Validation of catenary based methods for cable road layout planning

L. Ramstein, L. Bont, F. Frutig and J. Schweier
Swiss Federal Institute for Forest, Snow and Landscape Research
Contacts: laura.ramstein@wsl.ch and leo.bont@wsl.ch
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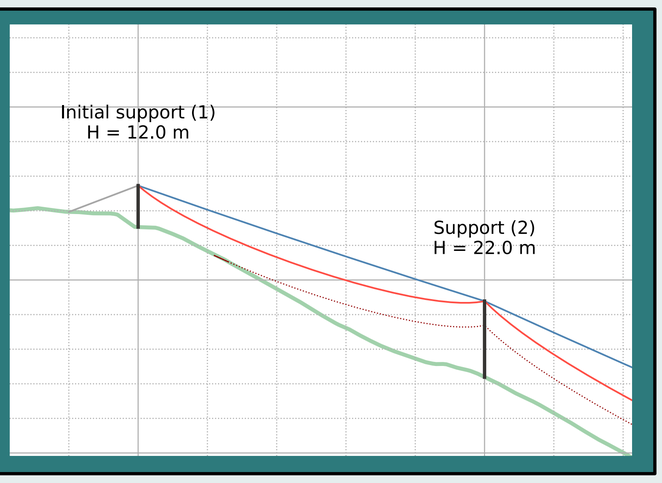
Aim of the project: Comparison of theoretical computations of cable line properties with field measurements

- Field measurements of skyline sag and cable tensile force for multi-span, standing skyline configurations (fixed anchored skyline at both ends)
- Comparison of measurements with commonly used calculation method of Pestal (1961) and a close to catenary method (Zweifel, 1960)

Material and methods: Data from modelling and field measurements (conducted in 2020)

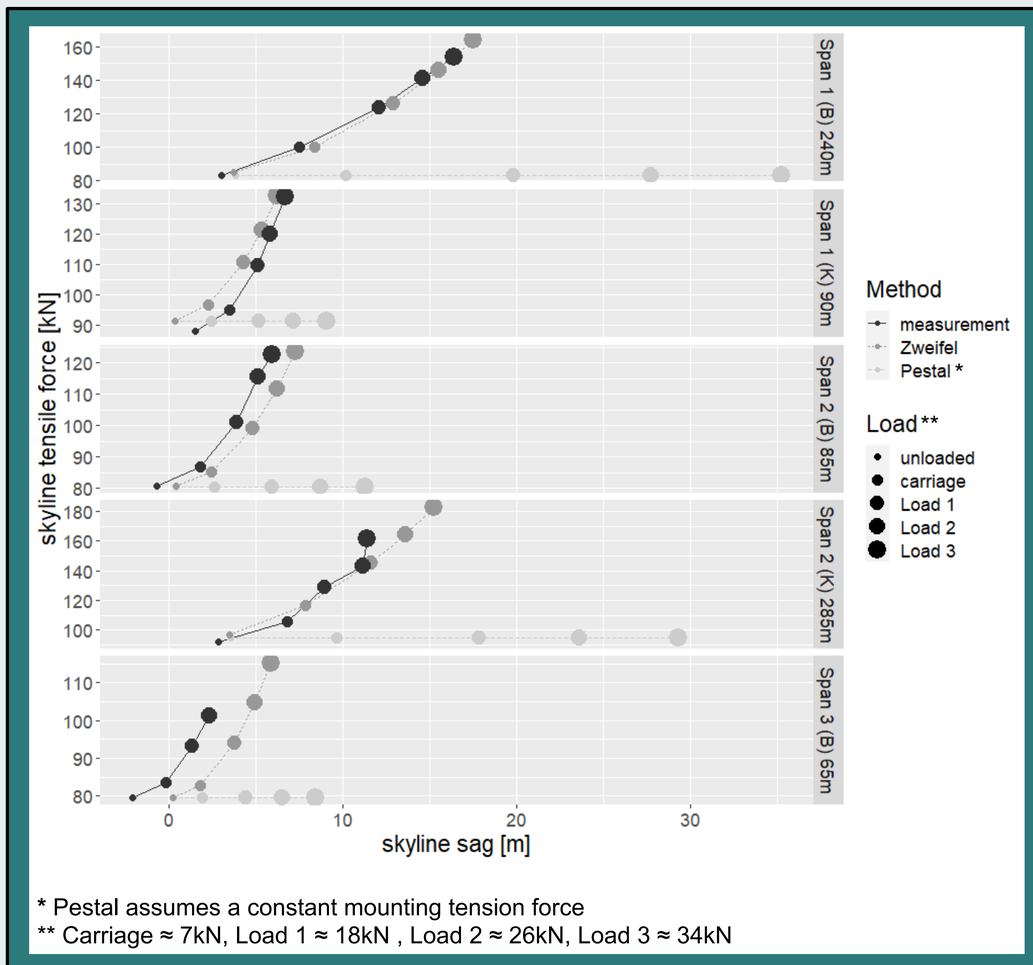
Model output
Modelled values of skyline sag and cable tensile force based on catenary method (Zweifel, 1960) and visualization of cable system



Cable tensile force
Measured with a load cell at the anchor

Skyline sag
Measured in the middle of the span for four standard loads (7 to 35 kN) with a Vertex (instrument for foresters to measure height or distance)

Results: Zweifel method calculates the measured parameters clearly more precise



* Pestal assumes a constant mounting tension force
** Carriage ≈ 7kN, Load 1 ≈ 18kN , Load 2 ≈ 26kN, Load 3 ≈ 34kN

Zweifel
Real cable line properties are accurately mapped, skyline sag and tensile force are slightly overestimated
> Inclusion of friction forces at intermediate supports (skyline - saddle) can further improve the accuracy

Pestal
Skyline sag is highly overestimated, tensile forces are highly underestimated, in particular for heavy loads and long spans
> Resulting in more and/or higher supports than actually needed

Foundation literature

Bont, L., & Heinimann, H.R. (2012). Optimum geometric layout of a single cable road. *Eur J Forest Res 131*(5), 1439–1448

Pestal, E. (1961). Seilbahnen und Seilkräne für Holz- und Materialtransporte. Georg Fromme & Co.

Zweifel, O. (1960). Seilbahnberechnung bei beidseitig verankerten Tragseilen. *Schweizerische Bauzeitung 78*(1/2):11