Analysis of suspended bridges for isolated communities

- *With emphasis on wind stability*

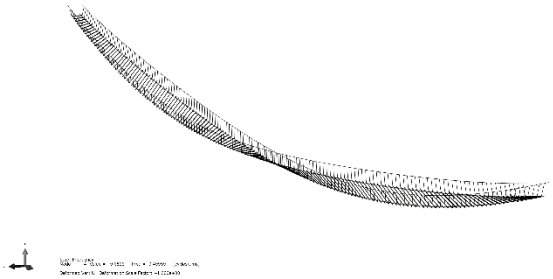
Light suspended pedestrian bridges are often built in rural areas to connect isolated communities. With steel cables as main load bearing elements, the structure becomes very load efficient. Due to easy construction methods and few parts, these bridges also becomes cost effective. Because of the lightness of these bridges, they become sensitive to wind effects. These effects are investigated in this thesis.

Figur 1 Suspended bridge, Jicaro, Nicaragua

Light suspended bridges are often used to connect villages or trail systems in geographical areas with lacking infrastructure and demanding topology. Different international non-profit organizations in collaboration with local promoters are building these bridges with the purpose of connecting isolated communities with health care and education.

The design and construction of these bridges has by and large relied on engineering judgement and design conservatism coupled with past experiences of similar construction projects. This master thesis aims to provide more sophisticated models of suspended bridges as material for future work.

Vibrations and sways due to wind can be a major problem for light suspended bridges. Due to their small dead load and low lateral stiffness, the sways and vibrations can be very large in comparison with more common pedestrian bridges. This could lead to temporary inoperability or in worst case structural failure. An existing bridge with a span of 100 meter has been analyzed to be able to calibrate reliable FE-models. With these models wind effects can be analyzed and suitable measures or restrictions can be proposed.



Figur 2 FE-model of a suspended bridge subjected to torsion

The contributions of the thesis are a general insight in the construction of these type of bridges, a working FE-model of suspended bridges and how the behavior changes with different setups such as span or sag. Some specific conclusions made in the thesis are:

- Modifying the sag is the best way to affect the natural frequencies.
- The criteria for using wind stabilization should rather be based on displacement than accelerations.
- Bridges designed with design guides provided by aid organizations requires larger cable dimensions than bridges designed according to Eurocode.
- Due to the nonlinearity of sagging cables a full implicit dynamic analysis is preferred when determining the dynamic response of a suspended bridge.