BEHAVIOUR OF PRECAST CONCRETE COLUMN WITH R-S SLEEVE MECHANICAL CONNECTOR

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Introduction: Test results for two reinforced monolithic concrete columns and three precast concrete columns with R-S sleeve mechanical connector subjected to monotonic loading are reported. Comparison between precast column and monolithic column in flexural bending showed that the column capacity did not reveal any significant differences. The experiments also had proven that the mortar connection between the beam and column and also inside the conduit of beam performed very well and behave similar to monolithic column until failure load is reached. Analysis by using Rigid Body Spring Method and other code are also included.

1. Test Setup and Material

A schematic diagram of the test setup is shown in Figure 1. Load were applied gradually at an interval of 5kN until failure. Each specimen was instrumented with load cells, displacement meter, joint opening gauge and strain gauge fixed to the face of concrete, reinforcement and to the R-S sleeve. The dimensions of the specimens are as shown in Figure 2. Early strength portland cement was used with an average 28 days concrete compressive strength of 46 MPa and 3.3 MPa tensile strength. The compressive strength of mortar used for connection was 95 MPa. The minimum tensile strength of reinforcement and the R-S sleeve were 295 MPa.

2. Discussion of Test Results

Crack Development:

Figure 3 showed the typical crack pattern. At 12 kN the high strength mortar used to fix the precast concrete column-beam joint opened. The shear cracks in the precast column was observed at 54 kN. For monolithic column the first clear crack was observed at 32 kN. The intersection between the column and beam showed a clear flexural crack pattern. Shear cracks were noticeable within 425 mm to the left and right hand side from the center of the precast and monolithic column specimens.

Load-Midspan Deflection Relationship:

The precast and monolithic column had shown a very similar load-deflection curve both reaching the ultimate load at 160 kN as shown in Figure 4. The test results were compared with the calculated values by using Rigid Body Spring Method and CP 110 (elastic limit state).

Performance of R-S Sleeve and Mortar Connections:

The strain for R-S sleeve located at the lower reinforcement (No.7) was between 600-800 μ and for normal reinforcement the strain (No. 5) was between 1500-2000 μ at 160 kN load as shown in Figure 5 might be due to slip of the reinforcement. The R-S sleeve connector gave a better local bond. The test results indicated that the mortar had the same or slightly improved pull-out strength when compared with bars in cast-in-place construction. The improved performance was attributed to the strength of the grout being greater than that of concrete. The strains at mortar joint (No.6) located at mid-span bottom reinforcement registered below 1500 μ for all precast column but exceeding 1500 μ for all of the monolithic columns (No.13) at 160 kN load as shown in Figure 6.

3. Conclusion

From the experiment we concluded that:

1. The column capacity for precast with R-S sleeve connector and monolithic was similar.
2. It is adequate to design column with R-S sleeve connector by adopting a normal reinforced concrete design.
3. The mortar joint performed very close to normal in-situ concrete.

The experiment will be continue by imposing axial load with reverse cyclic to the specimen to determine further behaviour of the column.

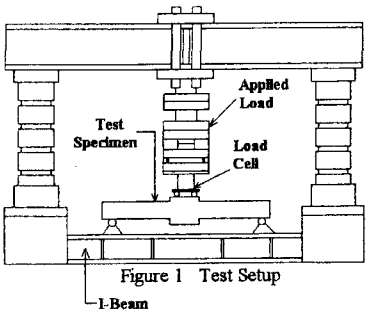

Figure 1 Test Setup

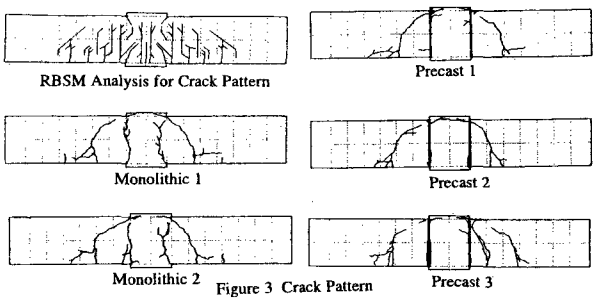

Figure 3 Crack Pattern

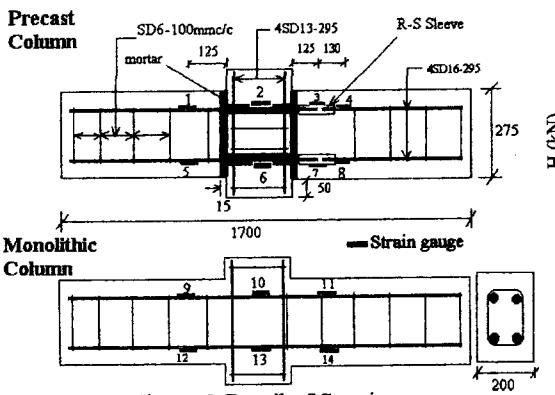

Figure 2 Detail of Specimens

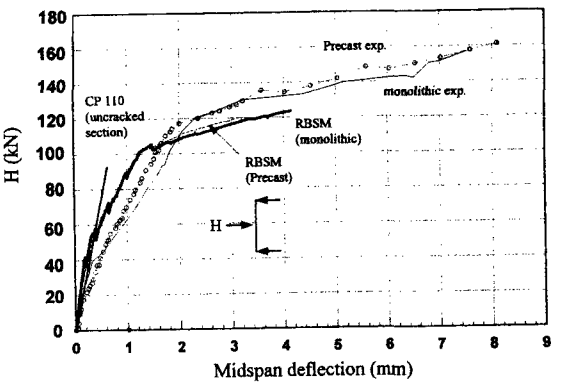

Figure 4 Experiment's result and analysis for monolithic and precast

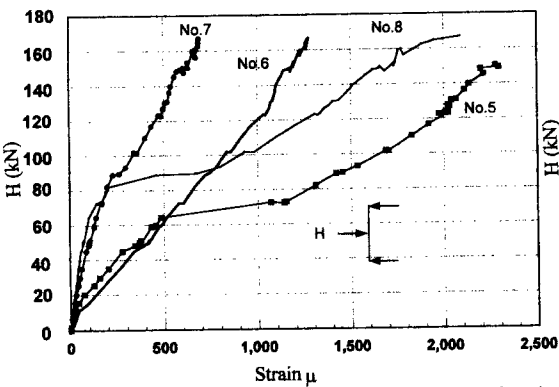

Figure 5 Strain at reinforcement (lower part of precast column)

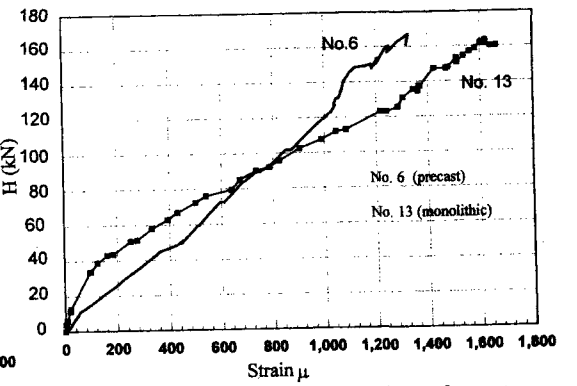

Figure 6. Strain at lower reinforcement at midspan of precast and monolithic column at the same location

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Kohji Maegawa, Michiro Tomida and Tomohiro Fujii (1991): "Bending Behaviour Of Assembled Precast Concrete Members Tightened by Prestressing-Experiment And Application of Rigid Body Spring Model- ,"The Third East Asia-Pacific Conference On Structural Engineering & Construction *Shanghai, 23-26 April, 1991.*

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