

The background image shows two men in high-visibility yellow and black safety gear and white hard hats. They are standing on a construction site covered in gravel, looking down at a set of plans on a tripod stand. In the background, there is a large body of water, a forested hill, and several wind turbines under a clear sky. A semi-transparent dark grey box is overlaid on the center of the image, containing the title and speaker information.

From Code Requirements to Cost Savings: Modern Design of Rock-Anchored Foundations

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Sweco overview



Key figures

329

M€ net sales
in 2025

28

Locations in
Finland

3300

Employees

Clientele

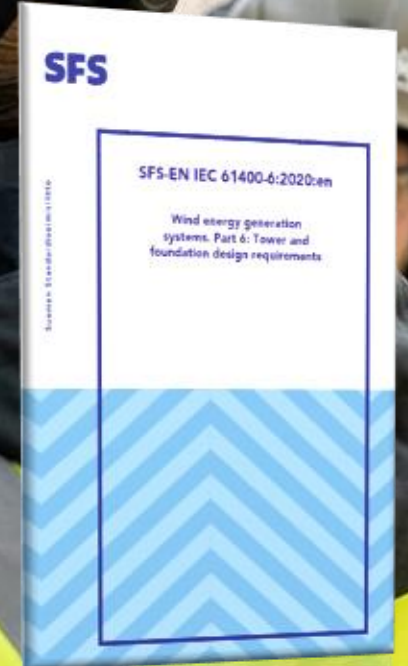
- Industry
- Construction
- Infrastructure
- 3,800 clients and 17,000 assignments per year

Industry services

- Project services
 - Project management
 - Engineering management
 - Procurement
 - Site management
- Risk management, permitting

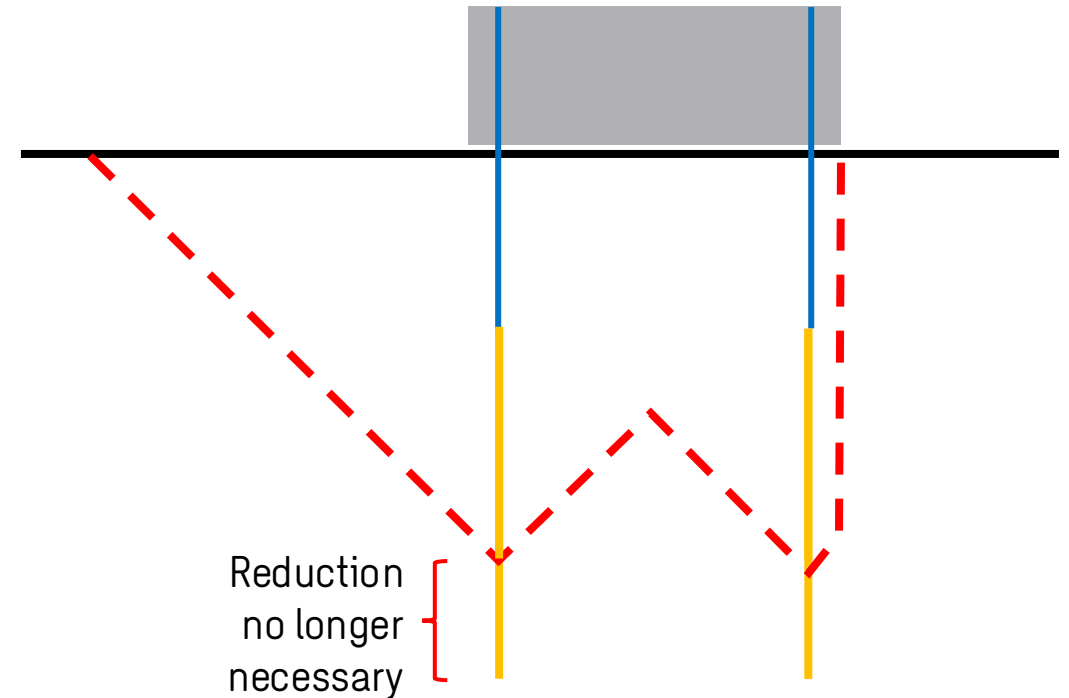
- All engineering disciplines
 - Process
 - Mechanical
 - Electr, autom.
 - Safety
 - Civil & structural
 - HVAC

Harmonizing codes: replacing conservative excavation guides with IEC standards



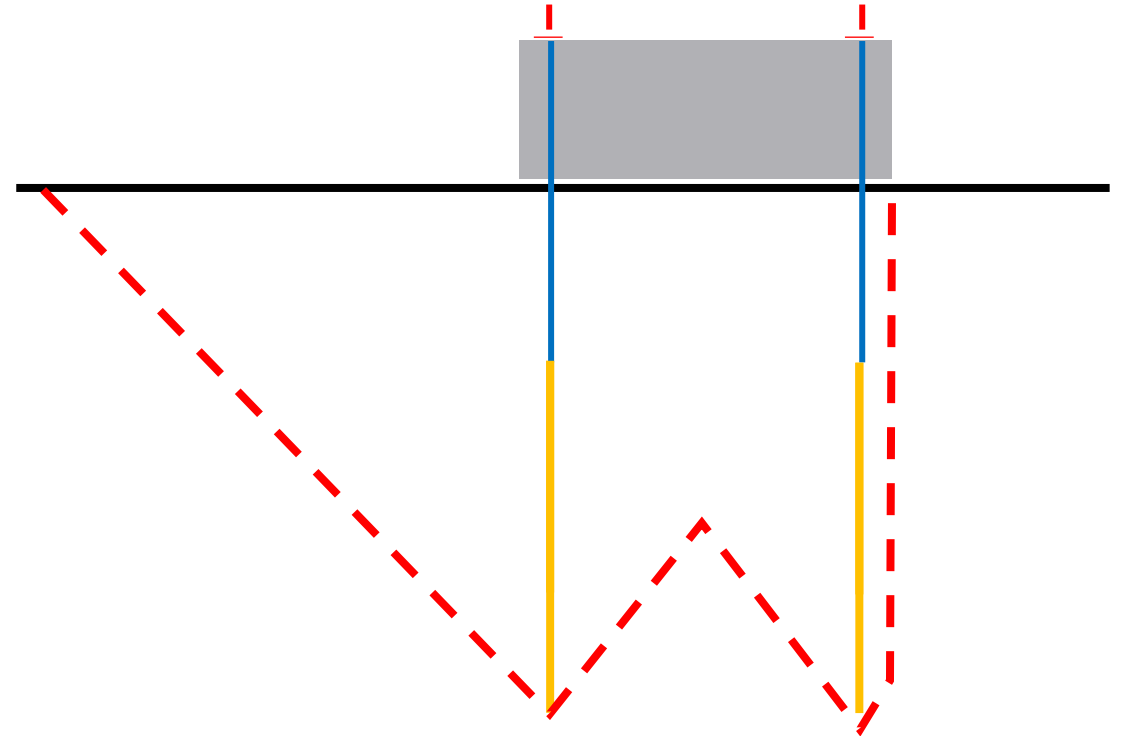
Replacing conservative excavation guides with IEC standards

- Finnish RIL 263-2014 trench guide has $L/3$ reduction to the bottom of the anchor
- This is a safety factor, should be finally replaced with partial safety factor as per Eurocode
- Also the bottom of the anchor can be taken in account bond length
- **SFS-IEC 61400-6 Wind energy generation systems**
-> gives further details



Replacing conservative excavation guides with IEC standards

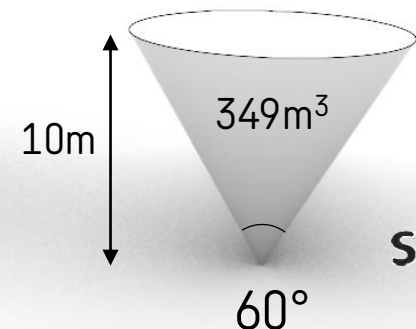
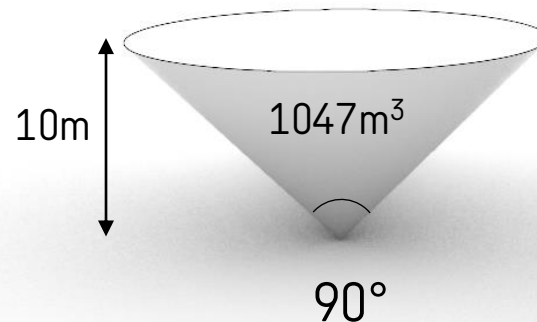
- Eurocode and SFS-IEC 61400-6 requires to check for example that:
 - **The lock-off load is smaller than the cone weight**
 - **The anchors do not yield or break**
 - **The grouting length is sufficient**
 - **The zero-cap condition is fulfilled**





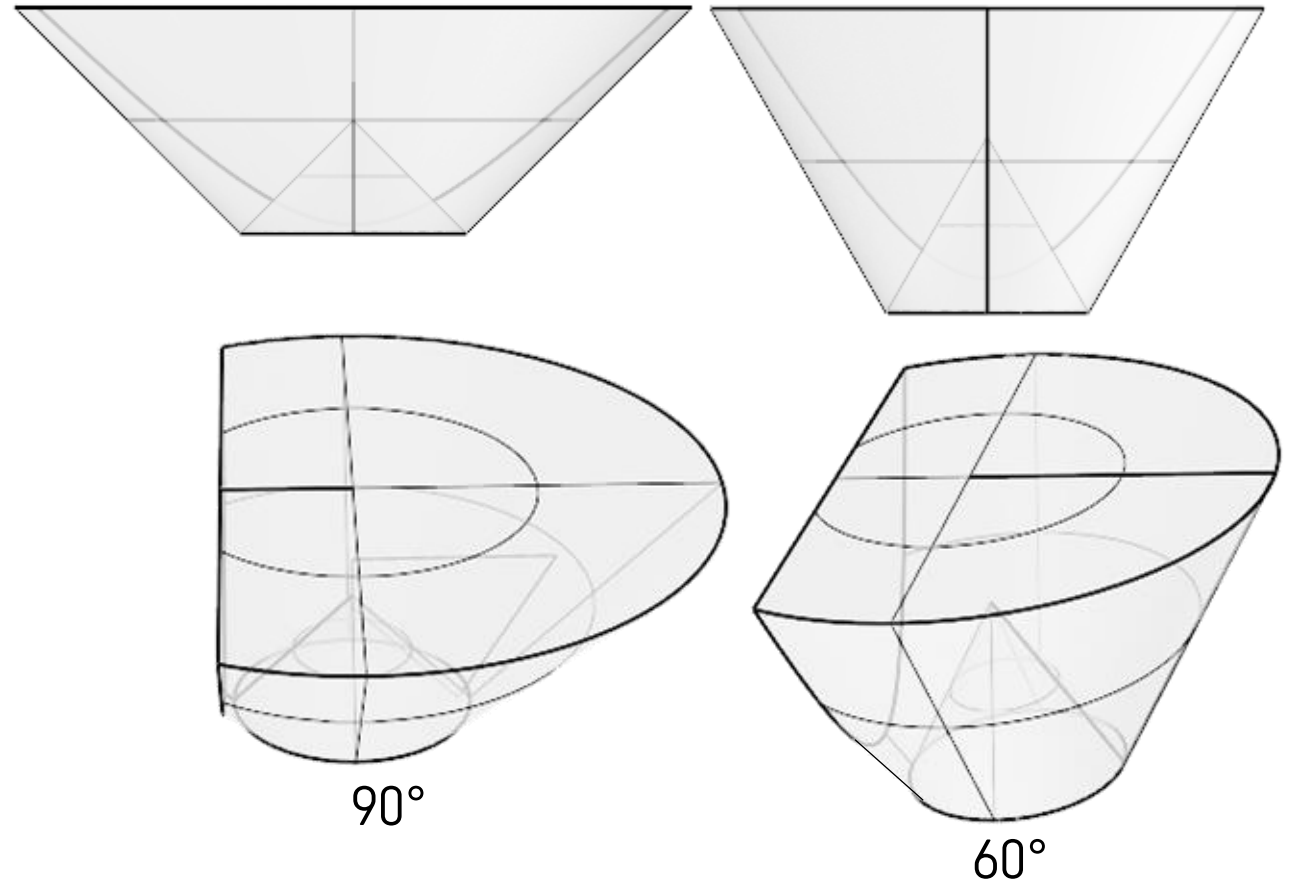
Rock mass determines the cone

- Rock mass quality should govern the selection of the inverted-cone base angle.
- For good-quality rock, a 90° angle may be used, for example in accordance with *Geotechnical Design – NCCI 7*, where:
 - GSI (Geological Strength Index): $\geq 50-60$
 - Q' -value: ≥ 4
- 90° cone has three times the volume of 60° cone



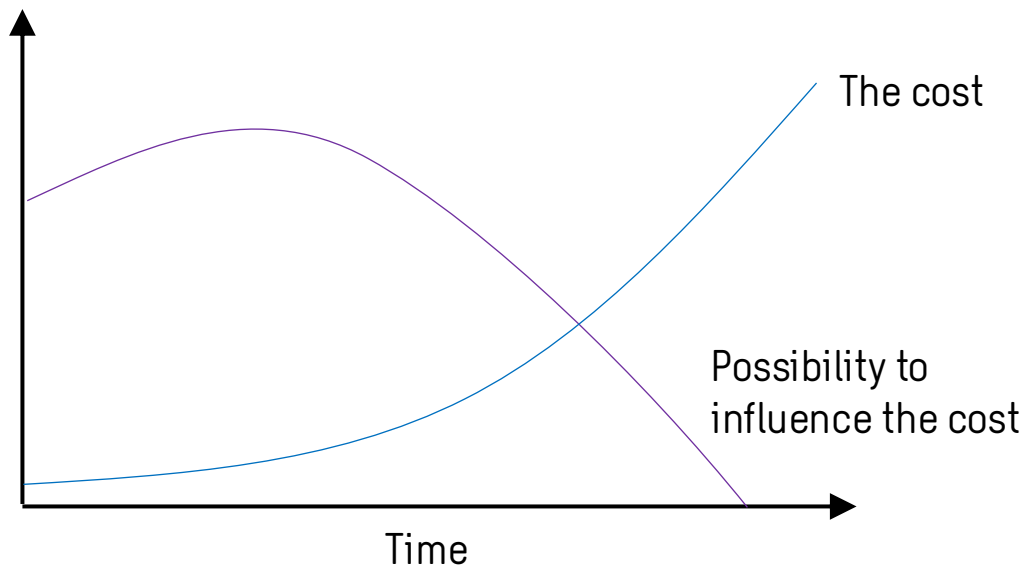
Cost savings per foundation by utilizing rock quality

- Lets consider a 22 anchor rock mill foundation
 - 15 m 60° cone is ca. 3 500 m³
 - 11 m 90° cone is ca. 3 500 m³
- A reduction of anchor length by 4 m can save ca. 24 000 € per foundation (only by taking in account the rock quality)



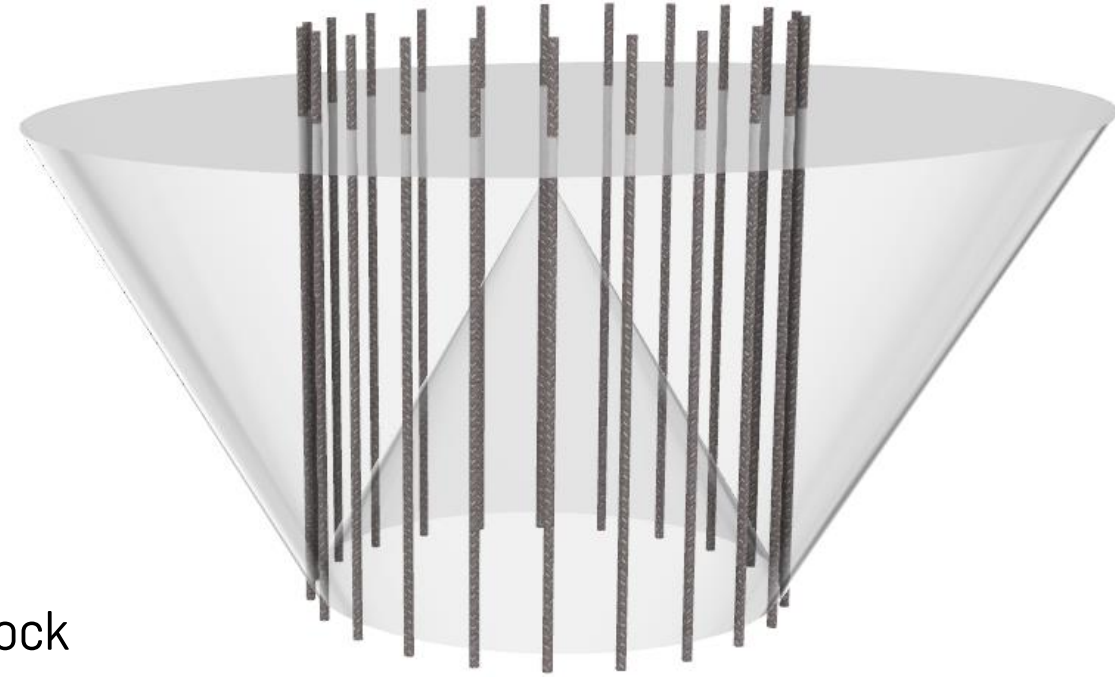
Savings start from the beginning

- Experienced geologists can place the foundations in locations with bedrock near surface and better quality rock (micrositing)
- This would require involving geology experts already at the beginning of the project



Conclusions

- Rock anchored foundations are feasible when:
 - Rock found near surface
 - Rock quality is at least decent
- Thorough bedrock investigations and sound engineering assessment are essential. Allocating more resources to bedrock investigations, together with the use of IEC, can help reduce overall costs.

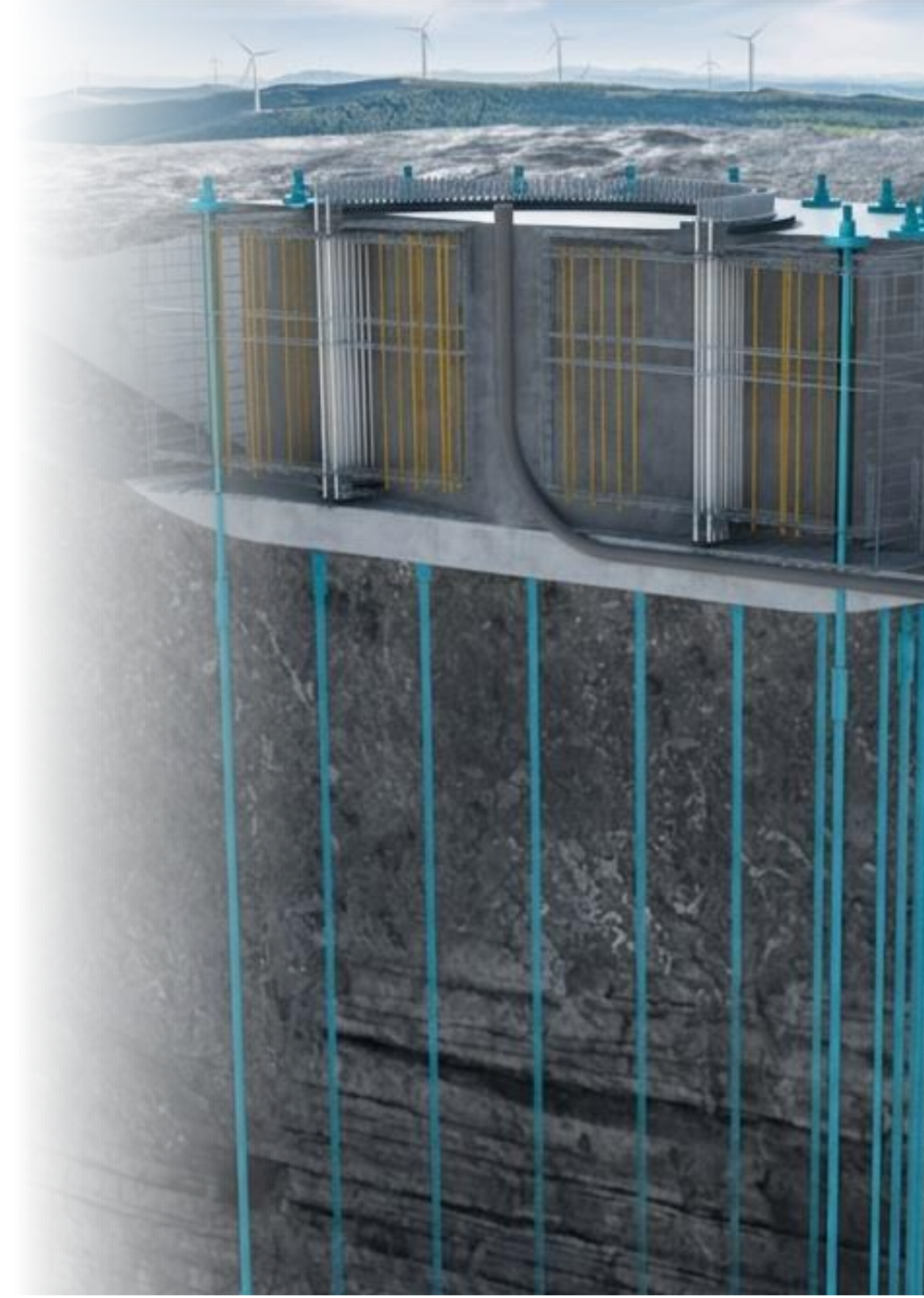


Conclusions

- Finally start using IEC and utilize the full cone height
- Take in account the real potential of good quality rock mass and utilize shorter anchor lengths



State-of-the-art approach for cost-effective Rock-Anchored Foundation Design



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