



The structural behaviour of composite beams with prefabricated reinforced concrete plate in positive moment zone



Ahmet Necati Yelgin, Muhammet Zeki Özyurt, Mucteba Uysal*

Sakarya University, Department of Civil Engineering, Engineering Faculty, Sakarya, Turkey

HIGHLIGHTS

- We investigate bearing behaviour of structural elements in positive moment zone.
- Certain model researches theoretically are done in this study.
- Epoxy resin was used to agglutinate reinforced concrete beams and steel elements.

ARTICLE INFO

Article history:

Received 20 May 2014

Accepted 30 June 2014

Keywords:

Bearing behaviour
Epoxy resin
Beam
Steel

ABSTRACT

In this study, it was investigated that the bearing behaviour of reinforced concrete beams and steel elements in the positive moment zone. The bearing behaviour and the bearing capacities of the reinforced concrete beams with steel elements agglutinated by the epoxy resin. Moreover, certain model researches are done theoretically to determine the distribution of the sliding and the normal strain throughout the coherence surface of the beams which are composed of the reinforced concrete plate and the steel elements agglutinated with the epoxy resin and equation are suggested for these kind of composite due to the results. Test results indicated that the bonding strength between steel and steel is 470% longer than that of concrete to steel.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

The composite beams which are composed of reinforced concrete floor plate and steel beams or bridge floor and steel beams are more economical than the steel beams that carries reinforced concrete plate freely on its own. Because, in a composite beam the tensile component of the force pair which is due to bending is carried by the steel profile and the compressive component that is also due to bending is carried by either reinforced plate or a of the reinforced concrete plate and steel profile cooperation system. So, the steel profiles get rid of carrying the compressive component of bending either completely or partially. In this way, the reinforced concrete plate carrying the dead load turns out to be a useful element which carries the compressive component and in this cooperation, the lever arm of the force pair become greater, so a good economical factor is constituted by this situation [1–6].

The composite beams are always lighter than the reinforced concrete beams. In the composite beam, less steel is used than

the reinforced concrete beams which have the same height. In the composite beams, a combination material called epoxy resin is used to provide the cooperation between the prefabricated reinforced concrete plate and the steel profile. During the cooperation between the concrete and the steel profile, the sliding and the lifting forced between the two materials are reacted by the help of the epoxy resin. There are not more researches about this subject (especially, about the composite beams which are consist of the reinforced concrete plate and the steel profile combined by the epoxy resin in the positive moment zone). Generally in the studies with the epoxy resin, the cooperation of the steel plate and the reinforced concrete beam is researched.

The main purpose of our study is researching the bearing behaviour of reinforced concrete beams and steel elements in the positive moment zone, and also researching how the cooperation by means of the steel profile and plates existing in the reinforced concrete beam (agglutinated with epoxy resin) is materialized (sliding and separation of epoxy resin from the steel, etc.) About this subject, in the experimental studies which are carried out by Swamy and Jones [7–9], the bearing capacities and the bearing behaviour of the reinforced concrete beams with steel elements agglutinated by the epoxy resin and how the sliding and the

* Corresponding author. Address: Sakarya University, Civil Engineering Department, Sakarya 54187, Turkey. Tel.: +90 264 295 57 45; fax: +90 264 346 01 51.

E-mail address: mucteba@sakarya.edu.tr (M. Uysal).

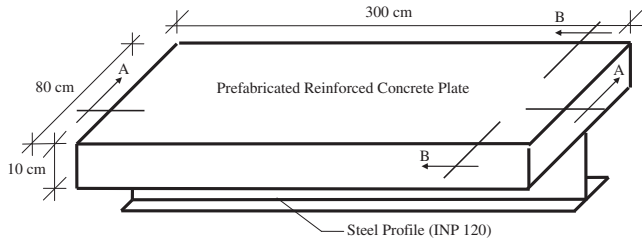


Fig. 1. Details of composite beams.

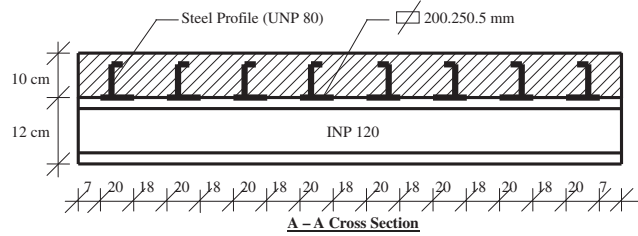


Fig. 2. The first type of interconnection elements spacing.

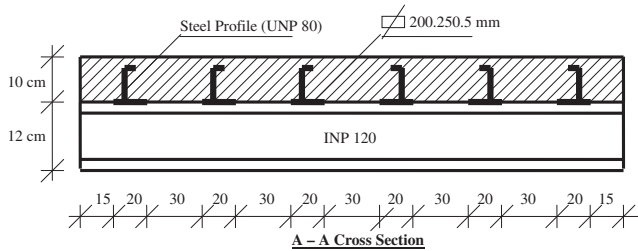


Fig. 3. The second type of interconnection elements spacing.

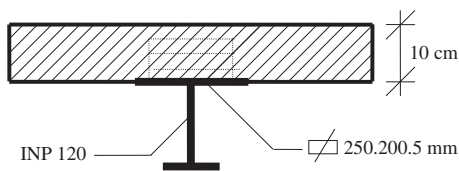


Fig. 4. B-B cross section of the composite beams.

separation between the steel element and the reinforced concrete beam is materialized, are researched. Besides, in the studies of Roberts and Haji-Kazemi (Roberts 1989) [10–12], certain model researches are done theoretically to determine the distribution of the sliding and the normal strain throughout the coherence surface of the beams which are composed of the reinforced concrete plate and the steel elements agglutinated with the epoxy resin and equation are suggested for these kind of composite due to the results.

The objective of the study is to research the influence of the epoxy resin which provides the cooperation of the prefabricated reinforced concrete plate and the steel profile in the positive

Table 1

The values of the beam cross section and the bearing capacities.

Sample number	Concrete dimension (mm)	Steel profile number	Interconnect point	The rate of the concrete	Bearing load (kN)
EPR-1	3000.800.100	INP 120	6	C 30	5.5
EPR-2	3000.800.100	INP 120	6	C 30	5.6
EPR-3	3000.800.100	INP 120	6	C 30	5.8
EPR-4	3000.800.100	INP 120	8	C 30	7.7
EPR-5	3000.800.100	INP 120	8	C 30	7.9
EPR-6	3000.800.100	INP 120	8	C 30	8.0

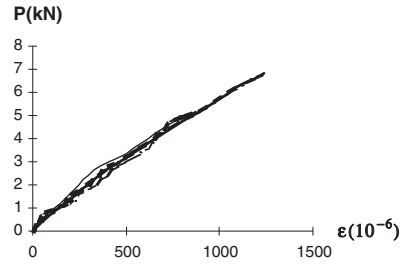


Fig. 5. Load – deformation diagram (steel).

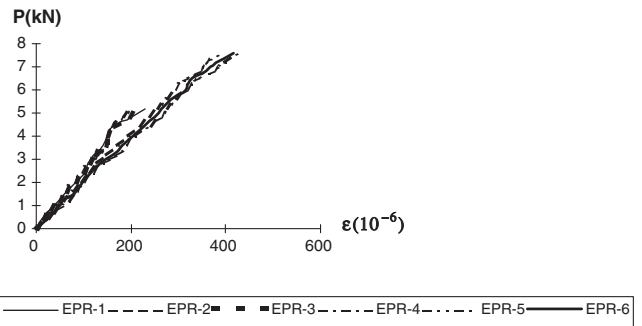


Fig. 6. Load – deformation diagram (concrete).

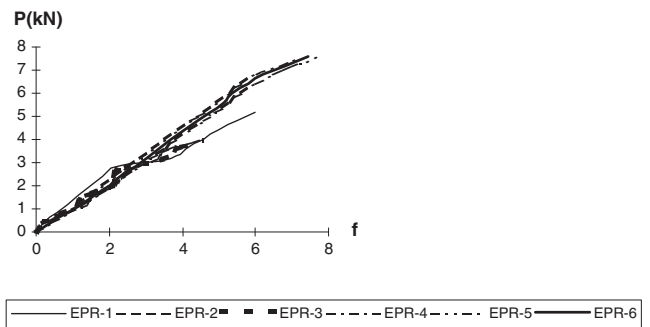


Fig. 7. Load – displacement diagram (centre of the beam).

moment zone on the bearing behaviour of the composite beam and also to find out how the additional equipment located in the prefabricated reinforced concrete plate and the steel profiles agglutinated with the epoxy resin affect the bearing behaviour of the composite beam. Besides in this study, as a result of the deformation of the composite beam under loading, the epoxy resin's degree of precaution on the rising and sliding of the prefabricated reinforced concrete collaborating with the steel profile is researched. The quality of the reinforcement that is replaced in the reinforced concrete plate is BS-1 and that of the steel profile which forms the composite beams is St 37. As the results of the tensile tests, the

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات