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Comparison of Reinforcement Anchorage Tests with British Code Requirements

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Summary

The aim of the research described in this paper was to improve the current method of assessing the shear capacity of existing bridge decks and, in particular, to determine the amount of main reinforcement anchorage below which the shear capacity is affected. This paper presents the results of tests carried out relating to a real bridge. A number of interesting comparisons are made between the test failure loads and the predicted flexural and shear strengths. Conclusions are then drawn relating to the Standard BD44/95 with implications for future assessments. The research indicated that the current bridge assessment method in BD44/95 for reinforcement anchorage and shear strength of slabs is overly conservative.

Abstract

Bridges in the UK are being assessed to confirm their capacity to carry the loading which results from increased lorry sizes conforming to European standards. Assessment is based on the assessment code for concrete bridges (BD44/95) published by the Highways Agency.

The Civil Engineering Department of Queens University Belfast was contacted concerning problems of deficient reinforcement anchorage which had arisen in the assessment of a Bridge in Northern Ireland. It had been found that using the Department of Transport Bridge Assessment Standard BD44/95, the bridge had insufficient shear capacity and would therefore require major repair work.

It was suggested that this problem, which was likely to be more widespread, should be investigated experimentally in order to ascertain if the current code requirements for minimum reinforcement anchorage were overly conservative.

The main reasons for the existing concrete slab bridges failing their assessments are as follows:

(a) the guidelines for shear are more conservative in current codes than in the earlier codes to which some of the earlier structures were designed and

(b) some bridges have been found to have reinforcement details at the supports which provide minimal anchorage to the main reinforcement.

The second of these is a particular problem because BB44/95 assumes that any shear capacity depends on a minimum anchorage length of 12 times the bar diameter. Enhanced

shear, up to 3 times the normal shear capacity may be assumed if the load is applied close to the support but this is dependent on an anchorage length of 20 times the bar diameter. No enhancement is permitted for anchorage lengths between 12 and 20 times the bar diameter. In an attempt to improve the requirements of BD44/95 an investigation of the specific problem of deficient shear capacity in a real concrete bridge was carried out at Queens University Belfast, where a number 1/3 scale models representing a typical bridge were tested.

The test results are compared with the predicted ultimate flexural and shear strengths according to BD 44/95 (An example of this is presented in Figure 1). It is shown that the reinforcement anchorage requirements of this standard are overly conservative and shear enhancement is possible for reinforcement anchorage lengths less than 12 bar diameters.

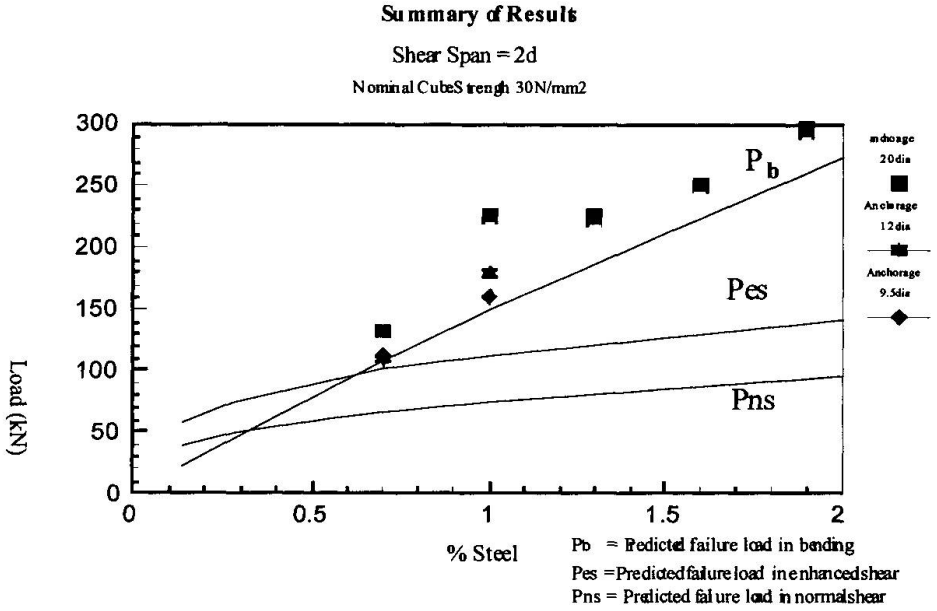

Figure 1 Comparison of Actual to Predicted Failure Loads

If the quality of bridges in the future is to be improved then there must be a more complete understanding of the effects of reinforcement anchorage. This will in turn prevent overly conservative codes of practice requiring expensive strengthening operations on bridges which do not need it.