Fatigue Damage Study of Prestressed Concrete Bridges

Suraj Parkash
Scientist
Bridges & Structures
CRRI, New Delhi, India
suraj.crri@nic.in
Suraj Parkash, born 1965, received his civil engineering degree from the University of Kurukshetra, India

Ram Kumar
Scientist
Bridges & Structures
CRRI, New Delhi, India
ramkumar.crri@nic.in
Ram Kumar, born 1953, received his civil engineering degree from the University of Roorkee, India

Summary

Fatigue problem may arise in concrete structures which are subjected to repetitive cycling loading. Fatigue may also endanger the durability of prestressed concrete (PSC) bridges due to fatigue in rebars and prestressing strands. Very little research has been done on experimental work of PSC structures under fatigue loading. The present research work deals with the PSC beams subjected to cyclic loading which is simulated by repetitive traffic load. The beams have been tested for ultimate collapse load also. The deflection pattern for the bonded and unbonded prestressed beams proves the validity of theoretical result. The experimental results of fatigue tests on bonded and unbonded beams show the development of flexural cracks along the depth and near the mid span portion of the beam under designed live load which provides information about the service span of a bridge under extreme loading case.

Keywords: Post-tensioning, fatigue, cracking, prestressing levels, repetitive, cyclic, loading, failure, ultimate, collapse.

1. Introduction

The literature is limited on the fatigue performance study of PSC bridges. There are several reasons of interest in the fatigue strength of PSC bridges, such as: (1) the widespread adoption of ultimate strength design procedures and use of higher strength material which requires the structural members perform satisfactorily under high stress levels. Hence, there is concern about the effects of repeated loads on beams/girders and bridge slab, (2) new or different uses are being made of PSC member or system, such as PSC railroad ties and continuously RCC pavements. These uses of PSC demand high performance product with an assured fatigue strength.

There is new recognition of the effects of repeated loading on a member, even if repeated loading does not cause a fatigue failure, it can lead to inclined cracking in PSC beams at lower expected loads. Olson in 1990 [1], carried out experimental study of 4 PSC bridge girders after

https://doi.org/10.2749/weimar.2007.0161