OITAF
Bozen/Bolzano
Congress 2017

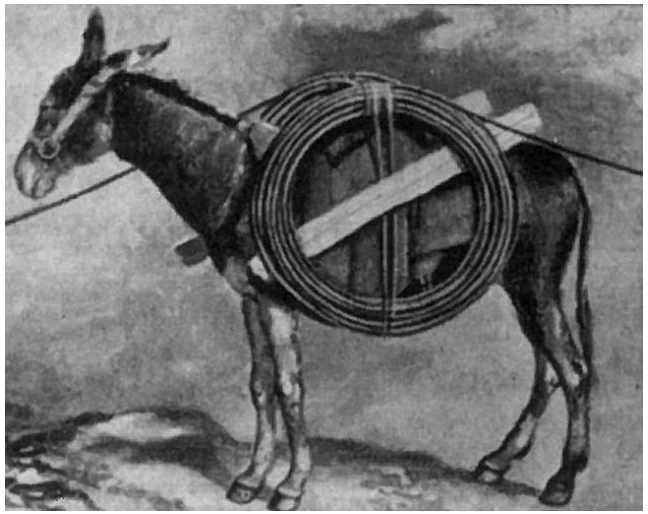
Fiber Ropes for building up ropeways

Konstantin Kuehner, IFT University of Stuttgart
Urs Schneider, Jakob AG
Fredy von Moos, Garaventa AG

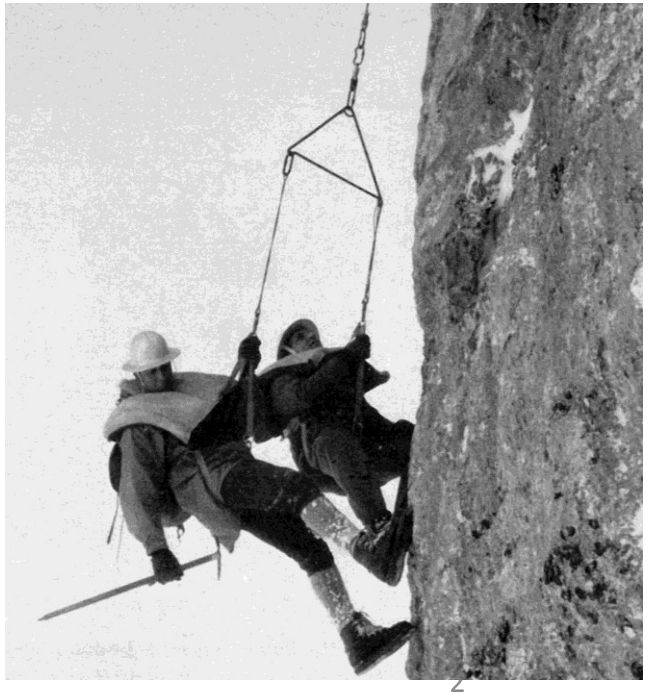
1. State of the art in rope mounting

- Time of pioneers: manual transport of <u>main rope</u>
  - by mules (end of 19th century)
  - by human hand (begin of 20th century)

- Manual transport of an advanced <u>pre-rope</u> (around 1950)



Trennert, Riding the high wire



Schmidt, Zur Eröffnung der Eibsee-Seilbahn

2. Problem and Solution

Today: helicopter transport & multiple pre-ropes

Problems:

- Expensive and time-consuming
- Increased risk of accidences within rope pull
- Rope twist has to be compensated
- Work is highly dependent on weather

Idea:

Helicopter transport of a single high-tensile fiber rope and direct pull of the final main rope

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seilbahnen-kogler.at

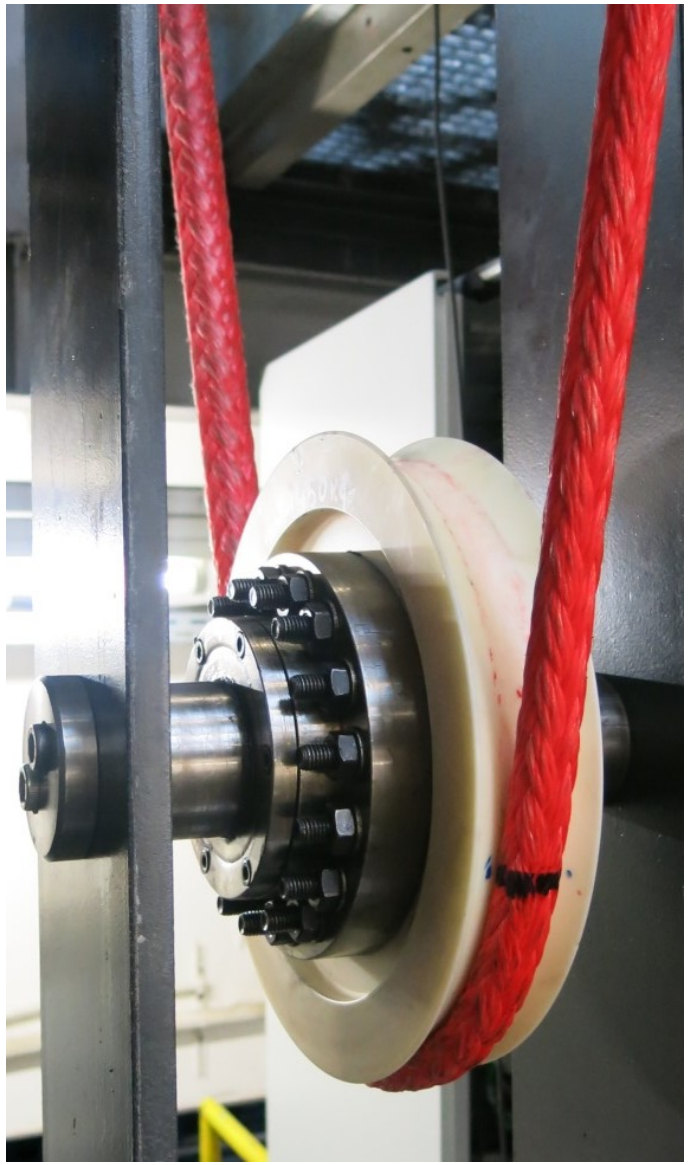
2. Problem and Solution

- Garaventa AG and Jakob AG:
  - Selection of a pilot rope
  - Proof of basic feasibility by first rope pull
- IFT University of Stuttgart:
  - Investigation of operational limits by laboratory testing
  - Setup of a user-manual

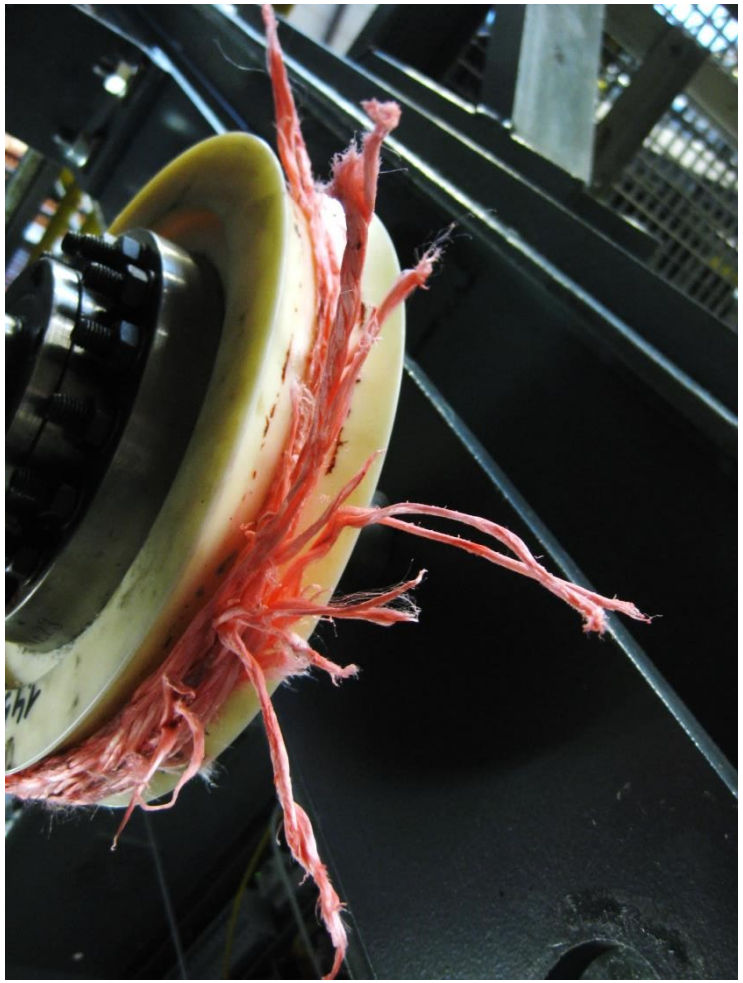
espazium.ch

3. Realization (I): Laboratory tests

- 3 different rope designs
- Ø 22mm, breaking load 300kN, material Dyneema
- Bending tests on polyamide sheave



3. Realization (I): Laboratory tests



3. Realization (I): Laboratory tests

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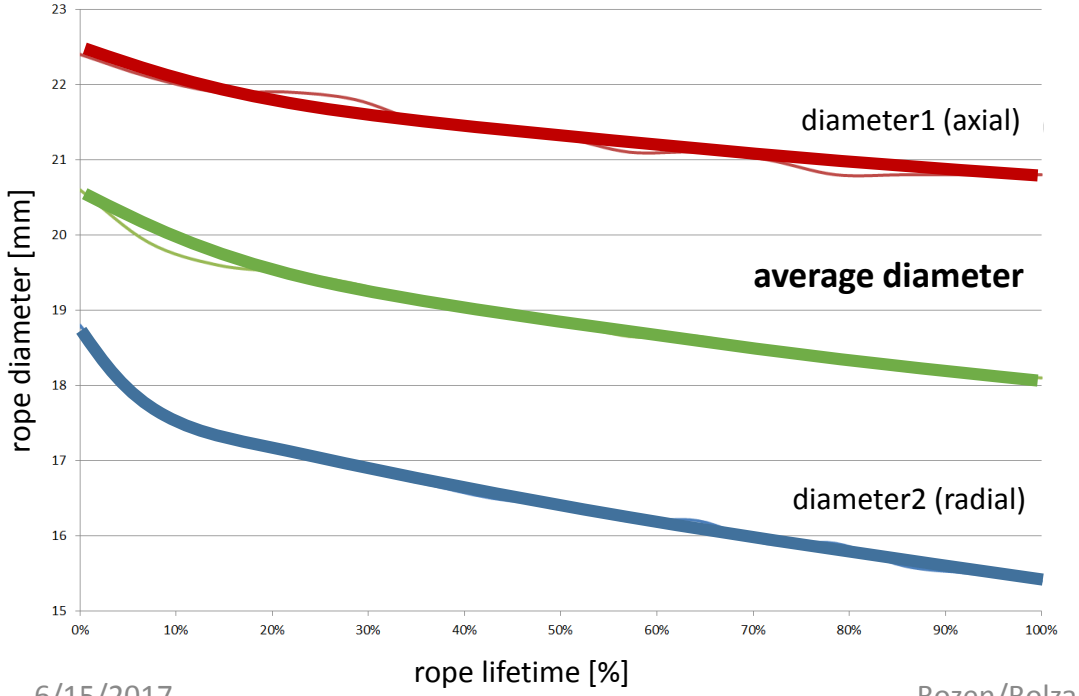
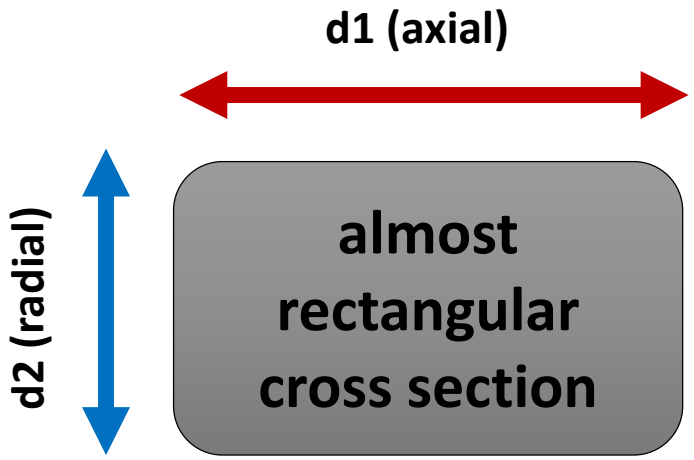
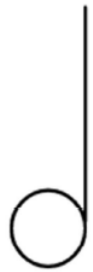
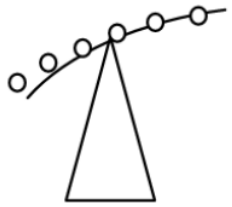
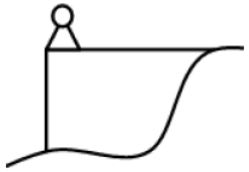
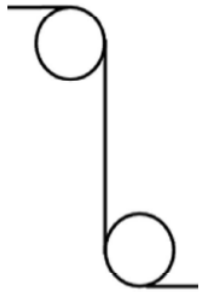
- Continuous diameter reduction of ropes
- Ropes only show little outer wear in advance,
  first strand breaks only occur close to total rope failure





4. Realization (II): user manual for field application

- Introduction of discard maturity and visual inspection
- Determination of bending cycles until discard in style of DIN 15020-part 1
- Rope exchange after 6 years or additional tests by manufacturer or accredited experts

					
drum / winch	support tower / roller battery	terrain ground roller	ground roller at basement	point of deflection	reverse bending

4. Realization (II): user manual for field application

Application protocol and point rating system until discard

LIROS D-Pro-XTR „red“ with protective cover, Inventory no. 000.1 Initial operation of rope: 17.09.2016					
	1	2	3	4	5
project / Location	Mount Example	…			
date	xx.xx. - xx.xx.2016	…			
used auxiliary devices	1 x drum (pay-off) 2 x support tower 2 x terrain ground roller 1 x reverse bending 1 x point of deflection 1 x winch (drive)	…			
bending cycles per rope pull	9 (fictive project!)	…			
amount of rope pulls	4	…			
sum of bending cycles	36	…			
residual maximum amount of bending cycles	266 (fictive project!)				
visual inspection	no abnormalities				
person in charge	Kuehner, IFT Uni Stuttgart				

5. Conclusion and prospects

- Rope pulls using high tensile fiber ropes are technically feasible
- User, manufacturer and test laboratories have determined safe limitations for in-field operation
- User-manual and documentation allow an increase of efficiency by a growing base of experience
- Presented method can be exemplary for industrial application of high-tensile fiber ropes

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Thank you.

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