

Wind Turbine Foundation – Durable buildings are needed

*- Foundation Damage -*

8.2 Ingenieurgesellschaft Timo Poetschke – Münster mbH

- Germany -

Dipl.Ing.(FH) Timo Poetschke

Expert for Foundations of Wind Turbines and Static Structures  
for Renewable Energies

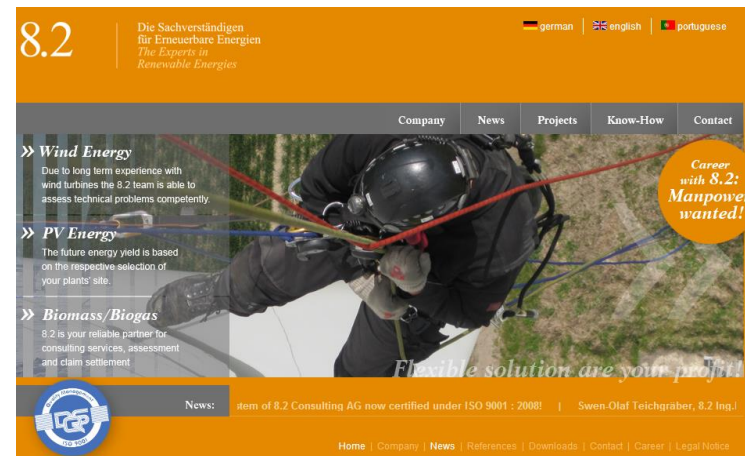
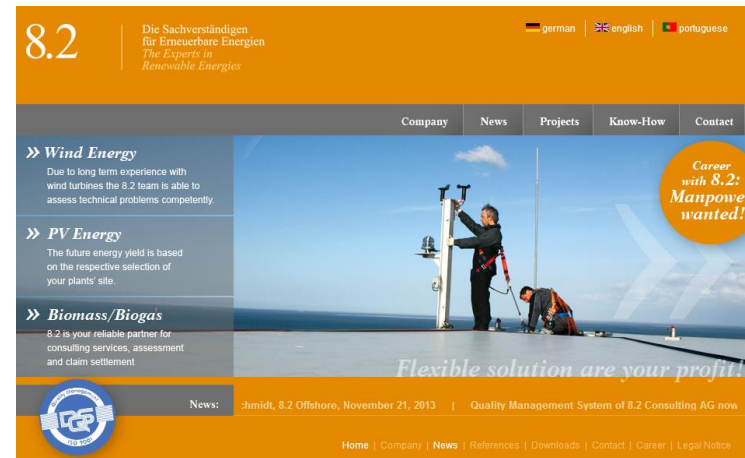
## 8.2 The Experts in Renewable Energies – Introduction

Was founded in 1995 with the 1<sup>st</sup> office in Süderdeich, Germany by Manfred Lührs

### Fields of work

#### » Wind Energy

In January 1997 Manfred Lührs was the 1<sup>st</sup> engineer, publicly appointed and authorised as expert for wind turbines in Germany.

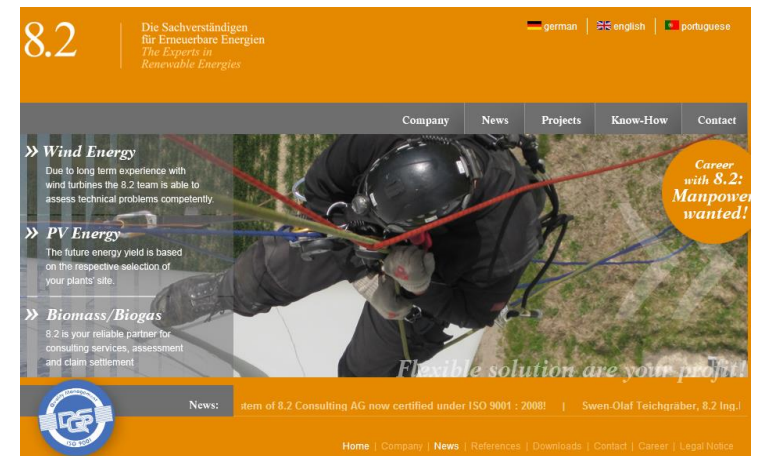
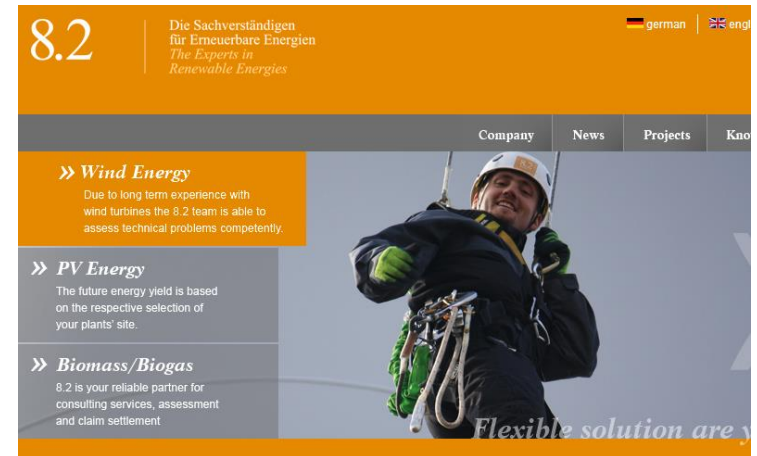


## 8.2 The Experts in Renewable Energies – Introduction

Currently 8.2 has 24 offices in Germany, Austria, France, Portugal, Taiwan.

### Fields of work

- » Wind Energy
- » PV Energy
- » Biomass/ Biogas

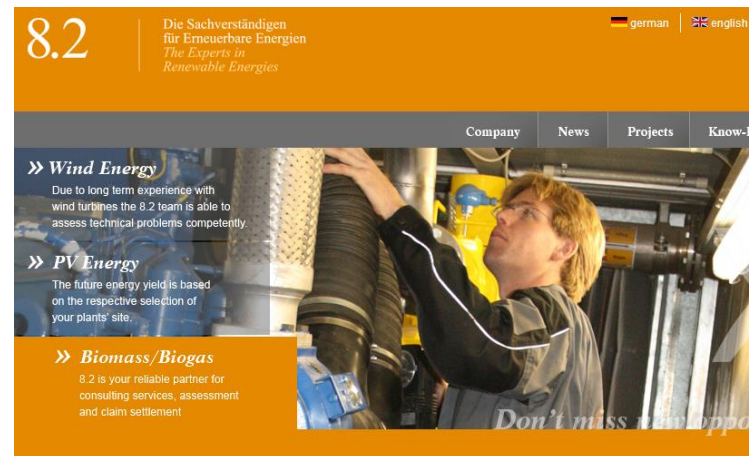
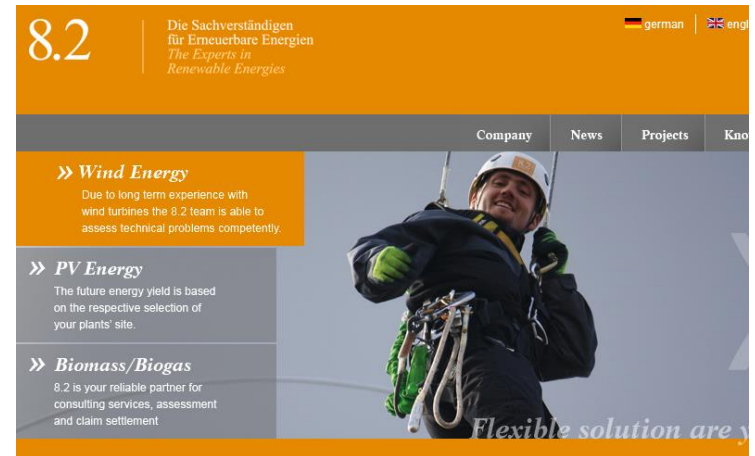


## 8.2 The Experts in Renewable Energies – Introduction

### 8.2 Consulting AG – Divisions

- » 8.2 Offshore
- » 8.2 Grid integration
- » 8.2 International Projects & Institutional Investors
- » 8.2 Academy

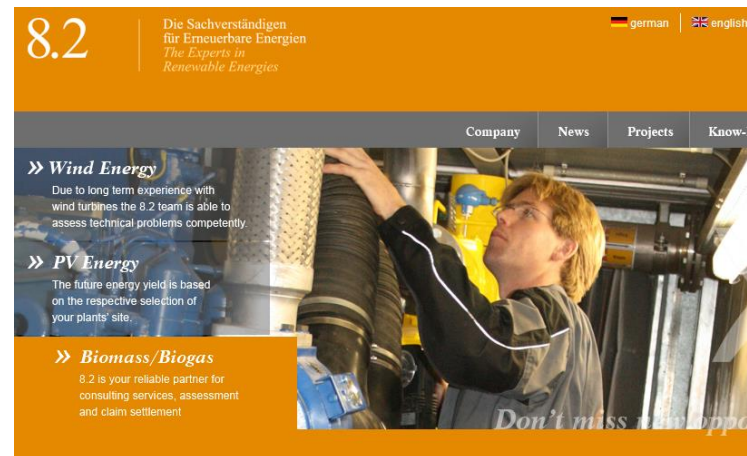
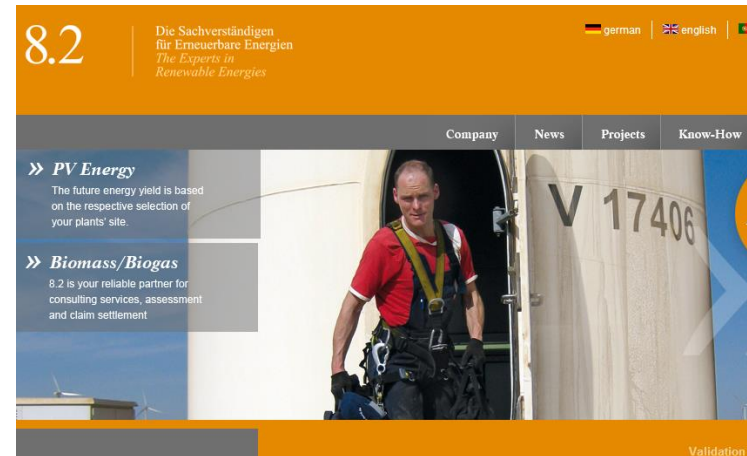
24 Independent engineering offices



## 8.2 The Experts in Renewable Energies – Introduction

Long Experience in:

- » Consulting
- » Technical Due Diligence (TDD)
- » Technical Inspections
- » Online Condition Monitoring
- » Video Endoscopy
- » Thermography
- » Construction supervision





## 8.2 The Experts in Renewable Energies – Introduction

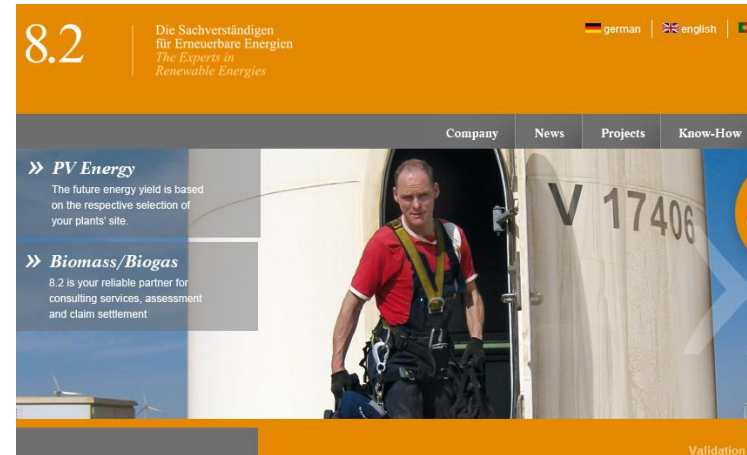
### Wind turbine foundations

Timo Poetschke - Expert

- » 44 years old, Münster - Germany
- » Civil Engineer, Business Administration, Quality management supervisor (QMB)

### Experience in Wind Energy

- » 6 years Manager Civil Engineering - Enron Wind/ GE Wind Energy
- » 2.5 years Technical Manager - Repair company Solido Bautenschutz
- » 4 years Manager - 8.2 Office Münster

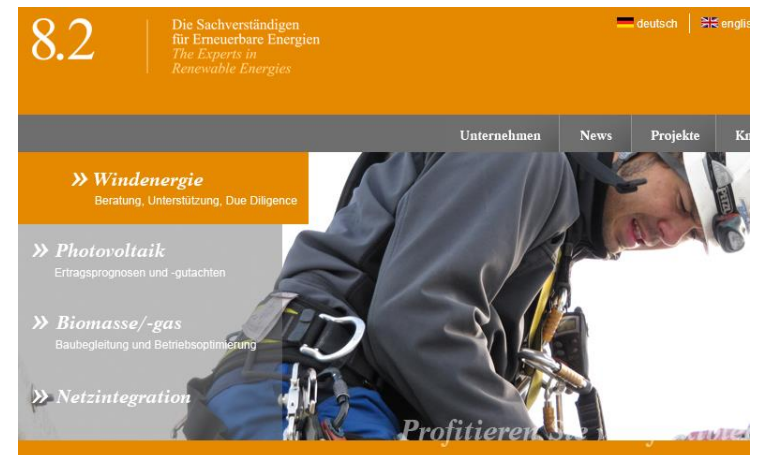
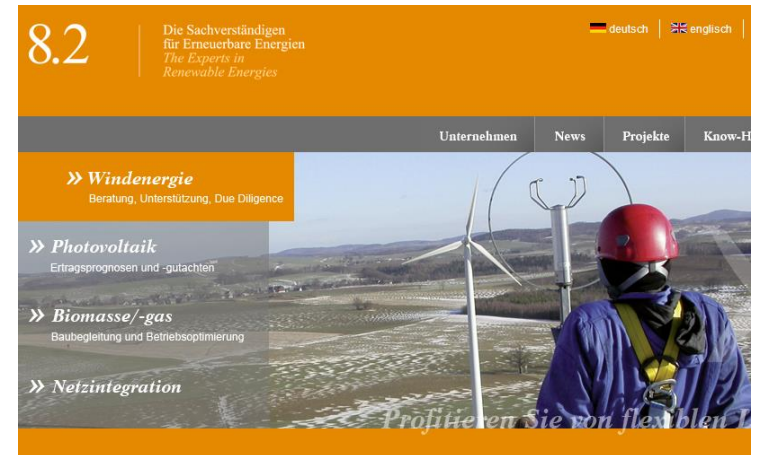


## 8.2 The Experts in Renewable Energies – Introduction

### Subjects – Wind turbine foundations

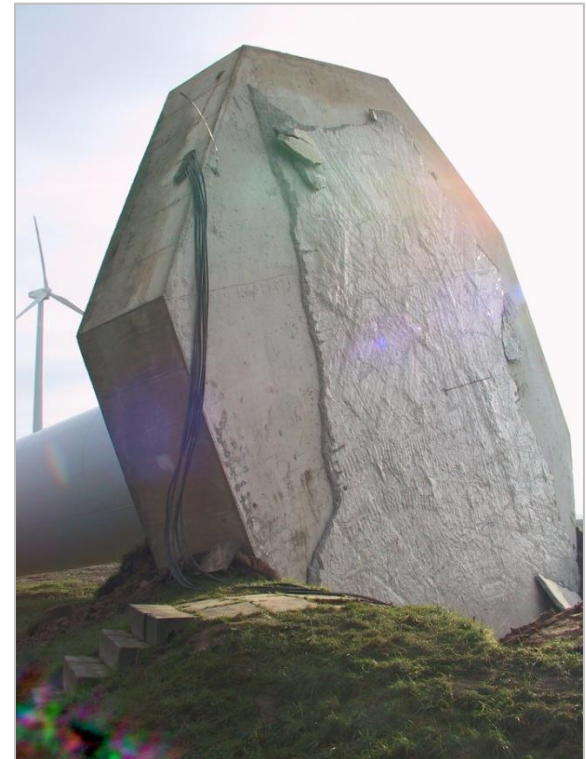
8.2 Ingenieurgesellschaft Timo Poetschke-Münster mbH

- » Construction supervision
- » Technical Inspections
- » Appraisal of foundation damage
- » TDD - foundation part
- » Construction controlling
- » Analysis of measurements related to vertical movement of towers



# Wind turbine foundations

Damage has to be avoided:

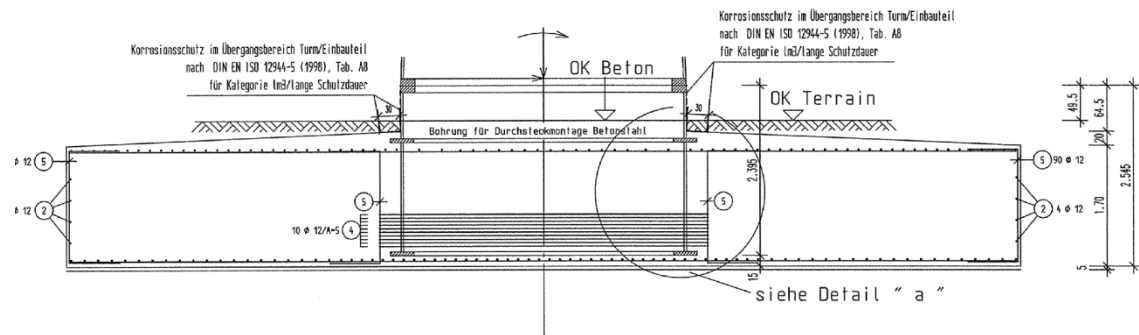




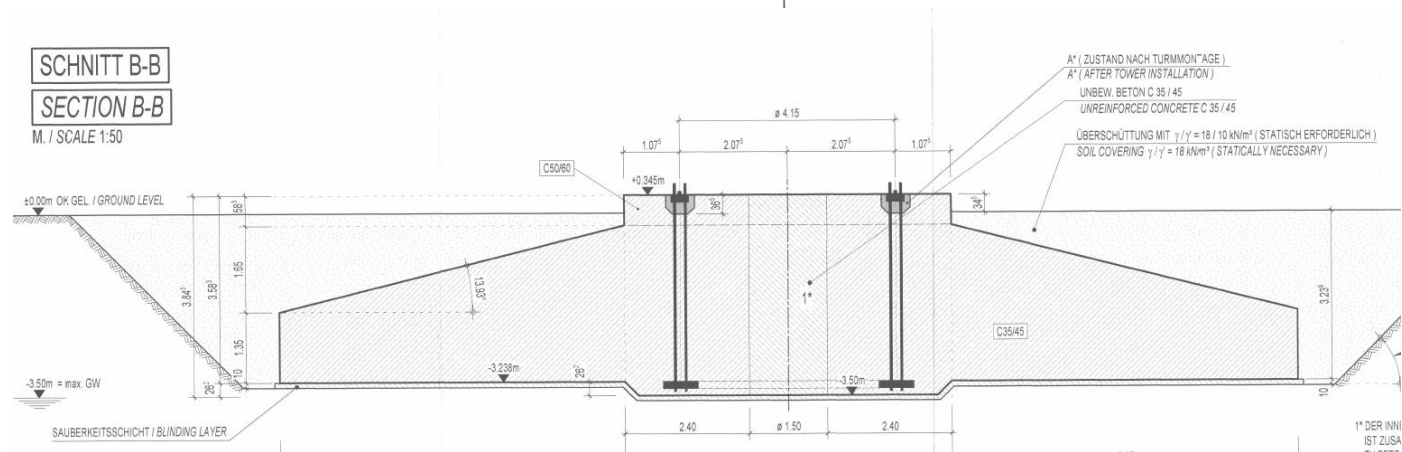
# Wind turbine foundation

## The most used types of tower interface...

» Foundation section Schnitt



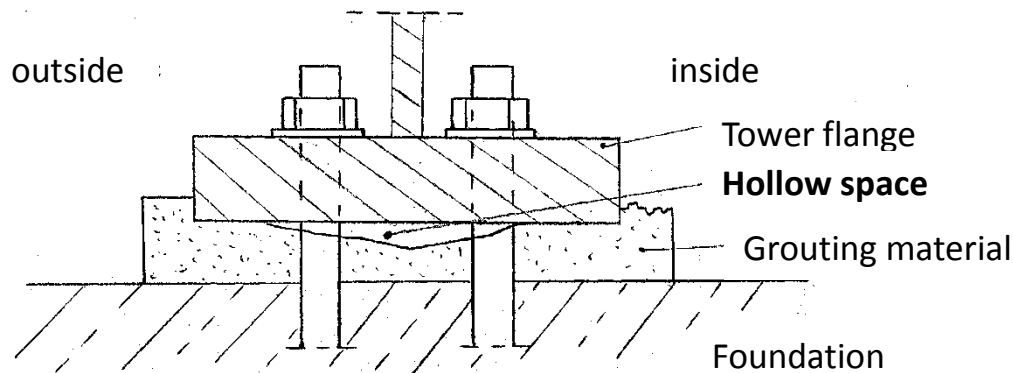
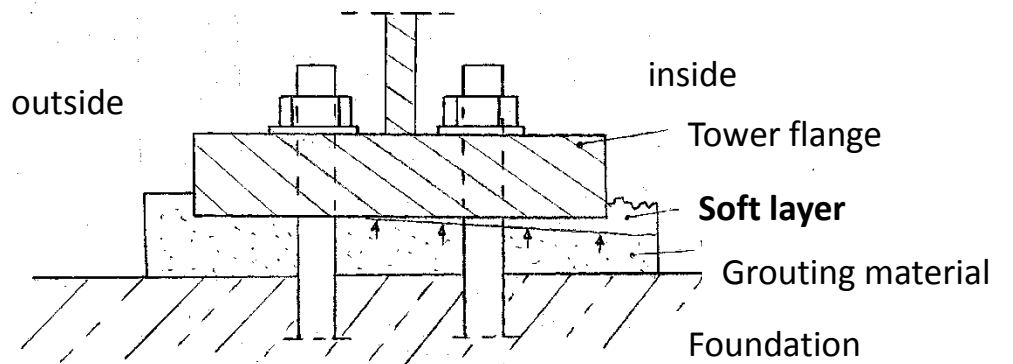
» Anchor cage



# Anchor cage

## Grouting joints

### » Reduced load transfer surface



# Anchor cage

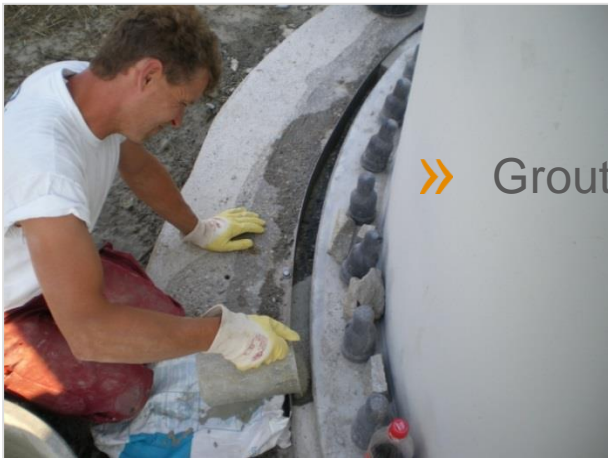
## Remedial action:



» Cut out old grouting joint



» Decoupling anchor bolts



» Grouting

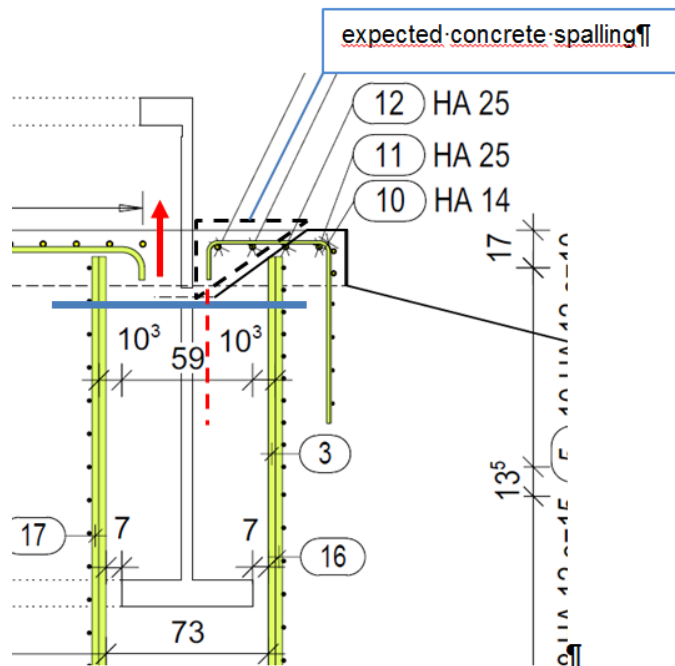


» Finished work

# Foundation section - Decoupling

## Decoupling needed

### » Elastic elongation of steel





# Foundation section - Decoupling

## Remedial action:

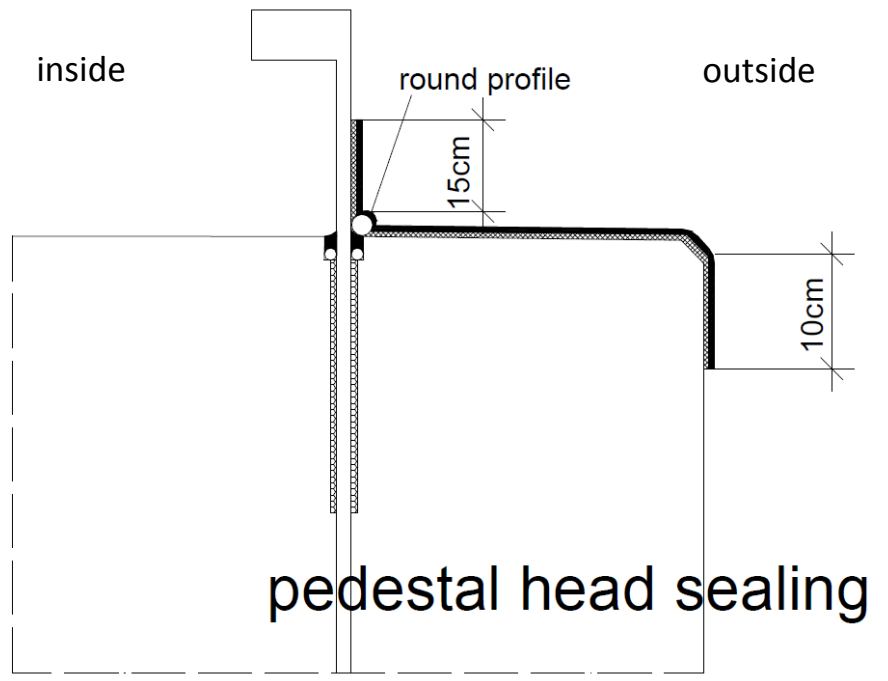




# Foundation section - Waterproofing

## Waterproofing the gap between concrete and tower

» Use a belt as well as additional suspenders!



# Foundation section - Waterproofing

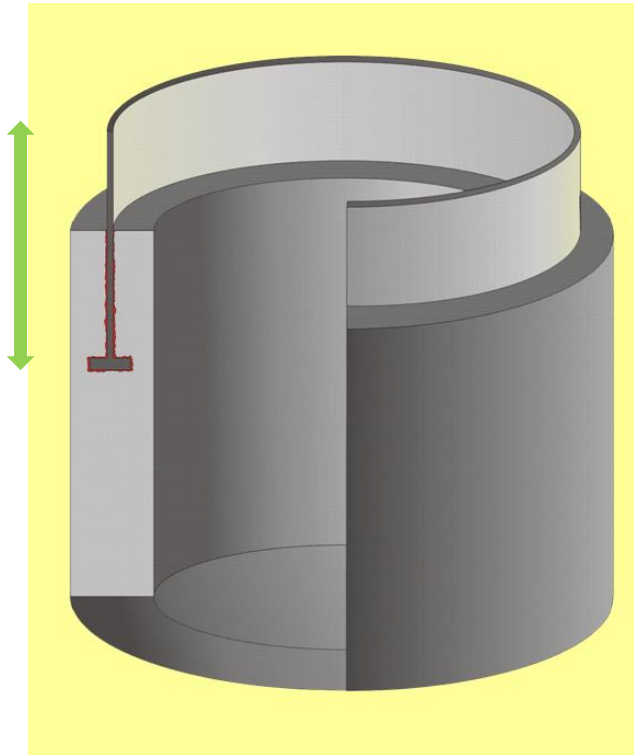
## Remedial action: belt + suspenders



# Foundation section - unfixed

## Loose tower fixation

» Water destroys the tower fixation

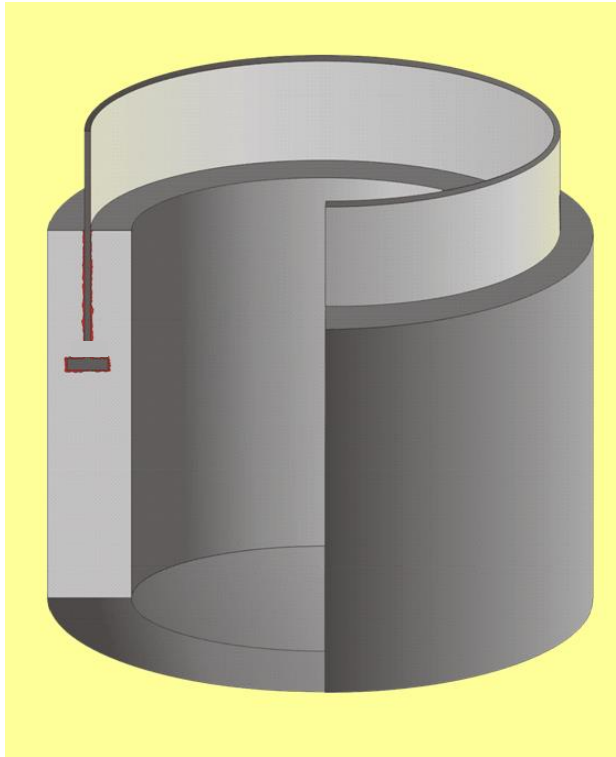


Analysis by  
measurement of  
vertical tower  
movement.

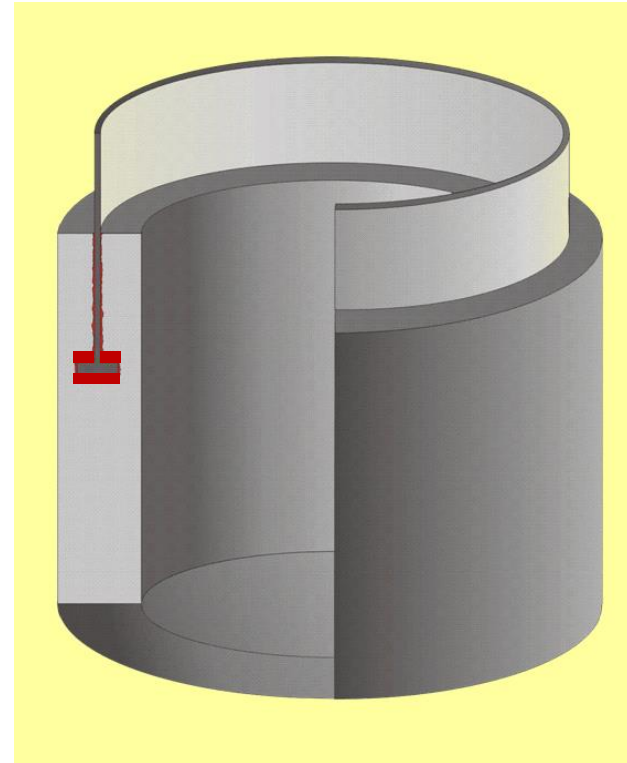


# Foundation section - unfixed

Causes for moving are:



» Broken weld seam or steel plate

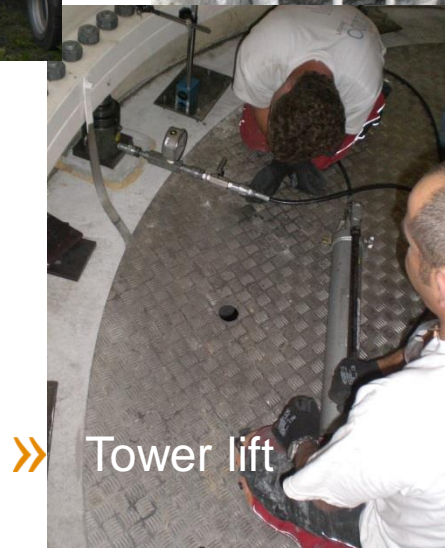
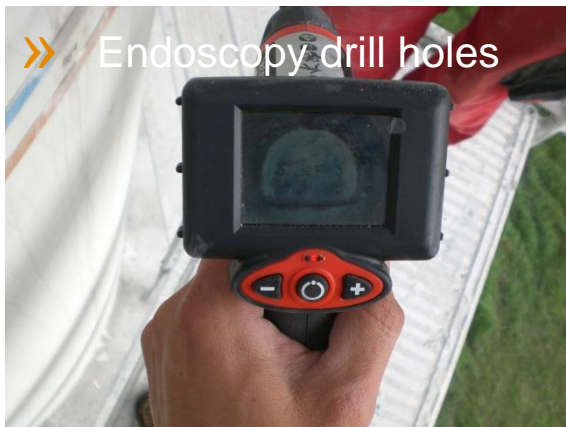
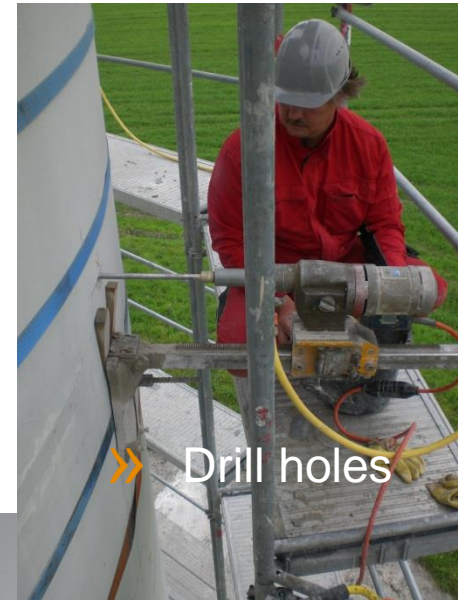


» Gap in form closed fixation



# Foundation section - refixation

## Remedial action:





# Reinforced concrete

## Cracks in foundation pedestal

» Work-sharing between concrete and reinforcement

Concrete = compressive force

Reinforcement = tractive force

Cracks in concrete show  
activated reinforcement

Water entrance will become a problem with  
durability for the building!



# Reinforced concrete

## Remedial action:



# Repair work reduces profit

- » All Wind turbine manufacturers are affected by foundation damage. Repair work is **possible** but complicated and expensive.
- » With proper design future structural damage can be avoided.
- » Construction supervision in the building process reduces the possibility of future construction damage.
- » *For Wind turbine owners it is recommended to **invest in both**.*

- » In Germany all Wind turbine manufacturers changed from foundation section to anchor cage (eno, REpower excluded).  
Anchor cage design is less susceptible to damage. It is recommended to have a construction supervision by an expert for grouting work.
- » In Europe the foundation-section-design is often used. Some constructive detail solutions are necessary to make this design durable. It is recommended to have a construction supervision by an expert for the construction work.
- » The least affected constructions are concrete towers and hybrid towers with external pre-stressing. They are quite expensive. It is recommended to involve experts for grouting joints, pre-stressing and repair work.

» If you need help with foundation damage, please feel free to contact me.

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