Where do we come from and where are we going
in 15 minutes

Robert Hack
ITC

30 November 2007

Long, long ago when I started in Leiden…

Average study time geology: 9 ½ years

(not me obviously)

In MSc:

3 years fieldwork of 4 to 12 weeks

Every year multiple excursions of 1 to 3 weeks

(Fieldwork and excursions were part of the study curriculum)

Little less long ago when I started in Delft as student…

Average study time: 7-8 years

(not me obviously)

In MSc:

One fieldwork of 4 weeks

May be an excursion of 1 - 2 weeks

May be fieldwork in thesis research work (limited to a couple of weeks)

More Little less long ago when I started in ITC as staff member…

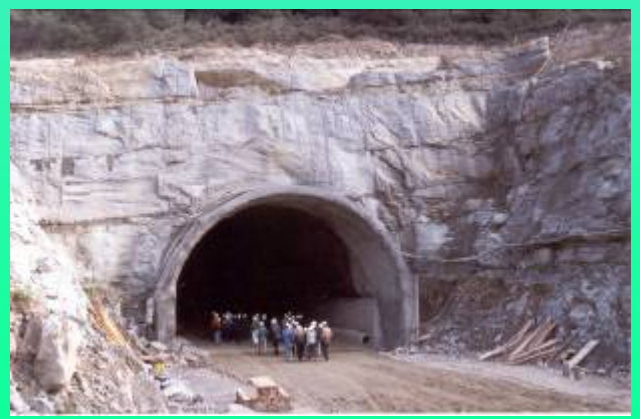
Average study time: 7 years

In MSc:

One (instruction) fieldwork of 4 weeks

May be an excursion of 1 to 2 weeks

May be fieldwork in thesis research work (limited to a couple of weeks)



Now…

Average study time: 5 - 6 years

Excursion to Canelles

Photo Brinkman

In MSc:

One fieldwork of 1-3 weeks

May be fieldwork in thesis research work (limited to a couple of days or weeks)

Fieldwork

The fieldwork was of imminent importance:

Geology

and

Engineering fieldwork

Only in fieldwork with sound supervision a proper exposure to real situations is achieved

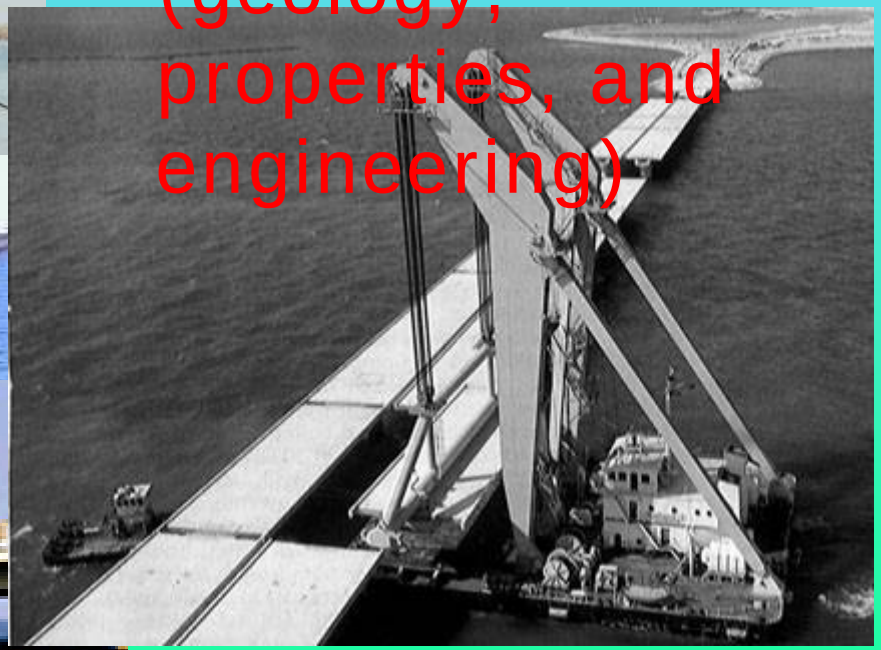
Career: Boskalis - Nacap

Topsoil over rock

(geology and properties)

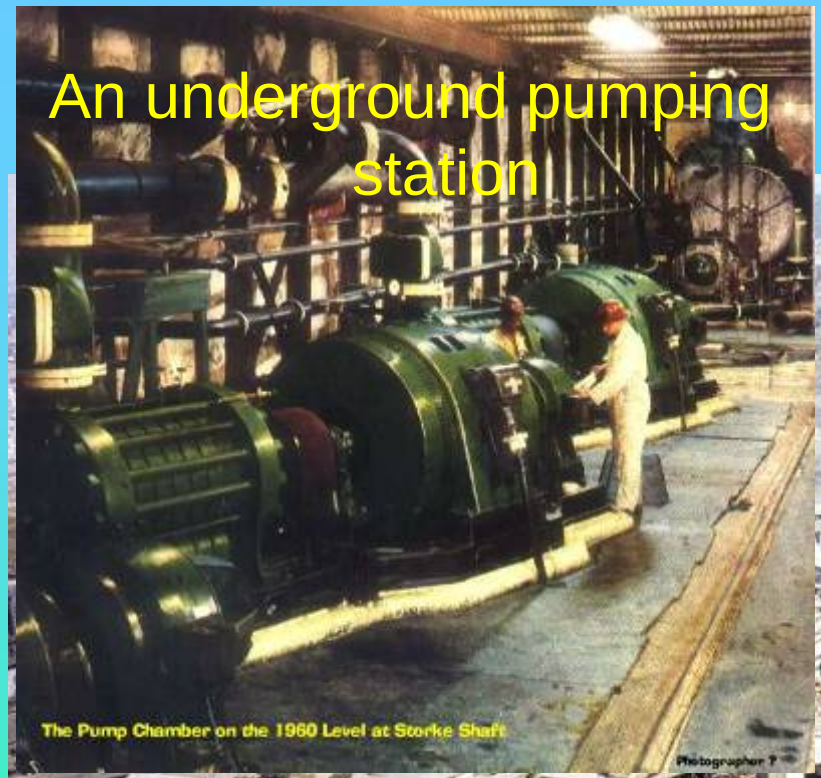
Career: Ballast Nedam

Off/onshore pile foundations in soil and rock (geology, properties, and engineering)



Bahrain-Saudi Causeway

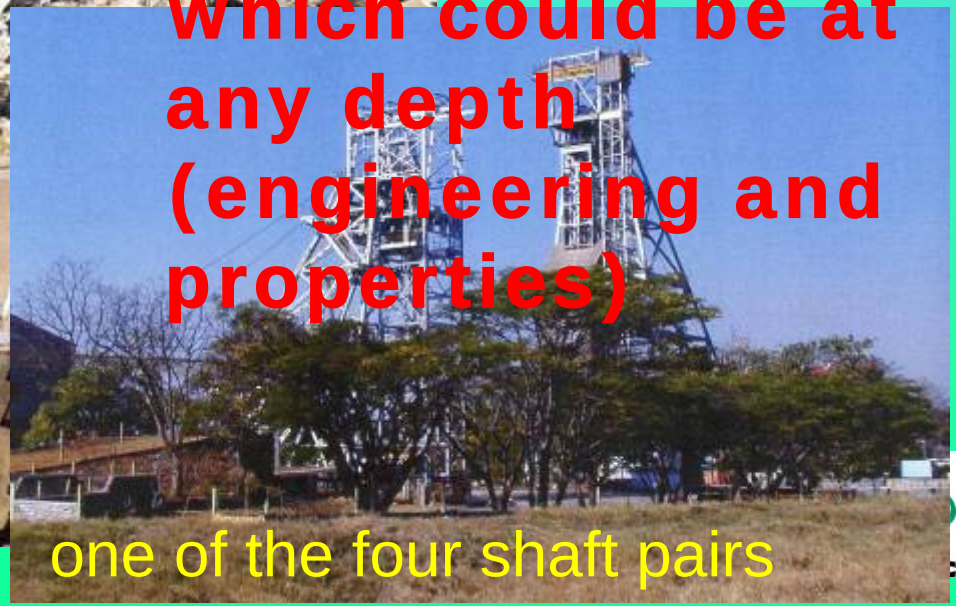
Career: ZCCM



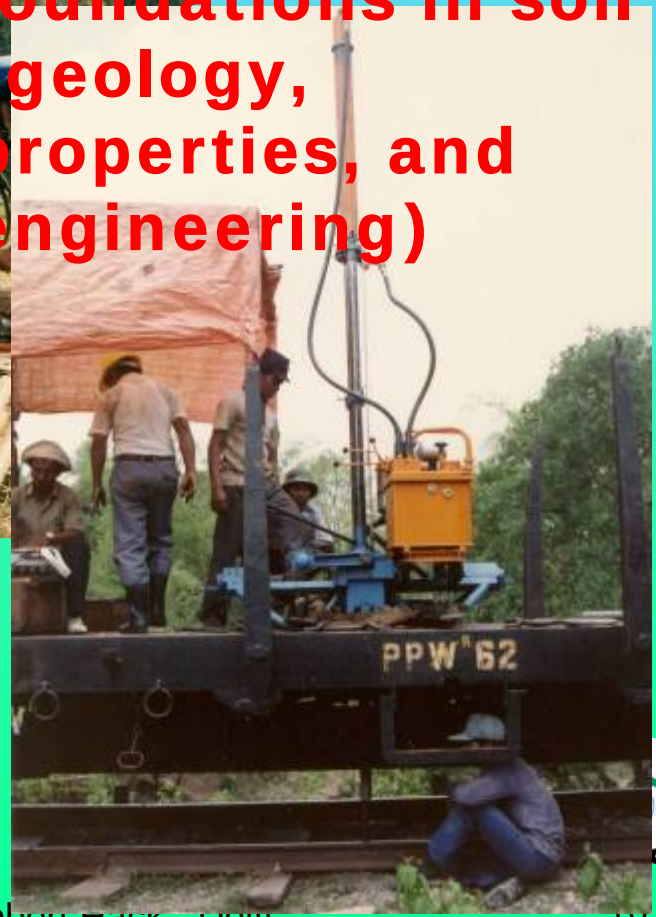
An underground pumping station

Mining in hard rock to 3000 m depth; but most problems when weathered to soil, which could be at any depth (engineering and properties)


Aerial view offices, concentrators and smelters; mine itself is outside picture


one of the four shaft pairs

Career: Grabowski & Poort



600 Railway bridge foundations in soil (geology, properties, and engineering)

Research in the Netherlands (over last 20 years):

Too many subjects to be complete, but main ones:

- Excavation: dregability, excavatability, etc.
- Mass characterization (tunnelling, slope stability, clay properties, shear strength, weathering)
- Uncertainty
- Geo-informatics (modelling, identification)
- Numerical modelling (earthquake response, seismic waves and discontinuous)
- Remote sensing (terrestrial/aerial photos, Lidar)

Present research in NL:

- Excavation: Dregability, excavatability, etc
- **Smart soils/In-situ ground improvement**
- Dyke stability/remote sensing
- Uncertainty
- Geo-information
- Clay and peat properties
- Bio-geomorphology – Building with Nature

Present research in the Netherlands:

Not all that much different from the past….

uncertainty:

Reducing uncertainty (risk) by better, more intelligent investigations or better tools:

– is immediately compensated by reducing ground investigation (cheaper)

Net effect: none

Seemingly the **unknown** risk is

deemed acceptable !!!!!!!!!!!!

uncertainty (2):

Quantifying uncertainty (risk) could possibly show the risks taken for various options

and

The (often dramatic) increase in risk if ground investigation is reduced

uncertainty (3):

Under the assumption that no stupid risks are taken

Stupid risks

What are stupid risks: (risks created by plain stupidity)

Data issue:

-Use of data of unknown quality

-Data lost

-Not knowing for what and where the data was collected

Engineering quality:

-Unqualified engineers

-Improperly educated engineers

-Engineers lacking experience

Stupid risks – data issue

Stupid risks due to data issues can easily be avoided if:

- More use was made of geo-information (to avoid losing the data)
- Data history (e.g. the why and what of data) is included with the data
- The quality of the data is quantified

Stupid risks - Engineering quality

Anglo-Saxon world (UK, USA, RSA, HK, etc.) :

Professional qualification

Only issued if:

Properly educated **and** with a minimum experience (7 to 10 years) under qualified supervisors

In the Netherlands:

No professional qualification at all

Anybody can call him/herself an engineering geologist……

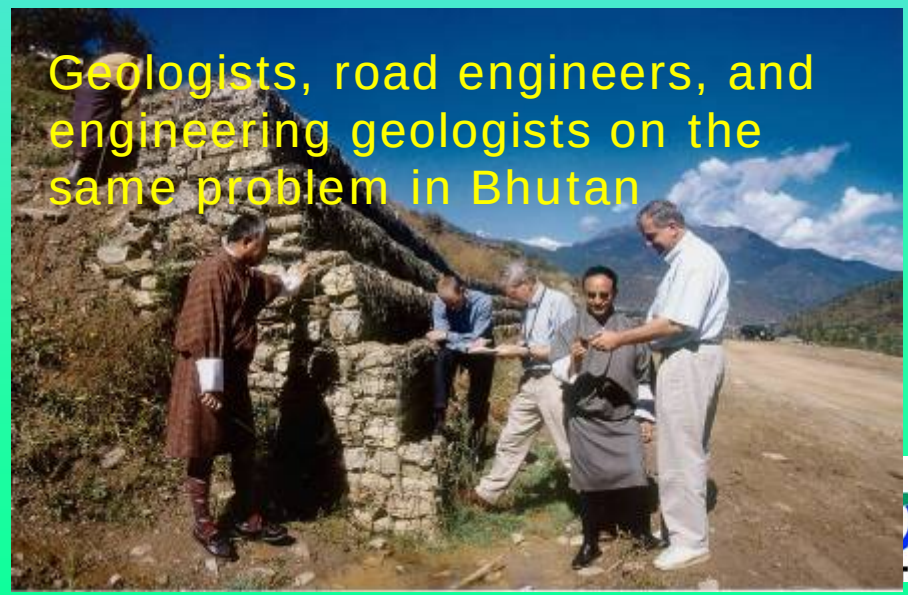
Is there is difference between geologists and engineers

Not necessarily, but

Many geologist (and engineering geologists) do not take the effort to understand or get involved in engineering (they stop at the moment that they have produced a list of boundaries and properties)

Why:

They lack enough experience to be comfortable with the engineering questions and, hence, avoid them.



Conclusions (1):

In the past:

More extensive education with extensive fieldwork which was properly supervised;

Now:

Very little

If this continues engineering quality will reduce (and it cannot be compensated for by uncertainty qualifiers)

Conclusions (2):

- Proper fieldwork should be re-introduced or extended in education
- Professional qualification also for the Netherlands
- Research topics unlikely to change dramatically, however,….

Future

Building by nature (not really new, but obviously very useful)

Smart soils and rocks (new and promising)

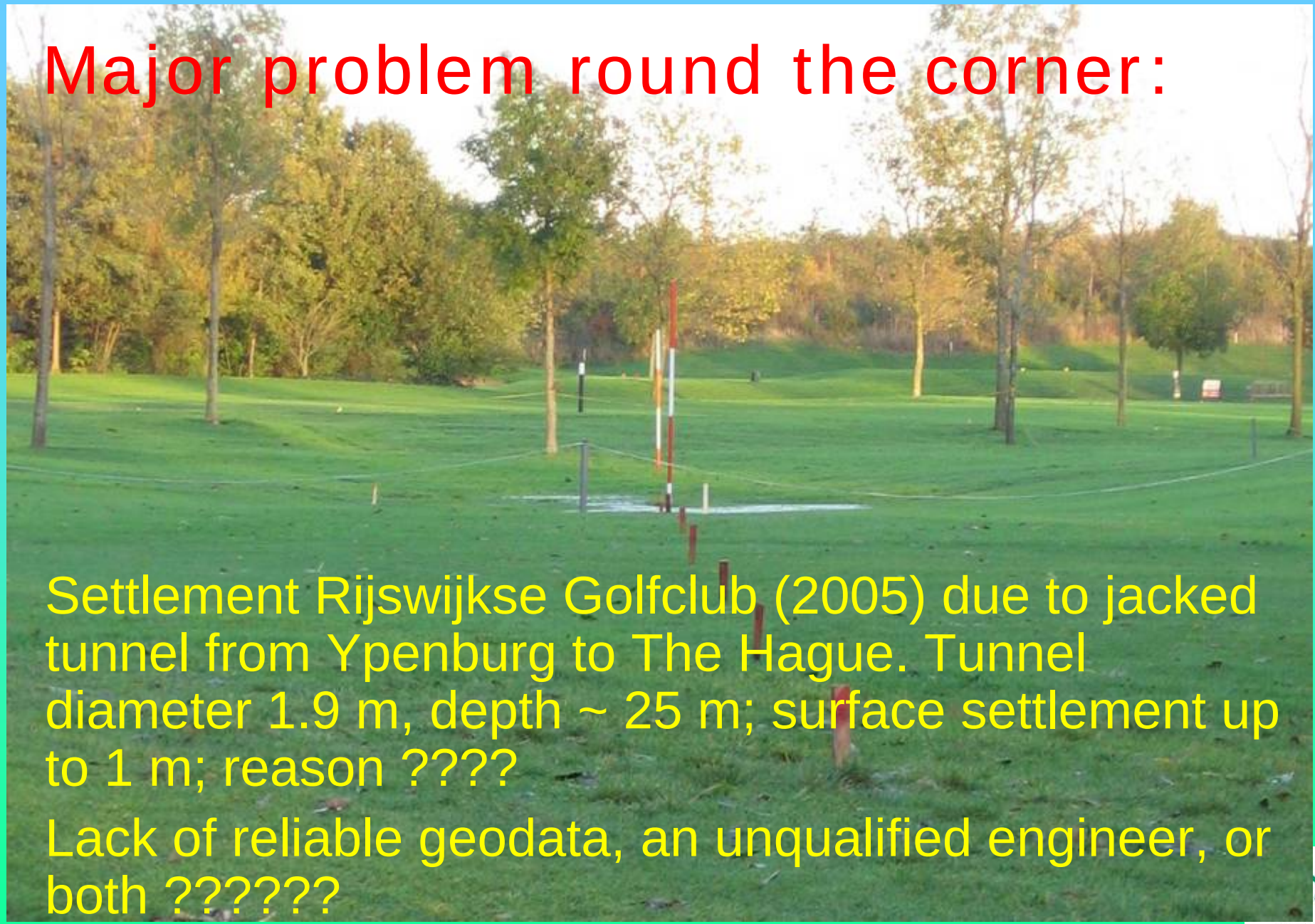
Uncertainty – risk issue - will continue (probably) forever

Future or science fiction?:

Underground excavation by high-intensity lasers or nuclear tunnelling

Underground excavation by animals eating soil and rock

Major problem round the corner:



Settlement Rijswijkse Golfclub (2005) due to jacked tunnel from Ypenburg to The Hague. Tunnel diameter 1.9 m, depth ~ 25 m; surface settlement up to 1 m; reason ????

Lack of reliable geodata, an unqualified engineer, or both ??????