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Parametric calculations of fatigue life of critical part of trolleybus rear axle

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Abstract

The paper describes the application of probability approach when assessing fatigue life of structures. The case study includes an assessment of two components of the rear axle of the trolleybus. The predicted fatigue life distribution functions were compared with service data. The calculations helped to identify and prevent fatigue cracks and fractures.

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Keywords: trolleybus; weld; rod pin; radius rod; fatigue failure; fatigue life distribution funcion.

1. Introduction

The methodology, which has been successfully applied for many years in the development of Skoda trolleybuses and buses, has been presented in the literature in the past [1] and recently [2]. This methodology is now being developed in connection with the production of battery buses [3]. In cooperation with RTI (research center of University of West Bohemia, Pilsen, Czech Republic) the following R&D areas of the former company's methodology are being improved: multibody simulation, FEM calculations, vehicle tests and their parts on electrohydraulic loading device, stress measurement during vehicle running on test and real roads, computational prediction of service fatigue

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life of important construction nodes and vehicle components, crash computation and experiments. Fatigue cracks (and fractures) occurred only sporadically. If they occurred, identifying their causes and eliminating their further occurrences were the lessons for designers and specialists dealing with the fatigue life of components. The presented case study is an example of a situation that has been resolved using commercial software (nCode) and parametric fatigue life calculations.

2. Case study description

The subject of the assessment was the area of the rear axle of trolleybuses, these trolleybuses were in operation in San Francisco. The fatigue cracks and fractures occurred in two parts (areas). The first area were welds, with which the short brackets were welded to the rear axle body. With the help of these brackets, the rear suspension beams and the radius rods were attached to the rear axles. The radius rods transmit the internal forces between the bodywork and the undercarriage frame and provide vehicle stability. Fatigue fractures also occurred in the neck of the rod pins at the ends of the radius rods. These pins provide the necessary degrees of freedom for the movements of the radius rods while driving on uneven ground. There are the critical places illustrated in sketches and photographs in Fig. 1, 2, 3 and in the following text.

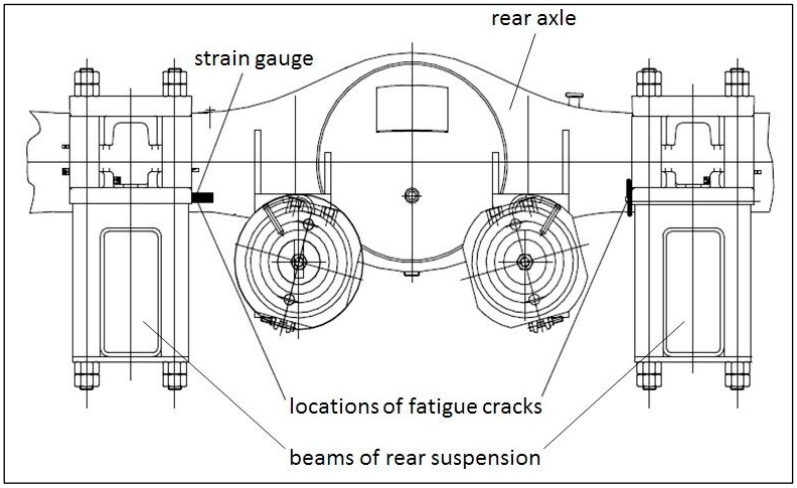

Fig. 1. Rear axle configuration.

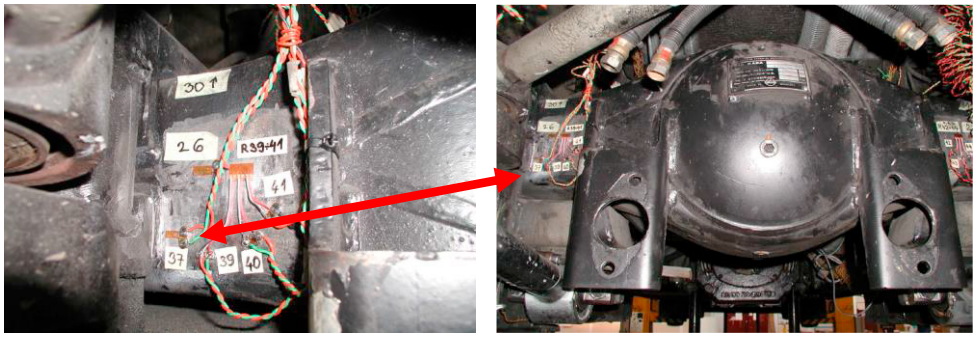

Fig. 2. Critical location of the rear axle and the strain gauge 37.