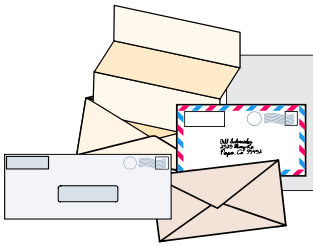

Letters to the Editor

Anchorage details and joint design in seismic RC frames

This has reference to the paper "Anchorage details and joint design in seismic RC frames" by C.V.R. Murty *et al*, published in *The Indian Concrete Journal*, Vol 75, No 4, on pp. 274-280.

The discusser would like to congratulate the authors for their timely presentation of the experimental investigation on anchorage details and joint design in seismic RC frames especially when the civil engineering fraternity is perturbed over the occurrence of the devastating earthquake in Gujarat.

The authors have evaluated the performance of the anchorage detailing specified for gravity loading (non-seismic) by IS 456 : 2000 under cyclic displacement loading where the structure is subjected to reversal of tensile stress and have sought to project it as inefficient. In my opinion, this amounts to evaluating the performance of a particular provision of the code for the purpose for which it is not intended to be applied.

Clause 26.2.3.3(b) specifies that when a flexural member is a part of the primary lateral load resisting system, the positive reinforcement required to be extended into the support shall be anchored to develop its design stress in tension at the face of the support. That means the rebar in tension extended into the support should have adequate development length.

The authors have applied cyclic displacement loading on the beam resulting in reversal of tension, that is, both sides of the beam are subjected to tension. Therefore according to clause 26.2.3.3 (b) of IS 456 : 2000 reinforcing bars on both sides of the beam should have been provided with adequate anchorage length in the column by extending them. If sufficient anchorage is not provided on the side of the beam experiencing tension the code is not at fault. It is quite natural and also expected that the performance of the joint with improper detailing is very poor because the side of the beam which is subjected to tension is not provided with adequate anchorage length. The code has not advocated such poor anchorage detailing. Clause 26.1.2 of the IS 456 : 2000 states that the recommendations for detailing for earthquake-resistant construction given in IS 13920 should be taken into consideration, where applicable.

Even though clause 12.1.1 of ACI 318 code states that hooks shall not be used to develop rebars in compression, the authors have chosen to provide a 90° hook in compression, which under cyclic displacement loading becomes tension and hence the hook is able to develop the required stress satisfactorily. This creates an impression that authors have not carried out the investigations in a well-concieved manner.

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The authors' reply:

The authors thank the discusser for his comments on the paper.

However, the authors believe that the discusser may have missed the point! The primary objective of the experimental programme was to evaluate the cyclic performance of beam-column joints of RC frames which are designed and detailed only for gravity loads as per provisions of IS 456. A large number of RC frame buildings have been designed and constructed in moderate to high seismic regions as per IS 456, for gravity loads alone, and the frames are not considered as primary lateral load-resisting system. Therefore, the requirement of Clause 26.2.3.3(b) of IS 456 does not come into force. Thus, these joints become highly deficient in case of reversal of loads expected during strong earthquake shaking, as observed in the tests reported in the paper.

Further, the paper nowhere claims that IS 456 is 'at fault' as suggested by the discusser. The authors firmly believe that the experimental programme was well-conceived and are satisfied with the results obtained.

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