# Fatigue Design of Steel Bridges for Finnish Vehicle Traffic

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## Abstract

Eurocode fatigue load models for bridges have been developed using traffic information gathered from Western and Central European roads. This study was carried out to determine how fatigue loads from Finnish traffic typography compare to the fatigue load models defined in Eurocode. A comparison was made between Eurocode Fatigue Load Model 3 (FLM3) and damage determined from recorded Finnish traffic data. Computer software was developed for the analysis that utilizes the recorded traffic data to determine fatigue damage for selected representative structural details. The results indicate that generally FLM3 provides overly conservative results with the studied bridges, but can also theoretically underestimate fatigue loads when using Finnish traffic typography.

**Keywords:** fatigue; bridge; Eurocode; traffic; simulation; composite bridge; steel girder.

## 1 Introduction

Fatigue loading of road bridges is presented in Eurocode EN 1991-2 with 5 alternative fatigue load models FLM1…FLM5. The first two fatigue load models are generally applied only for preliminary design since they are meant to verify the boundless fatigue life of structures and they lead to overly conservative design. Many member countries have adopted fatigue load model 3, the so called lambda-method since its use is straightforward and effortless. Some studies, however, have shown that load model 3 has inconsistencies and more refined load models should be used [1]. Fatigue load model 4 has been criticized as too onerous since it was developed for a relatively severe traffic composition. Also, the fact that local traffic typologies may differ greatly from FLM 4 equivalent lorries (Table 4.7 in EN 1991-2) casts certain distrust of the load model, if not investigated more thoroughly.

More accurate fatigue assessment is justifiable since the mean values of axle loads and total weights of heavy vehicles are strongly dependent on the traffic typology. The road classification has a major influence on the fatigue assessment of bridges as opposed to static design since daily maximum values of loads are much less sensitive to the traffic typology.[2]

The most refined fatigue load model in EN 1991-2 is FLM 5 which consists of direct application of recorded traffic data. This article presents versatile computer software that is used for the fatigue assessment of bridge structures with more accurate traffic loading. The traffic loading was



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