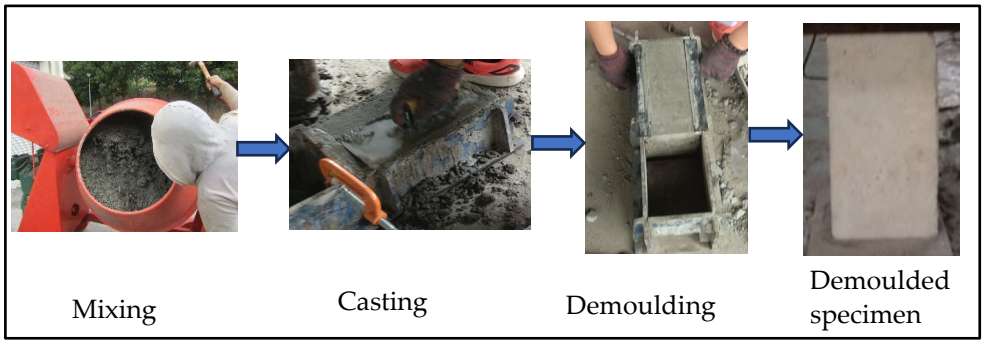


Figure 2. Preparation of concrete stub specimens.

2.4. Preparation of Precast Ferrocement Jackets (PFJ)

Constructing PFJ consists of cement, sand, and water, with a sand–cement ratio of 1:1. Two types of PFJ were made for this experiment, (i) L-shape and (ii) U-shape, with a thickness of 25 mm and a height of 296 mm. There is a difference of 2 mm on top and bottom in terms of the height of the square concrete stub columns. As a result, during the compression test, the load will be applied to the column specimens, and then transferred to the precast ferrocement jackets. As a reinforcement for the ferrocement panels, 2 layers throughout the length and 1 extra layer at the corners of the woven galvanised wire mesh, as discussed in Section 2.1, have been used so that concrete can sieve through and create a strong bonding with the mesh. One extra layer of wire mesh was placed at the corners to prevent the corner from premature corner cracking [3,4,31]. To keep the jointing mechanism simple, bicycle spokes were used to join two parts of ferrocement jacket panels. The spokes were connected with the wire mesh at a distance of 100 mm from the centre and 50 mm from the top and bottom of the specimens. In the L-shaped jacket, 3 spokes were installed on one leg, and 3 horizontal holes through the local longitudinal axis were kept in the other leg to receive 3 spokes from another jacket. The spokes and receiving holes were parallel to each other. On the other hand, in the U-shaped jacket, three spokes were installed on one leg, and three holes through the thickness of jacket were kept in the other leg.

Precast panels were constructed by pouring cement paste into 25 mm thick plywood moulds. A detailed design of the jackets is illustrated in Figure 3. After casting, the panels were demoulded and water-cured for 28 days prior to connecting to the concrete specimen. A total of eight ferrocement jackets were prepared, four were L-shaped jackets and the rest four were U-shaped jackets, as shown in Table 2.

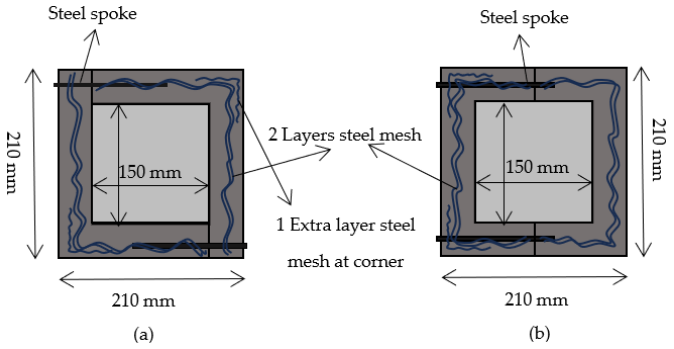


Figure 3. Design of (**a**) L-shape and (**b**) U-shape jacket.

Table 2. Precast ferrocement jackets (PFJ).

Description of Precast Square Ferrocement Jackets (PFJ)	Thickness (mm)
Four (L-Shape) precast ferrocement jackets with corners confined using two layers of wire mesh to minimise cracks.	25
Four (U-Shape) precast ferrocement jackets with middle joints confined using two layers of wire mesh to minimise cracks.	25

2.5. Jacketing of Column Specimens with Precast Ferrocement Jackets (PFJ)

All the column specimens and jackets were water-cured for 28 days. After the appropriate curing, all column specimens were stored in the lab for installing the jackets. Concentric load was applied to four of those columns until their first crack and two of them were jacketed using L-shaped PFJ, whereas the other two using U-shaped PFJ. This represented a damaged column and the retrofitting properties of PFJs have been tested. Furthermore, four columns were jacketed using L-shaped PFJ and U-shaped PFJ to test the performance of the jacketed concrete specimens in terms of load-bearing capacity and ultimate axial loading. Two non-jacketed columns were considered as control samples.

As the expansive grout, Sikagrout 215 (60 MPa compressive strength) was used as a binder between the jacket and columns in order to prevent debonding and shrinkage cracking. Figure 4 shows the schematic diagram of specimens after jacketing. Steel spokes were used to connect two segments of precast ferrocement jacket specimens on the existing column specimens. A conventional spoke screw was used to connect two parts of the jacket. After confining all 8 specimens, as shown in Figure 4, it is ready to be tested under concentric compressive load.

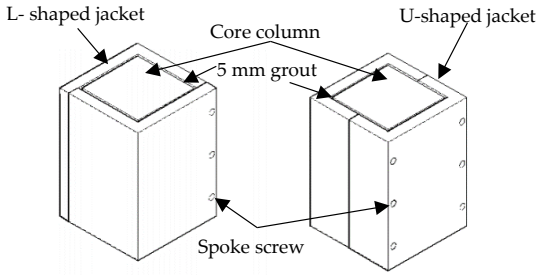


Figure 4. Confined specimens with L-shape jacket and U-shape jacket.

2.6. Testing Procedure of Specimen

In order to carry out the test, a Universal Testing Machine with a capacity of 1000 kN was utilised. The manufacturer of the machine is "TENSILE", having an accuracy of ±0.5% of reading down to 1/500 of load cell capacity. The test specimens were placed in the compression space and locked using manual clamping. Linear Variable Displacement Transducers (LVDT) were utilised to obtain accurate readings of both the axial and lateral deflections of each specimen, as can be seen in Figure 5. The test specimen was tested through progressively increasing concentric load of 1 kN/s applied from above until it finally failed. The load was applied concentrically to both the control sample and the specimens that were strengthened using a jacket. In order to evaluate the increase in compressive strength, axial deflection, and lateral deflection, as well as the effectiveness of precast ferrocement jackets for damaged and undamaged RC columns, test specimens and a control sample were compared [32].



Figure 5. Test Setup.

3. Results and Discussion

No matter how the ferrocement jacketed columns are constructed, the results are nearly identical. The following is a summary of the various points of view expressed in

relation to the study's conclusions. There are averages in Tables 3 and 4 for the ultimate load capacity, axial deflection, and lateral deflection. The responses of column specimens under different types of loading are demonstrated throughout Figures 6–9, which distinguishes between cracked and non-cracked columns, respectively, revealing various load capacities and deflections of specimens with and without PFJ.

Table 3. Average ultimate load capacity.

Specimen Type	Area (mm^2)	Yield Load (kN)	Increment in Yield Load (%)	Ultimate Load (kN)	Increment in Ultimate Load (%)
Control Sample (CS)	22,500	85	-	340	-
Pre-cracked Specimen with L-shaped PFJ (PCSLPFJ)	22,500	95.2	12	382z.1	13
Pre-cracked Cracked Specimen with U-shaped PFJ (PCSUPFJ)	22,500	101.5	19	403.5	19
Un-cracked Specimen with L-shaped PFJ (UCSLPFJ)	22,500	106	25	401.5	18
Un-cracked Specimen with U-shaped PFJ (UCSUPFJ)	22,500	135	59	418.7	23

Table 4. Ultimate loads and deflections of specimens.

Specimen Type	Area (mm^2)	Ultimate Axial Deflection (mm)	Increment in Ultimate Axial Deflection (%)	Ultimate Lateral Deflection (mm)	Increment in Ultimate Lateral Deflection (%)
Control Sample (CS)	22,500	6.3	-	1.85	-
Pre-cracked Specimen with L-shaped PFJ (PCSLPFJ)	22,500	7.8	24	2.5	35
Pre-cracked Specimen with U-shaped PFJ (PCSUPFJ)	22,500	9.9	57	2.8	51
Un-cracked Specimen with L-shaped PFJ (UCSLPFJ)	22,500	6.6	5	2.1	14
Un-cracked Specimen with U-shaped PFJ (UCSUPFJ)	22,500	6.9	10	2.2	19

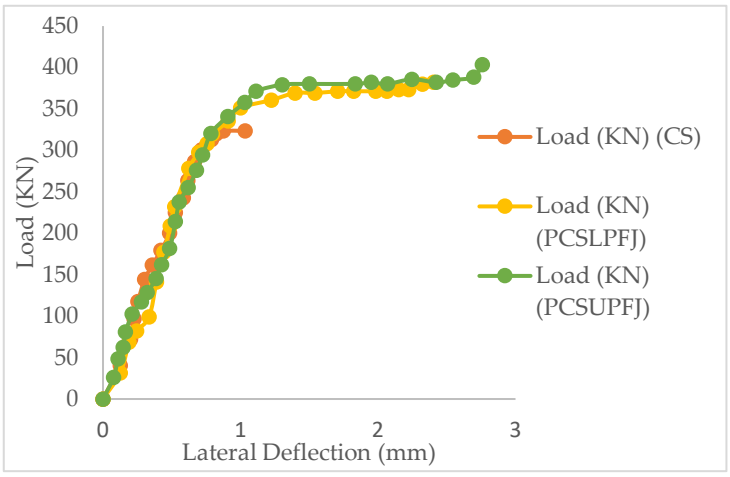


Figure 6. Variation of load with respect to lateral deflection for pre-cracked specimens.

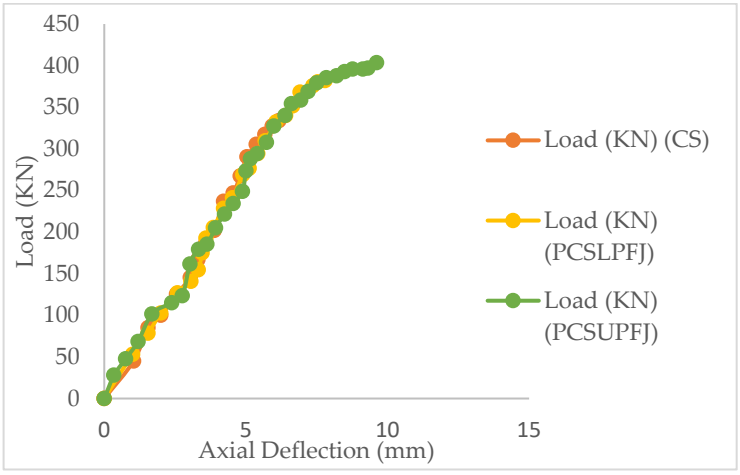


Figure 7. Variation of load with respect to axial deflection for pre-cracked specimens.

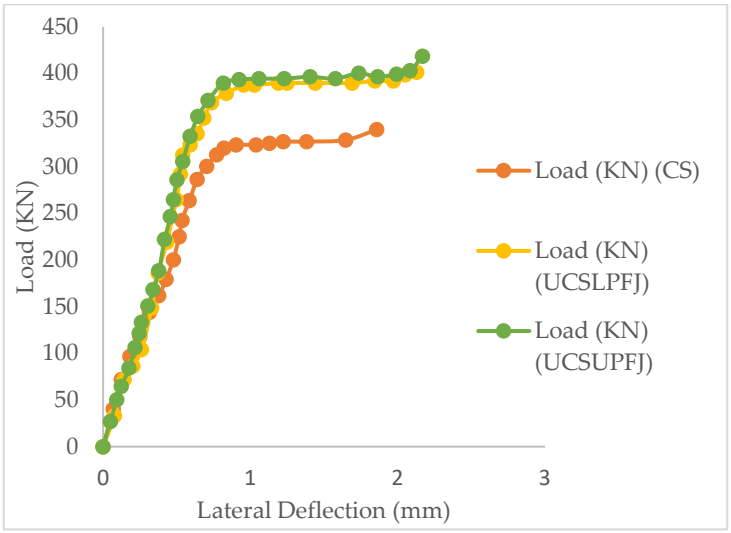


Figure 8. Variation of load with respect to lateral deflection for un-cracked specimens.

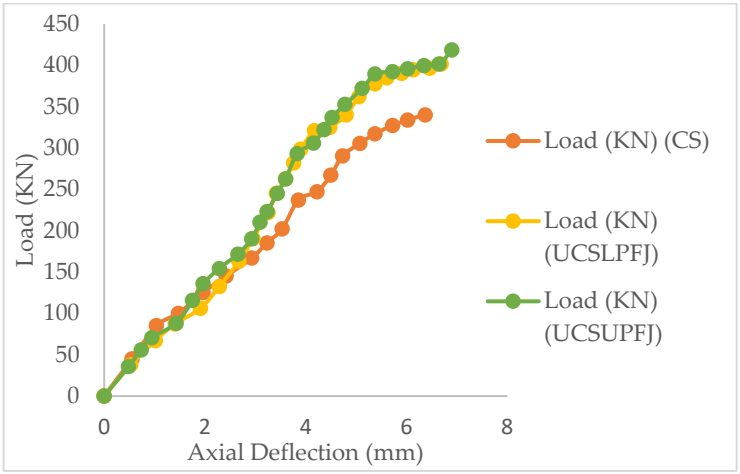


Figure 9. Variation of load with respect to axial deflection for un-cracked specimens.

3.1. Load Bearing Capacity

Table 3 reveals that the axial load carrying capacity of all jacketed specimens is greater than that of the control specimens without jackets. Moreover, cracked specimens demonstrated a higher yield capacity than the control specimen, which may be due to the effect

of cracks on the column, which prolonged the yield capacity but weakened it in terms of ultimate load [33], despite the fact that the column's load-bearing capacity has improved over the original column. On the other hand, cracked specimens indicate better yield load and load carrying capacity than any other specimens, demonstrating ferrocement's suitability as a reinforcing material [13]. In contrast, among all the jacketed and unjacketed specimens tested, the un-cracked specimen jacketed with U-shaped PFJ has the highest load-bearing capacity, 418.7 kN, an increase of 23 percent over the control specimen. It can also be observed that strengthened column specimens recorded higher load-bearing capacities than repaired column specimens, despite the fact that both types of specimens contain identical wire mesh layers. In both cracked and un-cracked specimens, U-shape PFJ has resulted in the highest load-bearing capacity, with an increment of 19% and 23%, respectively, which proves that the U-shape prefabricated jacketing method has the highest load-bearing capacity [3,11]. However, all the specimens had a tremendous increment in ultimate load ranging from 13 to 23%, which clearly indicates that PFJ is more effective and beneficial than non-jacketed specimens.

It should be noted that the thickness of the PFJ is 25 mm, excluding the 5 mm thick grout layer. Therefore, the total thickness of the additional jacketing system is 30 mm, which is very high compared to the width of the core specimens. This could be the reason for this high increment in the load capacity of the jacketed square concrete stub.

3.2. Axial and Lateral Deflections

From the results observed, the axial load and deflection at the top of jacketed column specimens are higher than those of non-jacketed column specimens. Similarly, the lateral deflection in the middle of jacketed columns is higher than the non-jacketed ones, as shown in Figures 6–9 and Table 4.

From Figures 6–9, it can be observed that both preloaded and unloaded jacketed specimens perform better compared to non-jacketed control specimens, in terms of axial deflection, similar to the research conducted by the authors of reference [3]. The cracked specimens with prefabricated ferrocement jacketing specimens, in Figure 6, show higher axial deflection than the un-cracked specimens, as seen in Figure 9. Among all the types of jacketing schemes, the U-type PFJ on the cracked specimen in Figure 7 shows the highest axial deflection at failure. The ultimate axial deflection of the preloaded jacketed specimens is 57% higher than the non-jacketed ones. These values for cracked and un-cracked L-shape prefabricated ferrocement jacketed specimens in Figures 7 and 8 are seen to be 24% and 5%, respectively.

Figures 6 and 7 show the determination of ultimate lateral deflection that is measured at the mid height of column specimens under concentric loading. In order to calculate the feasibility of PFJ in preloaded and unloaded column specimens, the performance of non-jacketed control specimens was used as a benchmark. From both Table 4 and Figures 6 and 7, under the concentric mode of loading, it can be seen that the cracked specimen jacketed with PFJ in Figure 5 showed higher ultimate lateral deflection than the un-cracked PFJ specimen. Among all the jacketing methods, the U-shape PFJ on the cracked specimen scored the maximum lateral deflection of 2.8 mm, which is a 51% increment from the control sample, followed by the cracked L-shape jacketing with a 35% increment in ultimate lateral deflection, as illustrated in Figure 6. Although un-cracked specimens strengthened with the U-shape PFJ, in Figure 8, show the highest load-bearing capacity, it is observed to have lower lateral deflection. This suggests that stronger corners drive pressures to the centre zone. Stated differently, stresses in these sorts of tested column specimens flow from the corners to the centre of their faces [3].

3.3. Stress and Strain Response

The typical stress–strain responses of the tested columns are shown in Table 5. The table shows that U-shape prefabricated ferrocement jacketing allows the specimens to reach higher ultimate stress, resulting in the repaired specimens 18 MPa and strengthened

specimens 19 mPa. Because of the extra layer of wire mesh across the corner of the U-shape jackets, the stress concentration that is responsible for producing cracks at the corner flows over the cross-section, thus creating less stress concentration and more uniform stress [3]. It also explains the reason for visible cracks in the middle of the specimens among the specimens jacketed using U-shape PFJs. A similar explanation has been found in observations by the authors of references [12,34]. Overall, un-cracked specimens showed a better increment in average ultimate stress, resulting in 20% and 26% for L-shape and U-shape, respectively. As for the L-shape jacketed specimens, they showed the lowest ultimate stress, and several cracks can be witnessed at the corner of the specimens. Due to lack of wire mesh in the joint and stress concentration on the corners, the specimens failed in the corners [35]. When it comes to ductility, the specimens from the jacketed column show an increment of 17–52% compared to the control column specimens when the failure stresses are applied. Because of this, it is possible to conclude that the specimens with the jackets are more ductile than the control column specimens. Among all jacketing schemes, cracked U-shape PFJ specimens showed the highest plastic strain over other specimens.

Table 5. Ultimate stress and strain.

Specimen Type	Ultimate Stress (mPa)	Increment in Ultimate Stress%	Ultimate Strain	Ductility
Control Sample	15	-	0.0063	2.3
Pre-cracked Specimen with L-shaped PFJ	17	13	0.0078	3.5
Pre-cracked Specimen with U-shaped PFJ	18	20	0.0099	4.6
Specimen with L-shaped PFJ	18	20	0.0066	2.7
Specimen with U-shaped PFJ	19	26	0.0069	3.0

3.4. Failure Behaviour

In Figure 10, samples of specimens following laboratory testing under the concentric loading mode are illustrated. At the point where the force is applied, the column specimens that are not jacketed start to fail due to concrete cracking. This can be seen in Figure 10a. All of the specimens of the jacketed columns, on the other hand, start to fail at the joints of the prefabricated ferrocement jackets, particularly in the centre of the faces and corners of the specimens [35]. Due to the accumulation of stress at the corners, corner cracks can be seen in L-type jacketed specimens that have been evaluated using the concentric mode of loading (see Figure 10b,c). The arching effect of strains at the corners (a point of stress concentration) could be to blame for this [36,37]. The corners of a U-type jacketed specimen are reinforced with additional wire mesh, which causes cracks to appear in the middle of each of the faces of the specimen (Figure 10d,e). The pattern of failure indicates that all the jacketed specimens are prone to failure on the joint area of the PFJ. The prefabricated jackets were jointed using steel spokes that could not provide an ample amount of shear strength to cater for the shear stress along the connection area. As a result, all the specimens showed cracks through the joint area. A better jointing system could provide an improved confinement system for the core specimens.

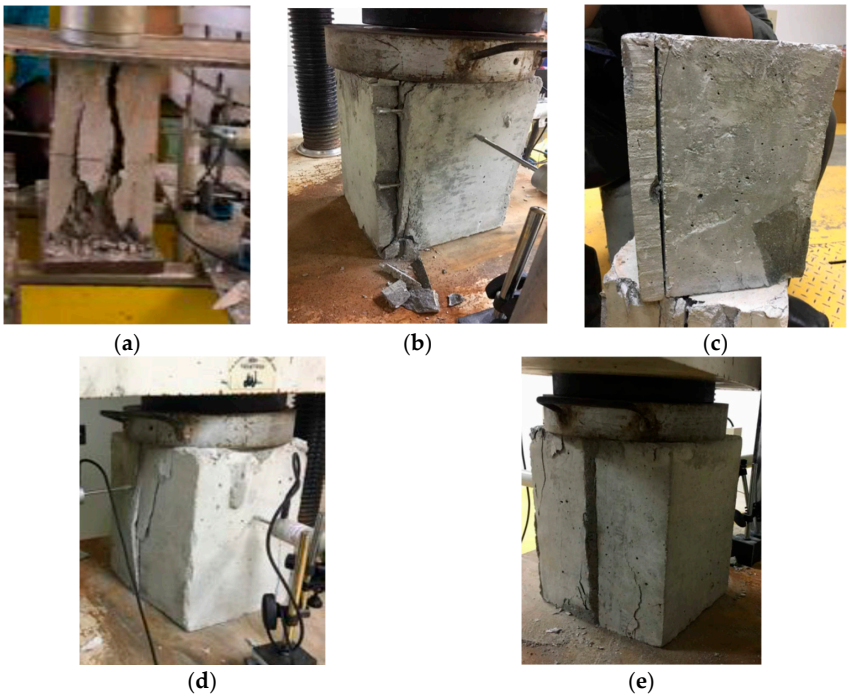


Figure 10. Failure pattern of test specimens: (**a**) control sample, (**b**,**c**) cracked and un-cracked L-shaped specimen, (**d**,**e**) sracked and un-cracked U-shaped specimen.

4. Conclusions

The investigation of non-jacketed and prefabricated ferrocement-jacketed RC column specimens yielded the following conclusions and recommendations:

i. Wearable prefabricated ferrocement jackets improve the load-bearing capacity, ultimate axial deflection, and lateral deflection of the columns, in comparison with non-jacketed specimens. U-shaped PFJ is more effective than L-shaped PFJ in repairing and strengthening square columns.
ii. More cracks are observed at the connection joint between the precast ferrocement jackets, which is due to the poor bearing capacity of the steel spokes used to connect two jackets for confinement. However, no cracks were observed at the corner of either L-shaped or U-shaped jackets due to the extra layer of wire mesh at the corners.
iii. Based on the failure pattern, it can be said that both types of jackets are effective in controlling the failure of core specimens. However, further study on the jointing mechanism is required to ascertain an efficient wearable PFJ technique.

A well-designed prefabricated ferrocement jacket with an efficient attachment mechanism is a necessity before implementing the suggested technology. The limitations of PFJ shapes should be considered and further investigation into the various shapes and their feasibility needs to be conducted. The proposed system also requires a full-scale test before being considered for practical application.

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Abbreviations

FRCC	Fibre-Reinforced Cementitious Composite
ECC	Engineered Cementitious Composite
FRP	Fibre-Reinforced Polymer
PFJ	Prefabricated Ferrocement Jackets
OPC	Ordinary Portland Cement
LVDT	Linear Variable Displacement Transducers
CS	Control Sample
PCSLPFJ	Pre-cracked Specimen with L-shaped Prefabricated Ferrocement Jackets
PCSUPFJ	Pre-cracked Cracked Specimen with U-shaped Prefabricated Ferrocement Jackets
UCSLPFJ	Un-cracked Specimen with L-shaped Prefabricated Ferrocement Jackets
UCSUPFJ	Un-cracked Specimen with U-shaped Prefabricated Ferrocement Jackets

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