

Background of target reliability levels for existing structures

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Summary

The structural safety of existing bridges can be confirmed by a bearing capacity assessment. The conventional method of evaluating a bridge is the partial safety factor method. A more sophisticated way to assess bearing capacity is the reliability analysis. It allows calculating the reliability index of the structure. The calculated reliability index should be compared to the target reliability index to determine if the structure and related risks are acceptable. Values for target reliability indices are proposed in codes. Structure and load type specific target reliability indices can also be determined. For existing structures, it is possible to calculate more accurate target reliability indices related to the consequences of failure. Increased probability of failure due to lower reliability indices can be tolerated if the consequences of failure are limited and an economic benefit is gained.

Keywords: Target reliability, reliability index, structural monitoring, safety level, reliability analysis

1. Introduction

In Finland and Europe, the focus of construction industry is increasingly shifting -from new building of bridges to the maintenance of the existing bridge stock due to worsening performance of the ageing stock due to deteriorating. On the other hand the requirements for existing bridges are becoming more demanding due to increased axle loads of both highway and railway traffic and increased speed of railway traffic. Heavy special transports have also become more common in both modes of transportation. These trends lead to an increase in the number of suspicious bridges. That, again, requires more bearing capacity assessments.

There is increasing need to develop and adopt assessment methods for determining the bearing capacity of bridges. In particular, there is a need for assessment methods that allow better detection of their present condition and development in a bearing capacity assessment. With the developed methods it is possible to evaluate the bearing capacity of a bridge more precisely. In addition to the calculation of structural reliability, an important part of assessment is to select a target reliability index.

The importance of the target reliability level of bridge structures is particularly pronounced with existing bridge structures. Too low target reliability of leads to failures, while too high value leads to uneconomical reinforcement solutions. Because of these two reasons, target safety level and target reliability index should be determined accurately. In the case of a newly built bridge, the economic effect of high target reliability is less significant.

It is possible to determine target reliability levels considering the consequences of failure. If it is possible to limit the consequences of failure the higher risk of failure can be tolerated. If there is a dependence between load intensity and consequences of failure under load, it is possible to determine different target reliability indices for different load types.

This paper presents some principles and background for determining an adequate target reliability