Target proof load determination for bridge capacity assessment

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Summary

Aging is a matter of increasing concern for most bridges that are part of the road and railway systems of the European Union. Many of these bridges are very old bridges and without documentation. A possible way to assess their capacity is by means of a proof load test.

The paper extends the application of the proposed method described in a previous paper to similar bridges with 20 and 30 meter span, as a part of the task of the EC 6th Framework Programme European Project ARCHES (Assessment and Rehabilitation of Central European Highway Structures). In the project a methodology of proof load testing for existing bridges will be proposed.

The final objective is to provide guidance of the most appropriate target proof load to be used based in very simple parameters of the bridge as span-length and percentage of heavy traffic.

Keywords: Bridge, assessment, capacity, proof load, load test.

1. Results

As can be seen in figure 1, the type of distribution is almost negligible for low values of the coefficient of variation of the traffic load. However, the coefficient of variation seems to have a higher influence. The influence of the percentage of total traffic in the proof load effect is almost linear independently of the type of distribution and coefficient of variation. The span length has not a great influence too.

In figure 1, the influence of the span length for a predefined level of the total traffic effect can be seen. As the span-length increases there is a trend to decrease the target proof load. From this figure it becomes very easy to evaluate the target proof load to be introduced in the test with the only input data of the bridge span length. Here the case of the Eurocode live load as representative of the traffic action has been considered. The next step is the derivation of curves similar to those in figure 5 but for the specific traffic of a country or bridge under assesment. Also the case of different values of the target realiability index will be considered.

2. Conclusions

The paper presents the application of a proof load test to assess the possibility of an existing bridge to carry higher loads than in the design or to follow into use if some damage is present. In particular, the objective is to see if the bridge can carry the traffic load as presented in the Eurocode

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for actions in highway bridges. In fact, due to the uncertainty in the variables involved (mainly the traffic), a reliability-based approach has been applied. Because the final results can be highly sensitive to the type of distribution and variability assumed for such random variables, the influence of the type of distribution and coefficient of variation of the traffic action on the final target proof load has been investigated. The Gumbel distribution produces the highest values of the target proof load, whereas the lowest are due to the Normal distribution. Nevertheless, it is found that the type of distribution has a lower significance in the final results than the coefficient of variation. These results are valid for span lengths from 10 to 30 m. The examples have been worked out with a target value of the reliability index of 2.3. Having the present results in mind, further analysis will be performed in the future for other values of the target reliability index. In this case, the reliability index gives the indication of the safety behind the load level attained in the test.

In this paper the traffic actions has been characterized by the live load model present in the Eurocode. Further research is being developed to take into account other traffic models that can be representative of the actual traffic conditions in new member States of the European Union, as well as site/bridge specific traffic conditions. The objective is to define target proof loads specific for particular bridges taking into account the actual and future traffic over the bridge.

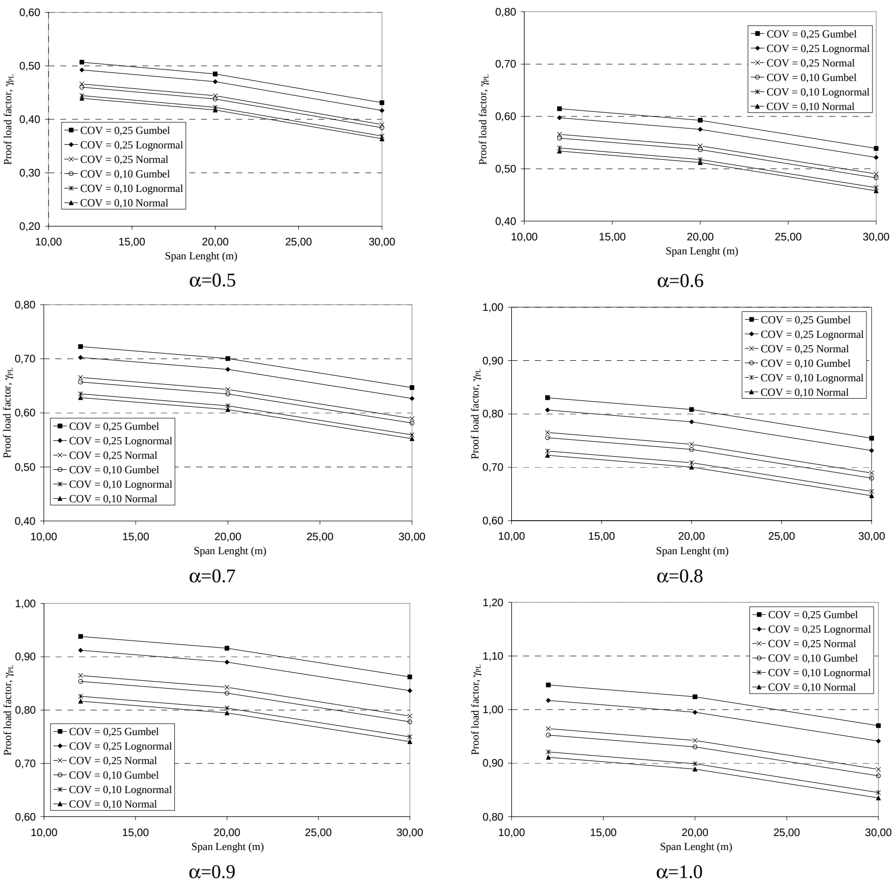

Figure 1. Influece of the span-lenght in the proof load factor for β target =2,3