COMPARISON BETWEEN THE BEHAVIOUR OF COLUMN-BEAM EXTERNAL JOINTS IN BOTH FIBRE BAR REINFORCED CONCRETE AND BAR REINFORCED CONCRETE.

by

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SUMMARY

The results of tests conducted on full-scale bar reinforced concrete and fibre bar reinforced concrete beam-column assemblies are summarized. Static cyclic (reversed)loading was applied to the tests specimens to simulate severe seismic loading. The tests showed that the capacity load and more the ductility factor can be improved in the joints without ties using the fibre reinforced concrete. The fibre reinforcement in the joint tied produced only a little improvement of the ductility factor.

INTRODUCTION

During the course of numerous experiences done these last years on the fibre-reinforced concrete and on its possible applications, the good peculiarities of ductility of this new type of concrete have been verified by authors. Up to now the problem of the ductility of the beam-column joint is not completely resolved in bar reinforced concrete, we thought to add steel fibres to concrete and studied the effects rised from the presence of these fibres.

CHARACTERISTICS OF TESTS AND DISCUSSION OF RESULTS

We predisposed beam-column joint specimens in reinforced concrete without ties in joint, either with the addition of steel fibres or without them. The same has been done with specimens with ties in the joint.The tests have been done in full-scale following the report by Park and Paulay related at the Fifth World Conference on Earthquake Engineering of Rome. However in this case the joint has been proportioned limiting at most the traditional bar reinforcements, in order to evidentiate the behaviour difference between the elements with fibres and the elements without fibres.

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Dimentions of specimens and bar reinforcements are those reported in fig. 1. The characteristics of materials are the following:

- Aggregate: 25 mm maximum size;
- Cement: 400 kg/m^3 of type 425 Portland (Italian Standards);
- Ratio water/cement: 0,4;
- Concrete: 300 kg/cm^2 (compressive cubic strength at 28 days);
- Bars: 3800 kg/cm^2 (specified yield strength);
- Steel fibres (only in bar fibre reinforced specimens): 0,6 mm dia x 60 mm long (deformed fibre type Bekaert) with ratio 40 kg/m^3 of concrete.

Every specimen has been conducted to collapse by several load reversed cycles acting on the extremity of the beam element (fig. 2). The difference verified between the behaviour of fibreless elements and the behaviour of specimens with fibres has been found remarkable (fig. 3,4 and 5). In the case of the tieless and fibreless joint the well known swelling with following pounding before collapse occurred (fig. 6). On the contrary the fibre reinforced joint without ties was not subject to swellings or poundings (fig. 7) and the strength of the joint has been higher than the previous ($\sim$30%) with comparable strains (fig. 3 and 4). The ductility factor (defined as the ratio of the rotation at a particular load to the rotation at yield load) is about tenfold higher in the fibre reinforced joint without ties, than in the joint without ties nor fibres. Considerable differences of strength between bar reinforced concrete and bar fibre reinforced concrete have not been remarked in tied joint specimens, but it seems that the ductility factor is larger in the fibre reinforced concrete joint with ties (see fig.5,8 and report of Park and Paulay).

ACKNOWLEDGMENTS

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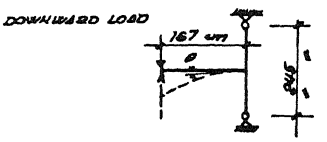

FIG. 1 - STATIC MODELL

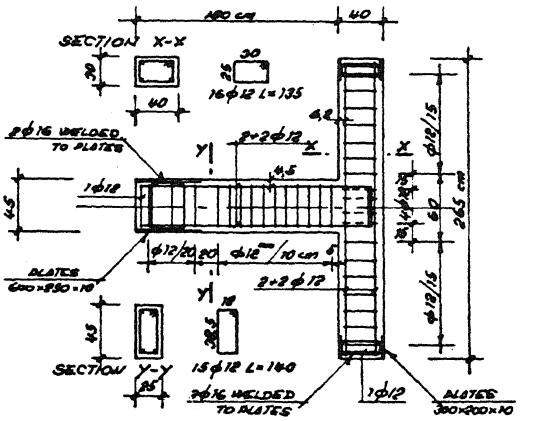

FIG. 2 - DETAILS OF SPECIMENS

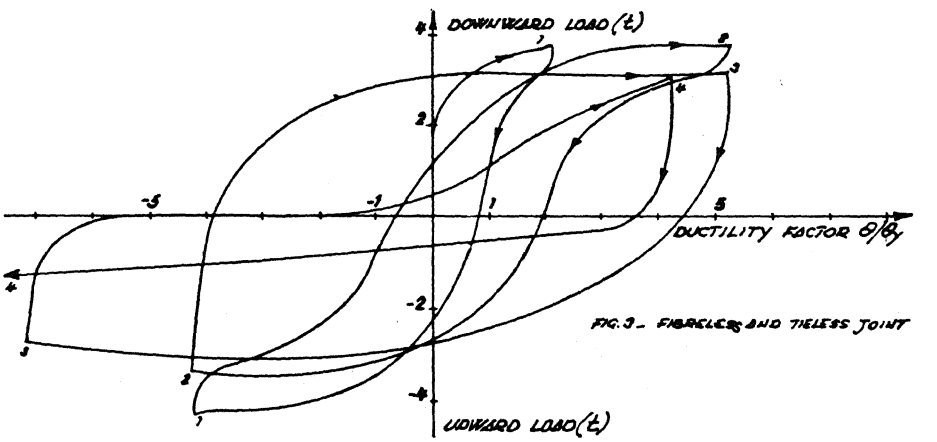

FIG. 3 - FIBRELESS AND TIELESS JOINT

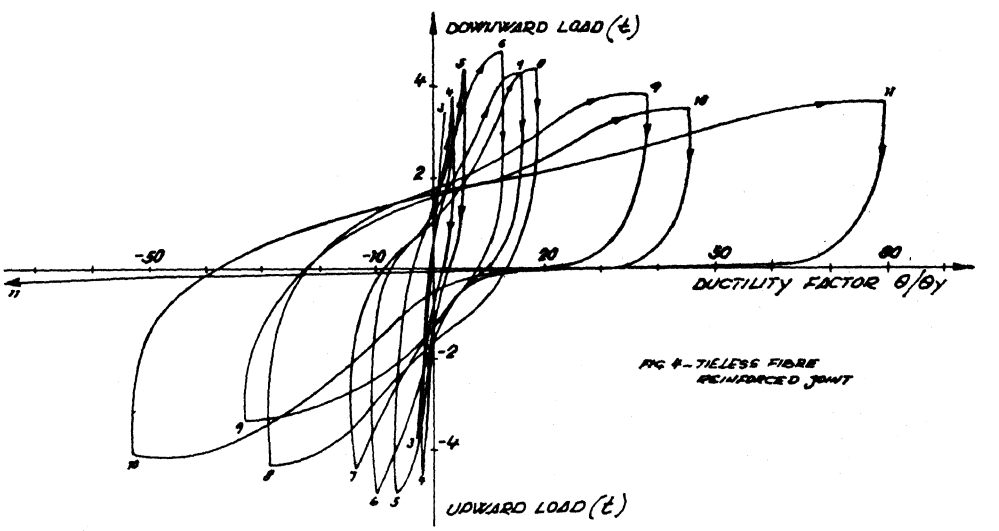

FIG 4 - TIELESS FIBRE REINFORCED JOINT

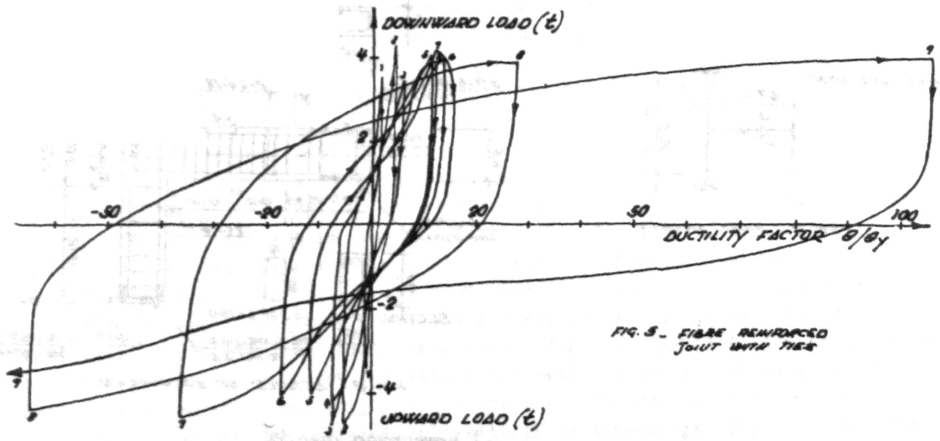

FIG. 5 - FIBRE REINFORCED JOINT WITH TIES

FIG. 6 - FIBRELESS AND TIELESS JOINT

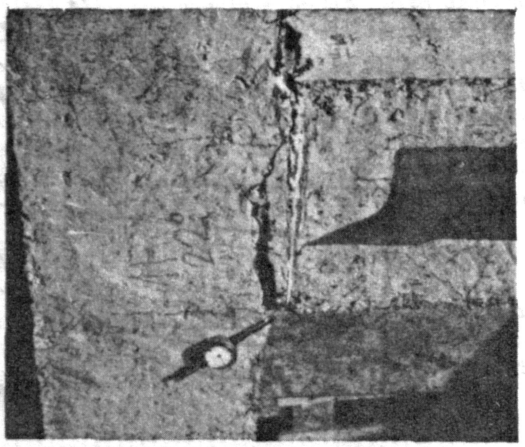

FIG. 7 - TIELESS FIBRE REINFORCED JOINT

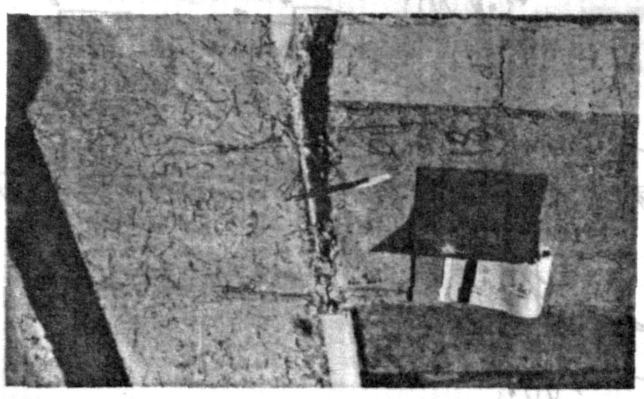

FIG. 8 - FIBRE REINFORCED JOINT WITH TIES