

## OPEN FORUM

### PROBLEMS AND SOLUTIONS

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#### Composite Action Between Girder and Bridge Deck With Precast Panels

**Q1:** With a cast-in-place concrete deck placed on precast, prestressed concrete deck panels that are supported on precast, prestressed concrete girders, can it be assumed that full composite action takes place between the deck, panels, and girders in calculations of service load stresses and strengths?

**A1:** The answer to this question can be illustrated by the results of recent tests on four specimens (see Fig. 1), carried out at the Ferguson Structural Engineering Laboratory at The University of Texas at Austin. Each test specimen consisted of a Type I AASHTO girder with a depth of 28 in. (711 mm) and a composite deck with a thickness of 8 in. (203 mm) and a width of 78 in. (1.98 m). Two specimens used a full 8 in. (203 mm) thick cast-in-place, normal weight concrete deck.

The other two specimens used 4 in. (101 mm) thick precast, lightweight concrete panels with a 4 in. (101 mm) thick cast-in-place, normal weight concrete deck. The panels were placed immediately adjoining each other with no special treatment of the joint. The specimens were tested in flexure with a span of 24 ft (7.32 m).

The load-deflection curves for two pairs of test specimens are shown in Fig. 1. Specimens 1 and 3 had a full-thickness, cast-in-place deck. Specimens 2 and 4 had precast panels with a half-thickness, cast-in-place deck. Specimens 1 and 2 were tested with a shorter shear span than Specimens 3 and 4. Consequently, Specimens 1 and 2 had less deflection for the same load and a higher load capacity.

The load-deflection curves and strengths for each pair of specimens are almost identical. Strain gauges placed across the width of the slab showed that the full width of the slab was effective for both the full-thickness, cast-in-place deck and the composite, precast panel deck.

Failure was identical for both cross sections with the strain at the top of the deck exceeding 0.003 before surface spalling and concrete crushing occurred at the maximum load. The measured flexural strengths exceeded values cal-

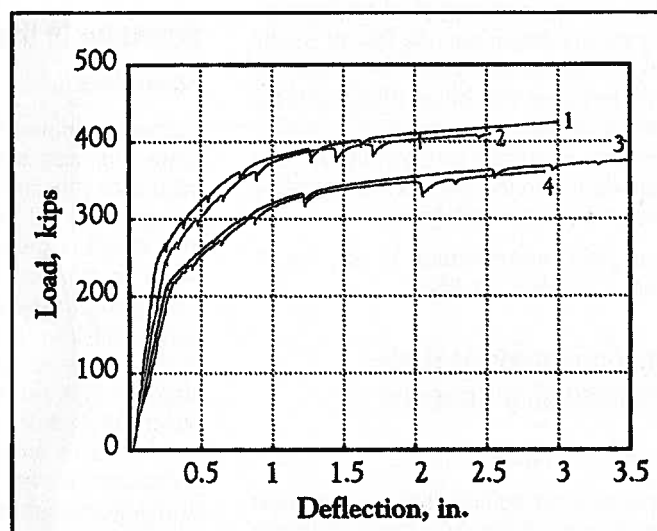


Fig. 1. Load-deflection plot of test specimens.

culated either using the provisions of the AASHTO Specifications or by strain compatibility analysis.

In terms of analysis at the section where the precast panels abut each other with no special treatment of the joint, the test results show that the calculations are straightforward and that no special analysis is needed. Based on the test results, full composite action, with or without the use of precast, prestressed concrete panels, can be assumed for both service load and strength calculations.

*[Answer contributed by Ned H. Burns, Zarrow Centennial Professor of Civil Engineering at The University of Texas, Austin, Texas.]*

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