Fatigue life assessment of road bridges with actual traffic loads (AGB2007/004)

Evaluation de la durée de vie en fatigue des ponts routiers sous charges de trafic actualisées (AGB2007/004)

Funding: National (Switzerland)
Duration: Dec 2007 - Nov 2013
Status: Complete with results

Background & policy context:

This project takes place within the general framework of the fatigue sections revision of the current structural engineering codes which deals with both road bridges and railway bridges (design code SIA 261 to SIA 267 revision planned), new as well as existing structures, since the use of the damage equivalence correction factor concept is also planned within the drafting of the codes for assessment of existing structures (SIA 269).

Objectives:

The objectives of the project are as follows:

- To extend the possibilities of a traffic simulation software by developing fatigue specific modules for the determination of internal force spectrums and damage sum for two lanes bridges.
- To allow for the revision of fatigue sections in the SIA codes n. 261 to n. 265 (damage equivalence factor).
- To clarify the rules for the determination of the influence line fatigue characteristic length in order to have a coherent fatigue verification method.
- To allow for the possibility of fatigue assessment for particular cases of existing bridges.

Related Projects:

Swiss Federal Roads Office; Research Roads-Bridges-Tunnels
Project number: AGB2002/005
Project title: Nachrechnung bestehender Brücken mit aktualisierten Strassenlasten
Project title (in English): Assessment of existing bridges with actual traffic loads
Project number: AGB2010/001
Project title: Ermüdung von vorwiegend auf Biegung beanspruchten Fahrbahnplatten
Project title (in English): Fatigue strength of deck slabs loaded predominantly in bending
Project number: AGB2010/002
Project title: Pertinence de l’état limite fatigue des goulons dans les ponts routes acier-béton
Project title (in English): Relevance of fatigue limit state of shear studs connection in steel-concrete composite road

Parent Programmes:
ARAMIS - ARAMIS information system

Institute type: Public institution
Institute name: Swiss Government: State Secretariat for Education and Research
Funding type: Public (national/regional/local)
Partners:
Switzerland
Swiss Federal Roads Office
EPFL-ENAC-IS-ICOM

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Key Results:
These are results of the project:

- Software for simulations for different traffic conditions on several types of bridges
- Software validation model

The principle of this study is to compare, for a given number of bridge types, the fatigue damage sum (Miner sum) resulting from, on one hand, calculations according to the current codes (travelling of a standard truck) and, on the other hand, probabilistic simulations of the traffic and the resulting internal forces variations. On the basis of these comparisons, updated values of the partial damage equivalence factors li given in the current codes (SIA 262 to SIA 265) is proposed. These new values are more realistic because they are not based on several simplified and conservative assumptions done during the drafting of the current codes.

These computations and comparisons are provided using a specific software. As a basis for the development of it, the traffic simulation software made during the research project AGB 2002/005 [OFROU, 2006] will be used and new specific modules will be written to perform fatigue computations. This software allows for the determination of the internal forces variations by virtual travelling of traffic models on the bridge; different bridge types with two lanes (bidirectional traffic) as well as different highway bridges types with two lanes of unidirectional traffic will be simulated.

Monte Carlo simulations are made, the different types of bridges being modelled by the influence lines corresponding to the internal force considered, and the traffic, vehicles, as well as the traffic conditions being defined through statistical laws.

Technical Implications
This research is practice-oriented and should improve the design fatigue of new structures through a powerful and versatile simulation software. From this software, the simplified verification of the resistance with the correction factor will be improved (more realistic, giving a better understanding of the actual level of security and also more economical bridges). In special cases, such as the evaluation of existing structures, the software can also be used to calculate the evolution of the injury totals, as an aid to the development of maintenance plans.

STRIA Roadmaps: Infrastructure
Transport mode: Multimodal transport
Transport sectors: Passenger transport, Freight transport
Geo-spatial type: Other