DOWNLOAD PDF EXPERIMENTAL ASSESSMENT OF PERFORMANCE OF BRIDGES

Chapter 1 : An article on experimental assessment of structural safety of solid bridges

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G1 -constant influence during the test Gd,j -rating value plus constant influences after the test DQd -usable increment of Q ext Ftarget -external part of test target load. A direct replication of the standard load is not practical so that the loading picture in the test is generated by substitute loads. The extent of the test target loads depends on the attempted loading in the crucial sections of the structure, the number and position of the load introduction points, the forces available through the loading equipment and influential factors reducing the loads in the test. Influential factors which can reduce load on the structure include: This resulted in the past in the requirement to remove structural layers for the loading test or take them into consideration accordingly when performing the test. In order to examine the problems, a reference quantity was defined as that physical quantity at which the structural safety assessment becomes extreme and therefore crucial. For the special task of defining the influence of the structural layers in solid bridges, the selected reference quantity has to allow for assessment of the load of a single fibre with differing cross section structure. Concrete tensile stress was selected as reference quantity. Given influential factors such as road surface etc. Load components and test target load. Some influences are constant or are controlled by administration e. In the case of constant factors such as restraint effects from concrete joints or earth resistance on the abutments, it is presumed that this influence has the same favourable effects for the residual use period. These influences do not have to be taken into account in the form of an overload and can therefore be used as potential for a higher experimental bridge rating. The overload coefficient d is used to ascertain the overload shares DF. The overload coefficient dF in our case is ascertained from the ratio of the concrete tensile stresses resulting from the overload share DF and the test target load Ftarget Fig. It shows by how much the test target load has to be increased to compensate for example for the influence of the structural layers. The overload coefficient dtot refers to the total load from dead weight and traffic load and therefore also shows the percentage deviation when the joint carrying effect is not taken into account in the level of the total load. It can presume values larger than, smaller than or equal to 1. If there are several influences road surface, protective layer, pavement areas , it must be discussed whether a leading effect is also defined for the partial overload coefficients, as for the combination coefficient Yo,i in the semi-probable safety concept, while the remaining overload coefficients are reduced. This would appear appropriate because the extreme case is unlikely. The test target loads are generally planned for certain marginal test conditions. The marginal test conditions such as temperature or material strength are however usually unknown at the planning phase and have to be estimated. For example, a lower ambient temperature at the point in time of the test results in an increased modulus of elasticity of asphalt and the joint carrying effect. Some marginal conditions e. Correction coefficients for forecast changes should be defined during the planning stage so that the overload coefficient stipulated at this point by presumptions can be adjusted to the actual conditions. The correction coefficient V. Due to flaws in building execution, large-scale corrosion had developed in the prestressing elements with partial failure of some of the prestressing elements so that the bridge classification had had to be reduced. In addition, the lateral load-bearing ability was damaged by grouting faults between the precast girders Fig. A solid support of structural steel frames had been erected under the bridge in case of a sudden loss of load-bearing ability. In view of the extreme damage, the bridge was to be demolished and a new one built. An auxiliary bridge was erected to bypass the building site during construction. The bridge was selected in cooperation with Stralsund road construction office, and made available for this thesis, for which we are very grateful. It was ideal for basic resarch into the effect of the structural layers, because it was available for a study period of approx. The existing crash support also saved considerable money and time resources, because such a structure was necessary for the failure load test and could also be used as an independent measuring basis. After removing the individual layers, a load level had to be chosen for the loading tests which ruled out damage to the bridge. Four loading frames were positioned on the structure so that a mini excavator could still travel across the bridge to remove the rubble produced in the process. The test plan was based on the corresponding arrangement of the loading frames. The frames were anchored in the abutments with tie rods Figs. The load was applied with hydraulic presses in controlled load cycles, based on the stipulations of the directive [2]. Identical loading tests were performed in the following conditions of the structure Fig. Additional symmetrical and asymmetrical load images were run for system identification and plausibility check. Every removal condition was concluded with a stress rupture test reaction measurement under constant load. One direct result of a stress rupture test was that long load holding times to compensate for the effect of bitumen bonded structural layers result in uneconomical test periods min. Finally, the load was increased through to the technical limit load in an attempt to cause failure of the structure. As this was not possible, subsequently two precast girders one damaged and one intact were removed, equipped with measuring equipment and each loaded through to failure. Conventional technology was used to measure reactions in the structure inductive position transducers, slope sensors, strain gauges and sonar emission analysis. Test results By means of a hybrid analysis, i. The measurement results for the overall system and the individual removed girders were stimulated in the computer. The reference quantity was compared for the support structure with and without structural layers to ascertain the influence thereof. The correction coefficient was estimated by varying the stiffness of the individual layers. The procedure of including the structural layers with estimated stiffnesses in the computing model and creating a realistic model of the partial bond by considering the soft sealing layer has proven to be a good approach. Summary and conclusions The results presented will allow a determination of the additional test load increment for compensating the influence of pavement layers, structural geometry and bridge caps in future experimental safety evaluations. For this analysis, the exact geometry of the structure, the thickness of the pavement layers as well as their material properties, especially the modulus of elasticity, have to be known: Pavement acts as a quasi monolithic strengthening of the structure. Its temporary influence has to be taken into account when calculating the experimental target load. The resulting overload factor may exceed a value of 1. Some influences are constant or may be controlled administratively e. A reference quantity is required to determine the overload factor. In many cases, the concrete tensile stress is suitable as a reference for determining the contribution of pavement layers. The influence of the pavement layers normally reaches its maximum at mid-span. It may be estimated by an expensive 3D finite element analysis as well as by a plane model of the longitudinal section with and without pavement, respectively. In spatial structures, the characteristic stresses are influenced by the actual geometry of the structure e. Exact knowledge of the geometry is required for an estimation of critical local stresses. Bridge caps and cantilevers result in a stiffening of the border regions. In plate structures, the inner regions are unloaded for this reason. The design of the supports often causes an unintentional restraint. The resulting advantageous effect may be determined in a loading test. In situ concrete on prefabricated elements is mostly cast after a certain time period and in several layers. Insufficient bond disturbs the inner load circuit and may result in failure of the concrete joint. This effect needs to be taken into account in the structural analysis. In loading tests, the effect may be detected and quantified. Acknowledgements Special thanks go to the supervisors of this thesis, [8], Professor Dr. Steffens and Professor Dr. VDI Verlag, , S. Research Results Digest Nr. Bridge Rating trough Nondestructive Load Testing. Experimentelle Tragsicherheitsbewertung von Bauwerken: Grundlagen und Anwendungsbeispiele, Bauingenieurpraxis. Bautechnik 78 , Heft 6, S.

Chapter 2 : Damage Spectra for Performance Assessment of RC Bridges Subjected to Earthquakes

The experimentation on the assessment of thermal bridges was conducted within the experimental campaign of the main project described in the integration frame. Depending on the experimental campaign, different faÃ§ades were *tested.*

Chapter 3 : Analytical and experimental assessment of steel truss bridge gusset plate connections

*Experimental Assessment of Performance of Bridges: Proceedings of a Session Sponsored by the Engineering Mechanics Division of the American Society [Leon R. L. Wang, Gajanan M. Sabnis] on www.nxgvision.com *FREE* shipping on qualifying offers.*

Chapter 4 : Experimental Study on Friction Sliding Performance of Rubber Bearings in Bridges

In this paper, an experimental and numerical approach to the characterization of thermal bridges is presented. The need for this characterization was found within an experimental study in a 2.