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Concrete Beams Reinforced with Cold-Formed Steel Channel

Poutres en béton armées de profilés en acier

Betonbalken mit kaltverformten Stahlprofilen als Bewehrung

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1. INTRODUCTION

An experimental research on strength and behaviour of steel concrete composite beams has been carried out at Nanyang Technological Institute, Singapore.

The first phase of investigation was on beams made of concrete and reinforced with mild steel lipped channel at the soffit level. Shear studs were used to enhance the bond between the concrete and the channel.

The broad objectives of this investigation are:

- ultimate load carrying capacity of the beams and their behaviour at collapse
- bond strength between the steel and concrete
- servicibility requirements in terms of deflection and cracking
- theoretical studies in respect of strength and behaviour of beams at servicibility limit state and ultimate limit state
- comparison of these new typed composite beams with similar conventional reinforced concrete beams
- to establish any design theory and principle that would be suitable for these types of composite beams

2. TEST AND RESULTS

2.1 Specimen and test arrangment

Details of a few test beams are shown in Figure 1 and the test arrangement is shown in Figure 2.

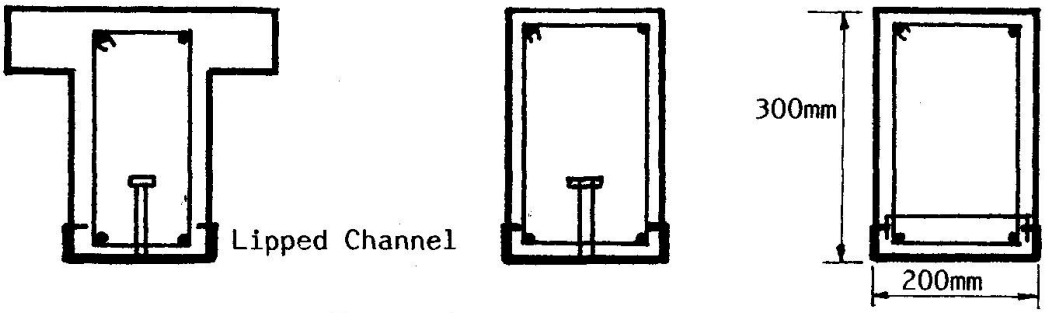

Figure 1 Cross-section of a few test beams

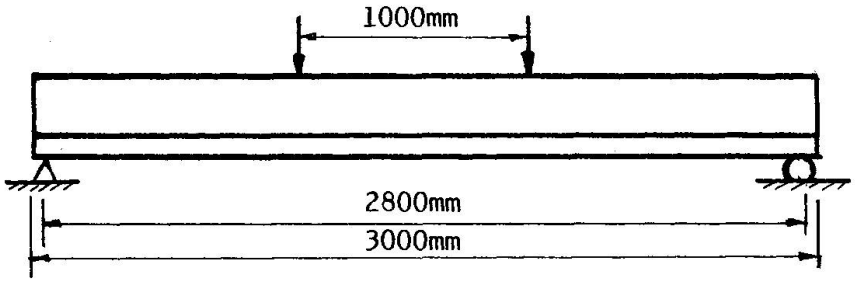

Figure 2 Loading arrangement of beams

2.2 Summary of Results

Tests have been carried out on 22 beams so far and results can be summarised as follows:

- The method of calculation of ultimate strength as developed for reinforced concrete (British Code BS 8110) can be applied for this sort of composite beam.
- The performance of the composite flange beams was found better than the composite rectangular beams.
- The ultimate load carrying capacity of composite reinforced concrete beams had shown almost 30% increase over conventional reinforced concrete beams of identical dimension.
- The stiffness of the composite reinforced concrete beams was observed to be much higher than similar r.c. beam and thus the deflection at working load was significantly low.
- A very good crack control was exhibited by the new composite beam. All cracks remain very fine up to the working load and were well within the limit specified by British Code BS 8110.

3. CONCLUSION

The significance of this investigation lies in the fact that this kind of composite beams can be used for short span structures such as multi-storey buildings. It is difficult to draw to a conclusion that this kind of composite beams will perform better than the similar reinforced concrete beams as only a limited number of tests have so far been done. The present investigation shows a promising result for these composite beams and more tests are necessary to establish the structural and economical viability of these beams. At Nanyang Technological Institute further tests are being carried out.