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Study of DNA HELICAL REINFORCEMENT

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ABSTRACT:

To make any structure column is a crucial element. Supporting the slabs is the key task of the columns. Beam columns are provide the support through supporting slabs & walls. If the columns are failed to provide support than the build structure will collapse badly. So, to provide good support to the structure proper designing of the column is necessary. Columns which show more ductile behaviour do not show a catastrophic failure and give warning prior to impending failure. The ductility of reinforced concrete columns is also important in evaluating their aseismicity behaviour, because the column with the excellent ductile behaviour would be capable of absorbing and dissipating seismic energy.

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KEYWORDS: Helical, reinforcement, concrete, mixture, cement, column

INTRODUCTION: In the structural engineering & architecture column or pillar is the essential component that spreads the weight of the framework above to other structural components through compression procedure. Thus column is a density component. A large round support with a base or capital or pedestal is considered in the column which generally made of stone or any other material. A post is small metal or wooden support and it also supports through the other non-round section or rectangular are which is commonly known as piers. Piers may also be circular as in bridges. The columns are designed to restrict the lateral power such as heavy wind and earthquake. The upper parts of walls and ceilings rest on the columns which generally build to support arches and beams. Column used in architecture has some decorative & proportional characteristics which is the key component of structure design. Sometimes columns are used for decorative purpose not for supporting purpose or providing strength to the structure.

To make any structure column is a crucial element. Supporting the slabs is the key task of the columns. Beam columns are provide the support through supporting slabs & walls. If the columns are failed to provide support than the build structure will collapse badly. So, to provide good support to the structure proper designing of the column is necessary. Columns which show more ductile behaviour do not show a catastrophic failure and give warning prior to impending failure.

As far as the feasibility of the usage of DNA helical reinforcement in columns is concerned it is fairly possible to incorporate this type of reinforcement as an efficient substitute in place of conventional spirally reinforced circular columns. The only practical hindrance is encountered in forming the reinforcement cage for this type of reinforcement which can be suitably and very conveniently overcome by the development of suitable mechanical devices for the same.

REVIEW OF LITERATURE:

A reinforced concrete column is a structural member designed to carry compressive loads, composed of concrete with an embedded steel frame to provide reinforcement. Column is an important element of every reinforced concrete structure. Whether the structure is man-made or created by nature, the key element in resisting the collapse under gravity load is the column in buildings and bridges. Other types of compression members include truss members (struts), inclined members and rigid frame members. The column is representative of all types of compression members and hence sometimes, the terms column and compression member are used interchangeably. IS-456:20006(Cl.25.1.1) defines the column as a compression member „the effective length of which exceeds three times its least lateral dimension."

CLASSIFICATION OF COLUMNS

The classification of columns has been based on different norms which are given below:

- Shapes of cross-section.
- Type of loading.

- Slenderness ratio.
- Type of lateral reinforcement

Shapes of cross-section

Columns has cross section characteristics which can be classified on the different shapes such as circular, square, pentagonal, L- shape, rectangular, T- shape, hexagonal, octagonal and etc.

Type of loading

The types of loading in columns are divided which are as follows:

(a) "Columns subjected to axial loads only (concentric)".
(b) "Columns subjected to combined axial load and uniaxial bending".
(c) "Columns subjected to combined axial load and bi-axial bending".

Objectives:

- In this paper our objective is study the behavior of DNA helix reinforced slender columns under axial loads and compares the same with the conventional systems.

METHODOLOGY:

The test procedure for spiral columns is similar to that of normally reinforced columns. The centric axial loading test system has been used to understand the axial load capacity which is the common testing method of testing.

Test Equipment: Tests are carried out in structural laboratory using a compression machine with adequate loading capacity. The machine should support loading speed suitable to the experiment. Generally in the displacement controlled mode testing procedure has been done. Several axial displacement rates falling in the range of 0.2 mm/min to 0.5 mm/max is used as compared to monotonic rate of axial displacement. With the help of high accuracy load cell the loading needs

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have been monitored which is sensitive. Dial gauges of least count 0.01mm are used to measure deflections.

The steps of work proposed to be done are mentioned as under:

1) Four slender column models would be cast whose features are as below:

Table: Material properties and system features

Parameter	**Model A**	**Model B**	**Model C**	**Model D**
Concrete mix	M20	M20	M20	M20
Weight of cement(kg/m^3)	436.4	436.4	436.4	436.4
Weight of sand (kg/m^3)	654.5	654.5	654.5	654.5
Weight of aggregates(kg/m^3)	1309.9	1309.9	1309.9	1309.9
Water cement ratio (W/C)	0.5	0.5	0.5	0.5
Rubber type	---	Butyl rubber	Butyl rubber	---
Steel Grade	Fe415	Fe415	Fe415	Fe415
Rubber tensile strength (kg/cm^2)	3.45-5.5	3.45-5.5	3.45-5.5	3.45-5.5
Column Length(mm)	1200	1200	1200	1200
Column diameter(mm)	100	100	100	100
Core diameter (mm)	60	60	60	60

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2) After 28 days from casting and proper curing of the models, these would be tested on the loading frame having capacity of 500kN under axial loading till failure.

3) During loading process following observations would be made:

a) stress-strain behaviour for compressive strength evaluation

b) load-displacement characteristics the slope of which would yield stiffness and flexibility parameters

c) Effect of rubber on flexibility and stiffness of the column

d) Effect of position of rubber ties on the flexibility and stiffness of the column

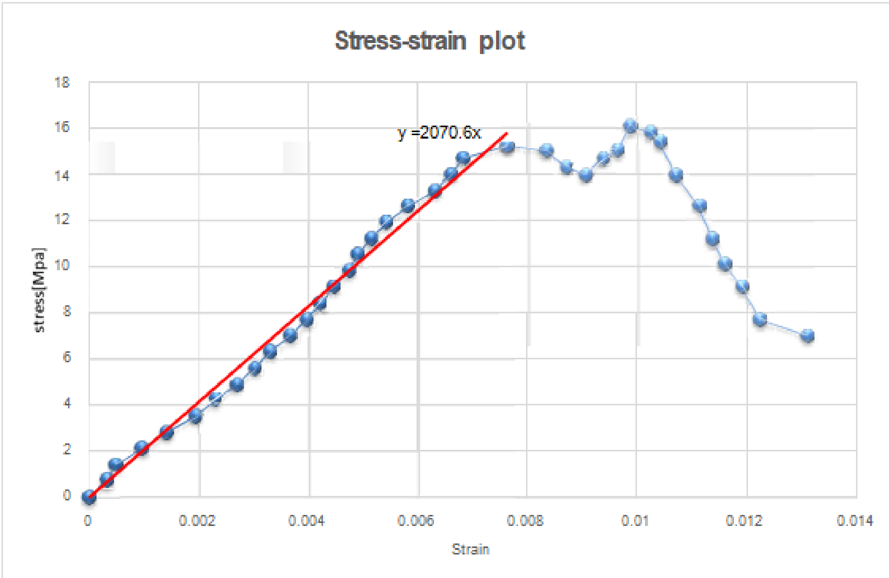
4) Finally a comparison between the DNA helix reinforced and conventional spiral helix reinforced columns would be made by evaluating the respective parameters as discussed above.

ANALYSIS: SAMPLE

Length of specimen (l) = 600mm

Diameter of specimen (d) = 135mm

Area of specimen (A) = $\pi/4 \times 135_2$ = 14313.88 mm



Stress strain curve spiral reinforced specimen 1

(1) Ultimate compressive strength

Ultimate compressive strength = 230kN

(2) Material properties in terms of elastic constants

(a) Young's Modulus (Secant modulus E)

$E = (\sigma_2 - \sigma_1) / (\epsilon_2 - \epsilon_1) = (14.97-0) / (0.0072-0) = 2068.98$ Mpa

(b) Young's Modulus (from equation of best fitting trend line)

y= 2070.6x

E = dy/dx = 2070.6 Mpa

(c) Poisson's ratio

μ = Lateral strain/Longitudinal strain = $(\delta d/d)/(\delta l/l)$

= (0.2/135)/(4.58/600)=0.194

(d) Shear Modulus (G)

G = E / 2(1+μ) =2070.6 /2(1+0.194) = 867.08 MPa

(e) Bulk Modulus (K)

K = E / 3(1-2μ) =2070.6 /3(1-2x0.194) = 1127.78 MPa

(3) Axial stiffness and flexibility (from stress-strain plot)

(a) Axial stiffness = k = AE/l =14313.88 x 2070.6/600 = 49397.21 N/mm
(b) Axial flexibility = δ = l/AE = 600/(14313.88 x 2070.6) = $2.02\times10_{-5}$ mm/N

(4) Ductility in terms of percentage strain

Ductility = $(\epsilon_{failure} - \epsilon_{elastic\ limit})$ x100 / $\epsilon_{elastic\ limit}$ = (0.0099 - 0.0072) x100 / 0.0072
= 36.42%

CONCLUSION:

In order to improve the ductility and various other parameters of the columns this project work advocates the use of DNA helical reinforcement along with steel and rubber ties as better substitute in place of conventional spiral helical reinforcement because of the improvements in the various column parameters observed by the use of DNA helical reinforcement in columns. It was found from the test results that there was a considerable amount of increase in the ultimate compressive strength, ductility, elastic modulus, shears modulus in the columns in which DNA helical reinforcement was used in comparison to conventional spiral helically reinforced columns.

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