

Determination of Influence Lines for Train Crossings on a Tied Arch Bridge to Optimize the Construction of the Hangers

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Abstract : The maintenance and expansion of the railway network represents a central task for transport planning in the future. In addition to the ultimate limit states, the aspects of resource conservation and sustainability are increasingly more necessary to include in the basic engineering. Therefore, as part of the AiF research project, 'Integrated assessment of steel and composite railway bridges in accordance with sustainability criteria', the entire lifecycle of engineering structures is involved in planning and evaluation, offering a way to optimize the design of steel bridges. In order to reduce the life cycle costs and increase the profitability of steel structures, it is particularly necessary to consider the demands on hanger connections resulting from fatigue. In order for accurate analysis, a number simulations were conducted as part of the research project on a finite element model of a reference bridge, which gives an indication of the internal forces of the individual structural components of a tied arch bridge, depending on the stress incurred by various types of trains. The calculations were carried out on a detailed FE-model, which allows an extraordinarily accurate modeling of the stiffness of all parts of the constructions as it is made up surface elements. The results point to a large impact of the formation of details on fatigue-related changes in stress, on the one hand, and on the other, they could depict construction-specific specifics over the course of adding stress. Comparative calculations with varied axle-stress distribution also provide information about the sensitivity of the results compared to the imposition of stress and axel distribution on the stress-resultant development. The calculated diagrams help to achieve an optimized hanger connection design through improved durability, which helps to reduce the maintenance costs of rail networks and to give practical application notes for the formation of details.

Keywords : fatigue, influence line, life cycle, tied arch bridge

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