The Effect of Confinement Spacing on the Load Carrying Capability of Short Column

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***Abstract* — In the compression members, lateral reinforcement play an important role in protecting the columns, when they are under strong earthquake. RCC specimens influence the lateral confinement on the compressive strength of concrete. This is an experimental study on the behavior of concrete short columns with aspect ratios 0.45 and confined by ties under concentric loading. All longitudinal bars are confined with lateral reinforcement with different spacing for aspect ratio 0.45. Spacing of ties varies from110 mm to 150mm. The study will be aiming to find out the effect on the strength carrying capacity of short column having variation in the confinement spacing for aspect ratio 0.45.**

Keywords—Confinement, load carrying capacity

I. INTRODUCTION

The breadth to depth ratio of short column should not be less than 0.45, as per IS 13920:2016. With lateral reinforcement the longitudinal bars are confined. Various tests were done to evaluate the code.

Column carries various loads which are under axial compression. Column is of three types generally they are short column, long column and intermediate column. In the current study I prefer short column whose slenderness ratio is less than 12.The short column is resistant to buckling. The confinement effect by tie reinforcement is taken in to account. This paper evaluates the behaviour of short column with aspect ratio and various spacing. Five specimens with aspect ratio and various spacing were used. Based on the test result the code requirements are evaluated. Various spacing considered is 110mm, 120mm, 130mm, 140mm and 150mm.

II. MATERIALS USED AND MIX PROPORTIONS

Following materials were used in the present study:

Cement: Ordinary Portland cement of 53 grades was used with specific gravity 3.15.This is used as main binder in the mixes. Fine Aggregate: Manufactured sand was used as FA with specific gravity 2.6. As per sieve analysis results the fine aggregate is confined to zone II. Coarse Aggregate: Crushed stones were collected from local quarries were used as CA with specific gravity 2.68.

Mix Proportions: M20 mix is adopted for the present study. Mix proportions are as follows.

III. EXPERIMENTAL INVESTIGATION

The column dimensions were selected based on trial and error methods. The sizes of the specimens were 450x300x135mm with spacing varied from 110mm to150mm.

Table 1: Mix proportion for 1m3 M20 Concrete

Material	cement	fine aggregate	coarse aggregate
quantity (kg)	379.01	680.11	1217.24

Fig 1: Reinforcement Details

A total of 5 specimens were casted using M20 mix. To study the behaviour of short column slenderness ratio 12 was maintained. The dimensions of the short columns are chosen based on the laboratory facility. Fig 1 shows the reinforcement details of the specimen. After trial mixes the obtained cube compressive strength was 26.8 MPa.

A. *Testing arragement and testing procedure*

The test setup is shown in fig. 2. Dial gauges are used to measure the lateral deflections of the column and strain gauges are used to measure the lateral strain readings. The loading is continued and the corresponding dial gauge reading and strain gauge reading are noted.

Fig 2: Reinforcement Details

The specimen details are shown in below Table 2

Table 2: specimen details

Aspect Ratio	Label	A_{st}	Load(ton)
0.45	A1 A2 A3 A4 A5	4#12mm dia	58.1

Crushing failure were experienced by all short columns as seen in fig 3 and 4

Fig 3: Failure and crack pattern of short columns

Fig 4: Failure and crack pattern of short columns

Fig 5: Failure and crack pattern of short columns

IV. RESULTS AND DISCUSSIONS

On the following parameters a detailed studies has been done to understand the performance of short columns.

A. *Load displacement behaviour*
B. *Load deflection behaviour*
C. *stress strain behaviour*

A. Load Vs Displacement graph

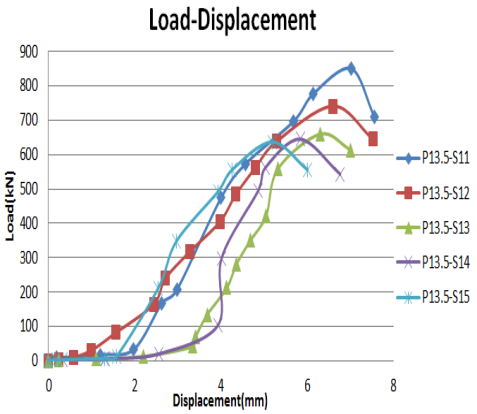

Fig 6: Load Vs. Displacement Graph

From load displacement graph it is clearly seen that the displacement is more for highly confined specimen. Table 3 shows the ultimate load details.

Table 4: Ultimate load details

Specimen	W_u(kN)
P13.5-S11	850.49
P13.5-S12	741.65
P13.5-S13	660.119
P13.5-S14	645.17
P13.5-S15	636.17

B. Load Vs Lateral Deflection graph

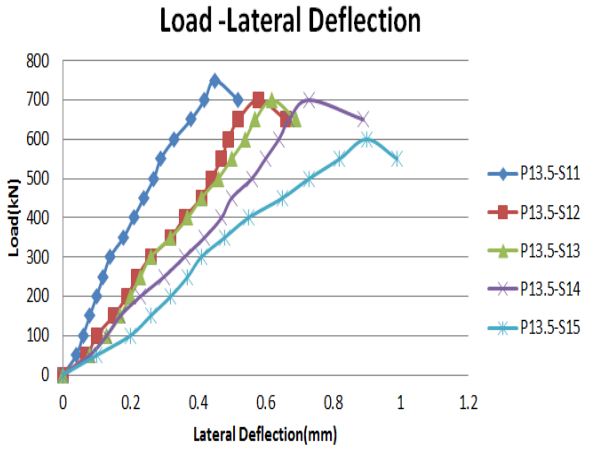

Fig 7: Load Vs Deflection Graph

From lateral deflection readings it is seen that the lateral deflection is least for highly confined specimens. As the confinement increases the deflection get increased.

C. Stress Vs Lateral Strain graph

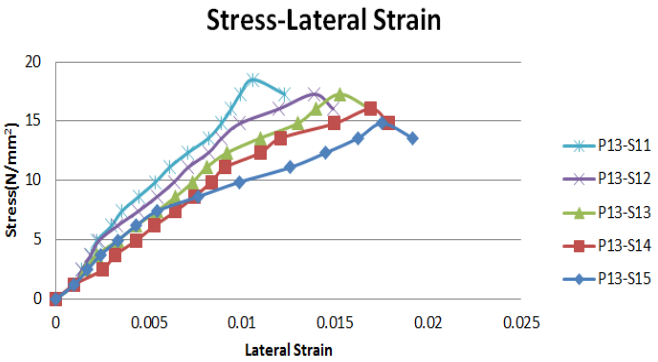

Fig 8: Stress Vs Lateral strain Graph

From stress – lateral strain readings it is observed that the lateral strain is least for highly confined specimens. As the confinement increases the strain get increased.

V. CONCLUSION

On the short column experimental investigation has been analysed to study the, load displacement behaviour, load deflection behaviour and stress strain behaviour. The conclusion are outlined below

- From the IS code the mix proportion for M20 was gained. The obtained slump value was 75mm.
- 300x135mm was the cross section of of all columns. The height of column was 450mm.slenderness ratio of 12 was maintained.
- From the experiment it was clear that due to crushing short columns were failed.
- It was got that with increase in confinement; the load carrying capability increased and the displacement get increased.
- From load-lateral deflection behaviour it was observed that as confinement increases the lateral deflection get decreases
- From load Vs lateral strain behaviour it was observed that the lateral strain got decreased as the lateral strain improves

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