

ROSTOCK 12 TH BALTIC SEA GEOTECHNICAL CONFERENCE,
31 MAY – 2 JUNE 2012

MASS STABILISATION IN CONSTRUCTION OF SOFT SUBSOILS AND IN ENVIRONMENTAL GEOTECHNICS AT CITY OF HELSINKI



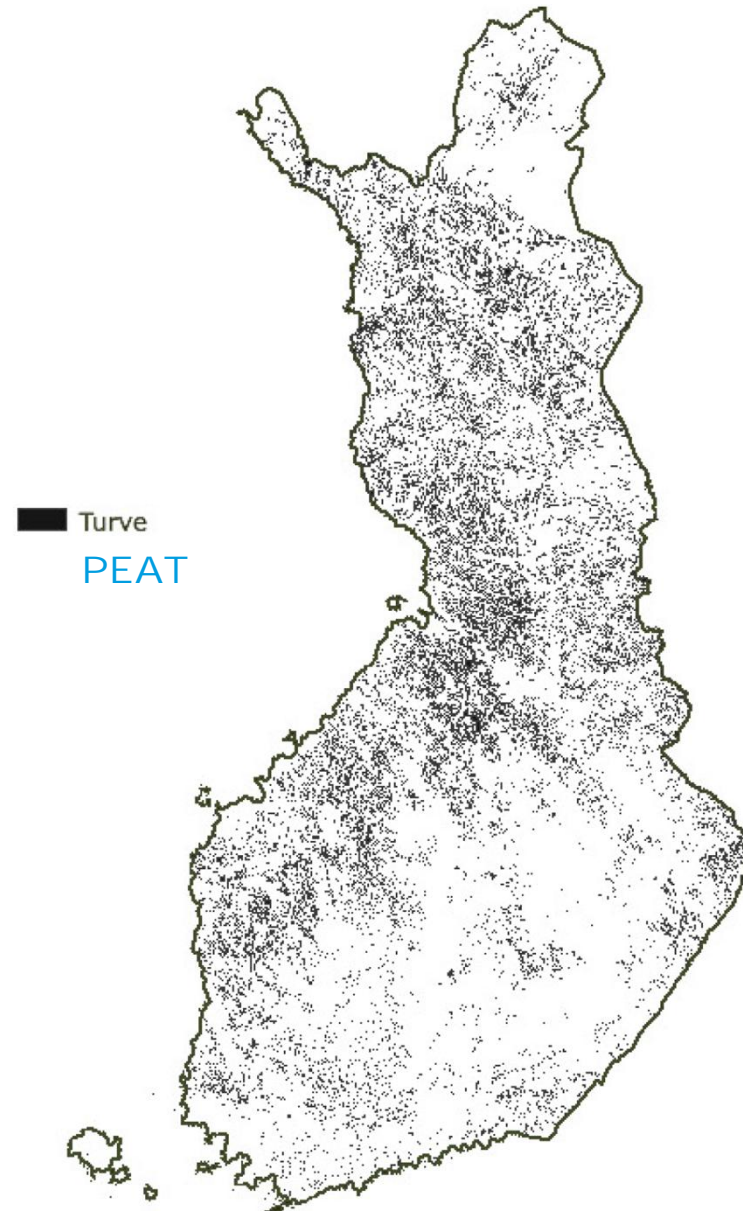
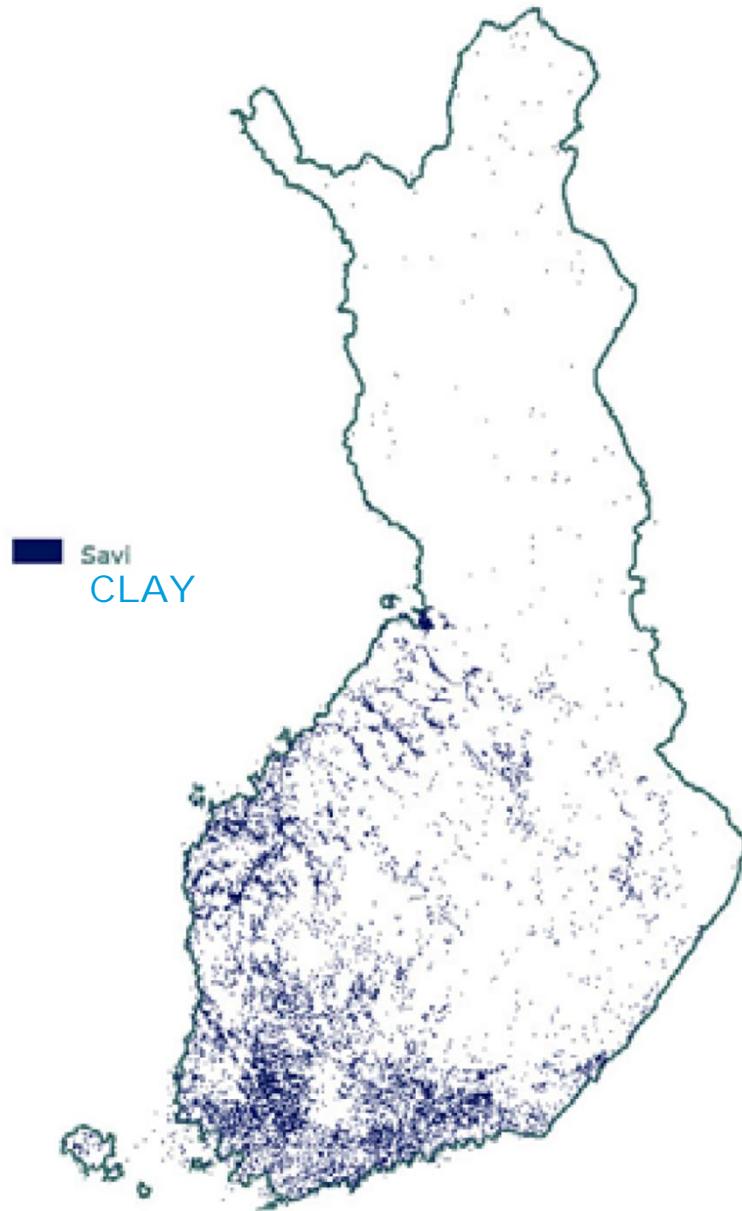
RAMBOLL

1.6.2012, ESPOO, FINLAND
JUHA FORSMAN

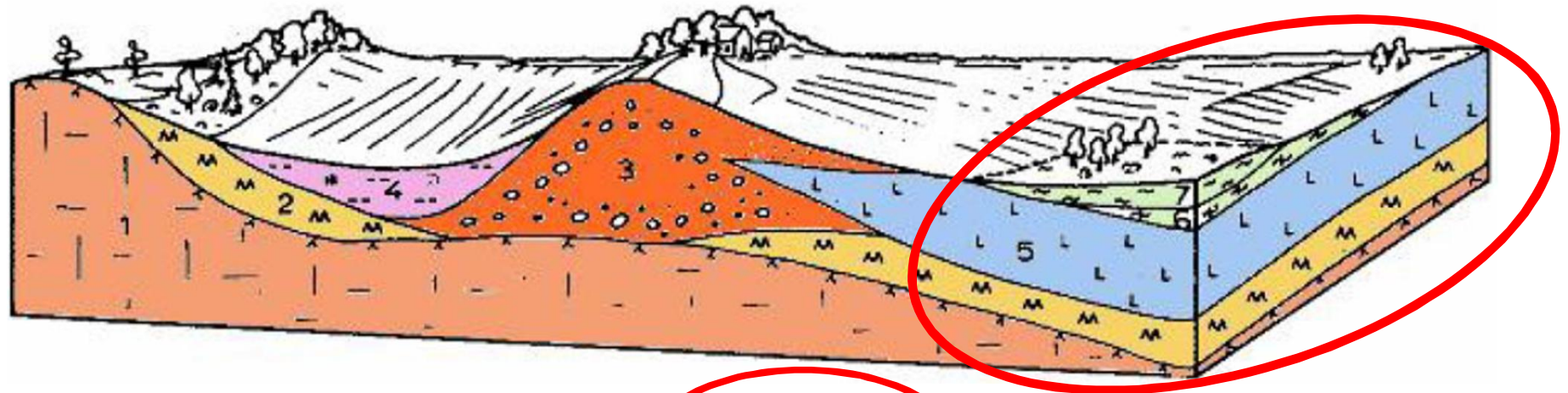
MASS STABILISATION IN CONSTRUCTION OF SOFT SUBSOILS AND IN ENVIRONMENTAL GEOTECHNICS AT CITY OF HELSINKI

1. MASS STABILISATION METHOD AND FINNISH GEOLOGIES
2. MASS STABILISATION IN THE CITY OF HELSINKI / ABSOILS PROJECT
3. CASE KIVIKKO: MASS STABILISATION AS A GROUND IMPROVEMENT METHOD
4. CASE KYLÄSAARI: LIGHTENING OLD EMBANKMENTS FLOATING ON SOFT SOIL LAYERS
5. CASE VIIKKI: SUBSTITUTING ROCK MATERIAL IN ROAD CONSTRUCTION
6. CASE VUOSAARI: ISOLATING CONTAMINATED SOIL LANDFILL
7. FUTURE SCENARIOS

1. CLAY AND PEAT AREAS IN FINLAND



1. TYPICAL FINNISH GEOLOGIES



- 1 Kallio - Rock
- 2 Moreeni - Moraine
- 3 Hiekka ja sora - Sand and gravel
- 4 Siltti - Silt

- 5 Savi - Clay
- 6 Lieju - Mud
- 7 Turve - Peat

Clay, Mud, Peat:

$w_o = 50 \dots 2000 \%$ (from dry weight)

$\tau_o = 1 \dots 25 \text{ kPa}$

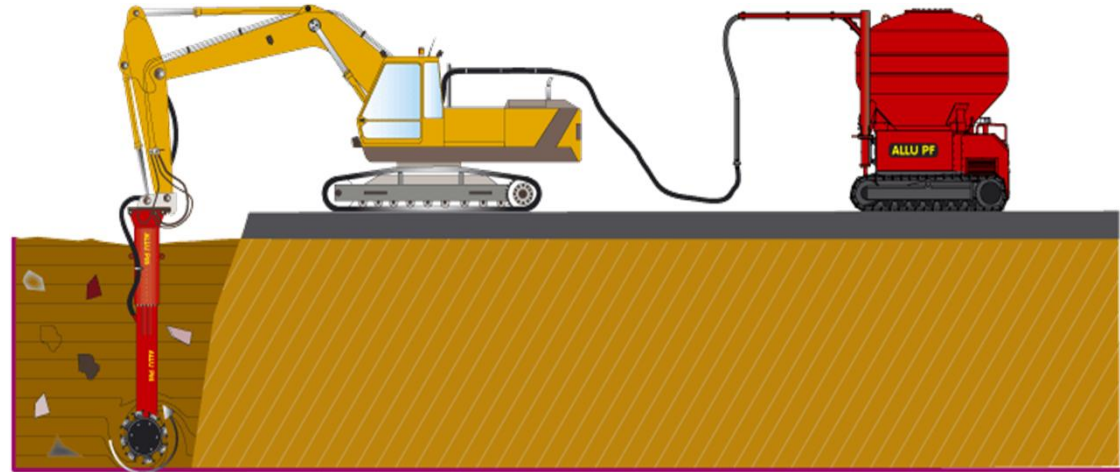
Organic content = $0 \dots 97 \%$ (from dry weight)

Bearing capacity = no capacity low

1. DEEP STABILISATION METHODS



2. MASS STABILISATION METHODS USED IN CITY OF HELSINKI



Mixing tool installed on an excavator machine and binder storage tank

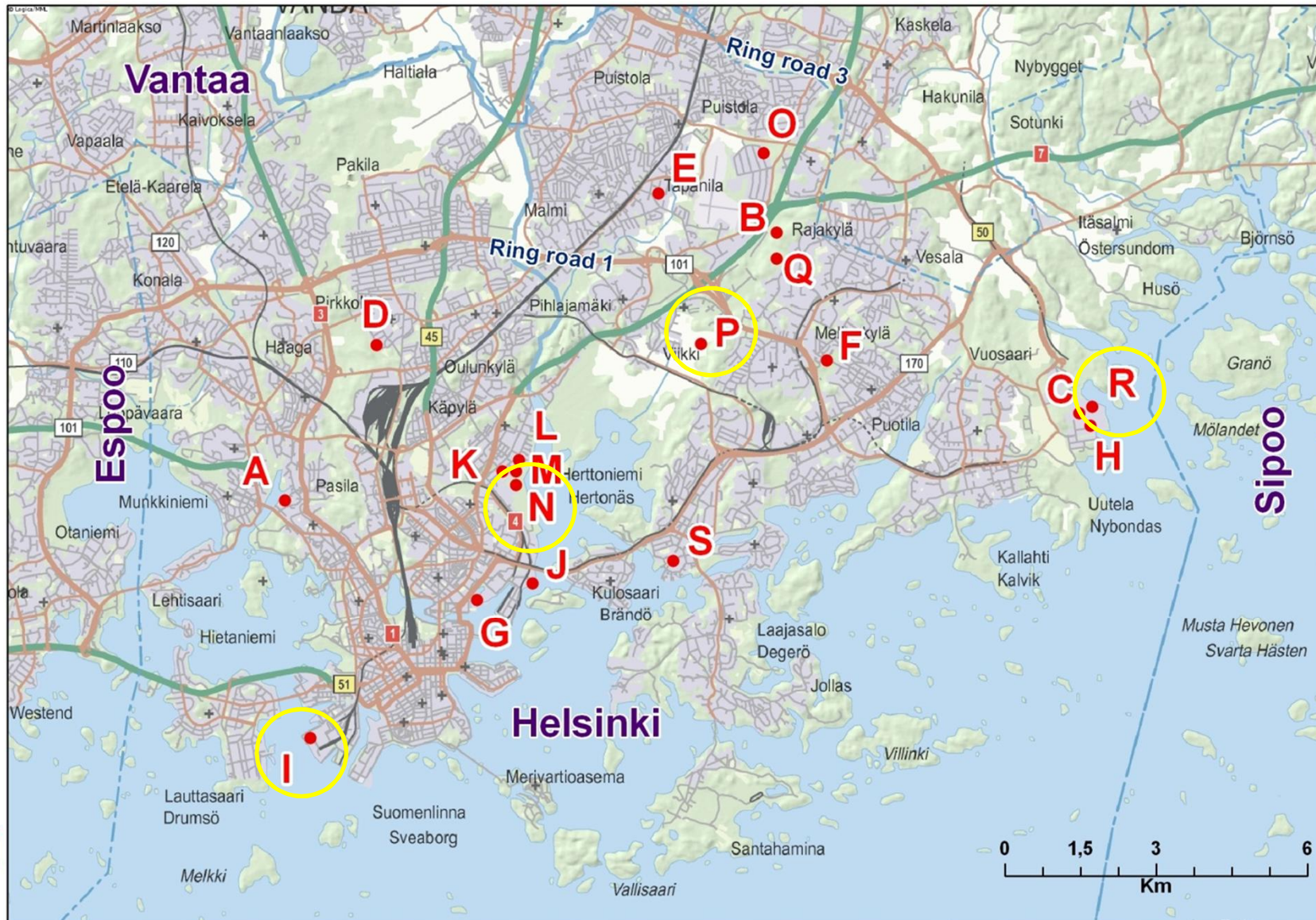


Windrow turner



Screener crusher

2. LOCATIONS OF MASS STABILISATION SITES IN CITY OF HELSINKI



2. SOME MASS STABILISATION SITES IN CITY OF HELSINKI (1991-2012)

Site	Volume m ³	Year
1. Improvement of soft clay and peat layer as a ground improvement method		
A Pikkuhuopalahti – housing area	test stab.	1993
B Kivikko - industrial area	≈ 270.000	1997-2010
C Vuosaari harbour – yard ("Rice field")	185.000	2003-2004
D Haaga, Laajasuo - sports park	78.000	2006
E Ormuspelto housing area	31.500	2008
F Mellunkylä, Virtasalmenkatu, street	50.000	2011
2. Solidification of contaminated sediments and their use as filling material		
G Sörnäinen – contaminated sediments	20.000	1998-1999
H Vuosaari harbor - TBT-contaminated sediments	500.000	2006-2007
I Jätkäsaari – contaminated sediments	20.000	2011
	80.000	2012
J Kalasatama – contaminated sediments	12.000	2011
3. Lightening old embankments floating on soft clay and mud layers		
L Toukoranta - park, KTK-embankment	69.000	2005-2006
M Toukoranta – streets and housing area, Mertakatu	35.000	2007-2008
N Kyläsaari, Arcada 2 - streets and housing area	35.000	2010-2011
4. Substituting rock material with stabilized clay in road construction		
O Tattarisuo – embankment	test stab.	1991
P Viikki - clay street	500	1997
5. Isolating landfill for contaminated soil with mass stabilized clay		
Q Kivikko – landfill for lead contaminated soils	25.000	2001
R Vuosaari, Melumäki – landfill for contaminated soil	25.000	2004-2007
6. Utilisation of mass stabilized surplus clay in earth constructions		
S Vuosaari and Herttoniemenranta – landscape creation	≈ 10.000	≈1998
=> 18 sites	=> 1,45 milj.	

1991-1999: $V = 0,1 \text{ milj.m}^3$, 2000-2012: $1,35 \text{ milj.m}^3$

EU LIFE PROJECT - LIFE09 ENV/FI/575 ABSOLIS

Project pilots:

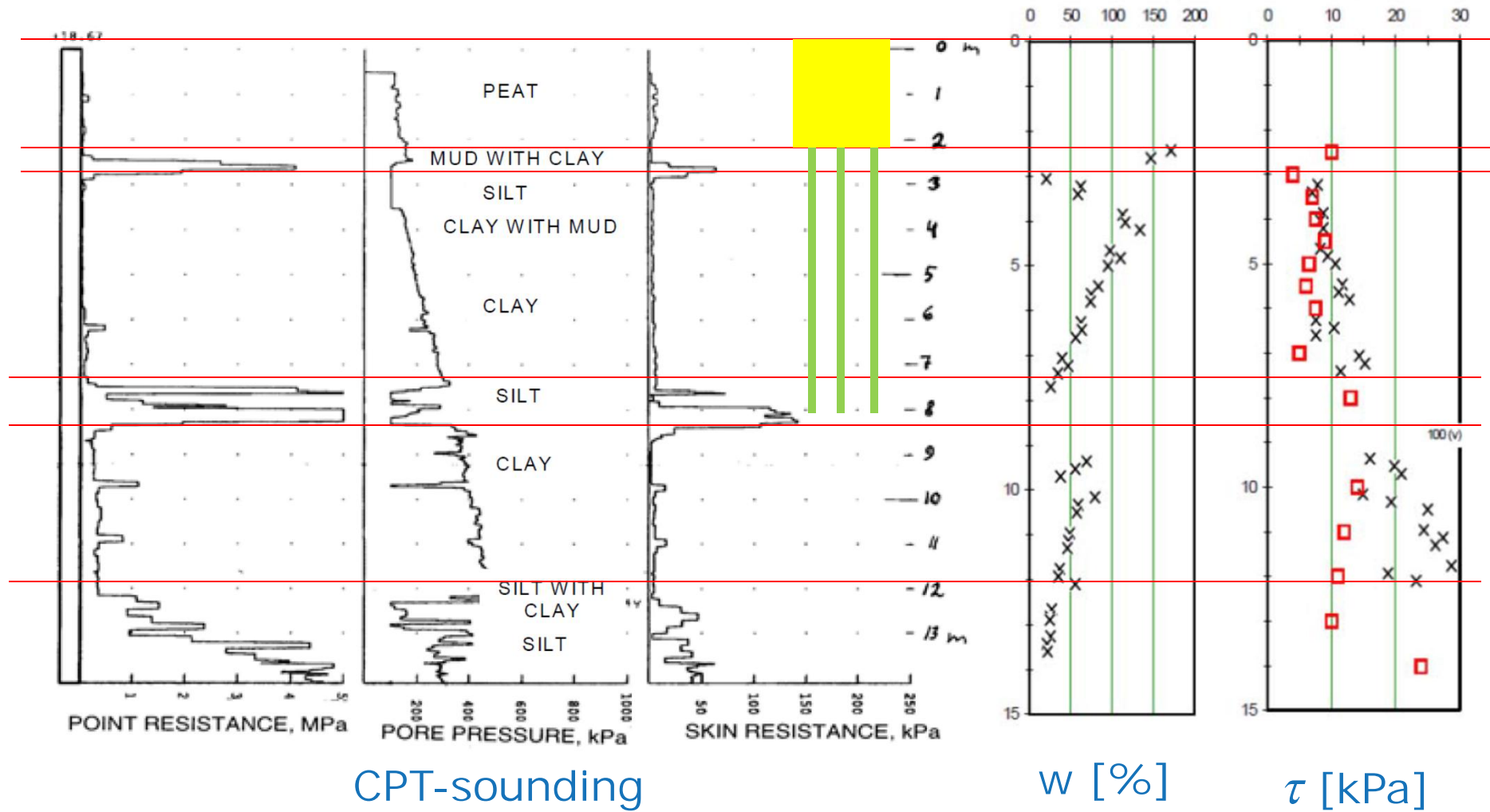
- Arcada 2 KYLÄSAARI , Helsinki
- Jätkäsaari sediments basins, Helsinki
(stage 1 and 2)



- Perkka Dog Park in Espoo



3. CASE KIVIKKO: MASS STABILISATION AS A GROUND IMPROVEMENT METHOD



Result of a CPTU, vane and laboratory tests

KIVIKKO – PEAT STABILISATION

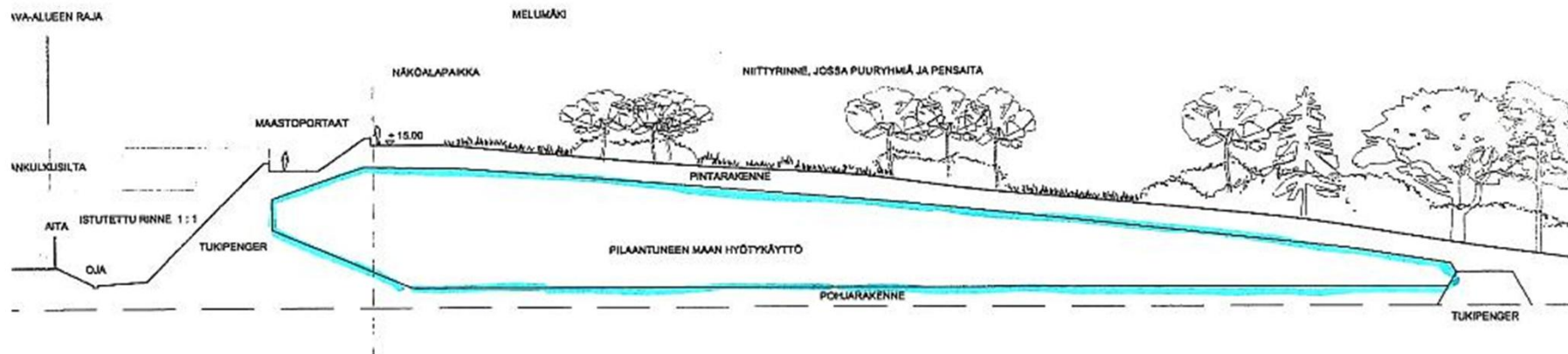
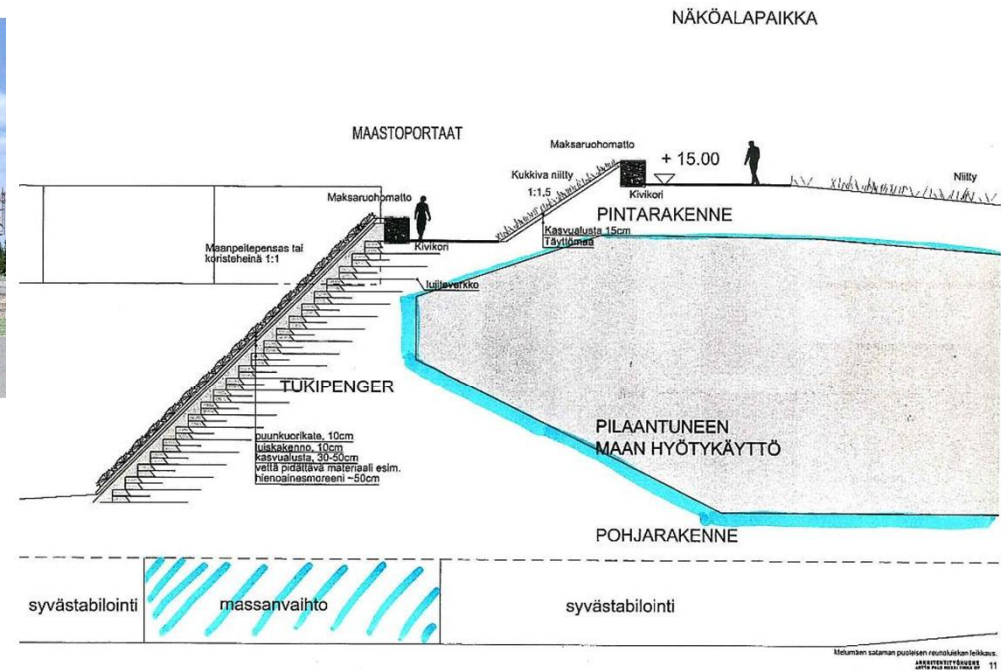
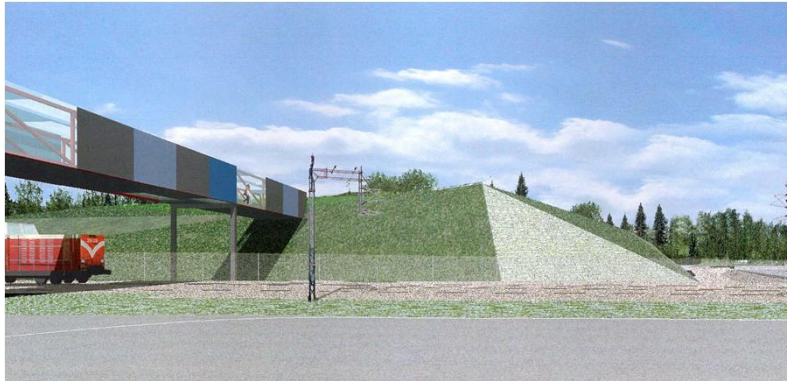
- New industrial area on wet peat and clay



Before

After

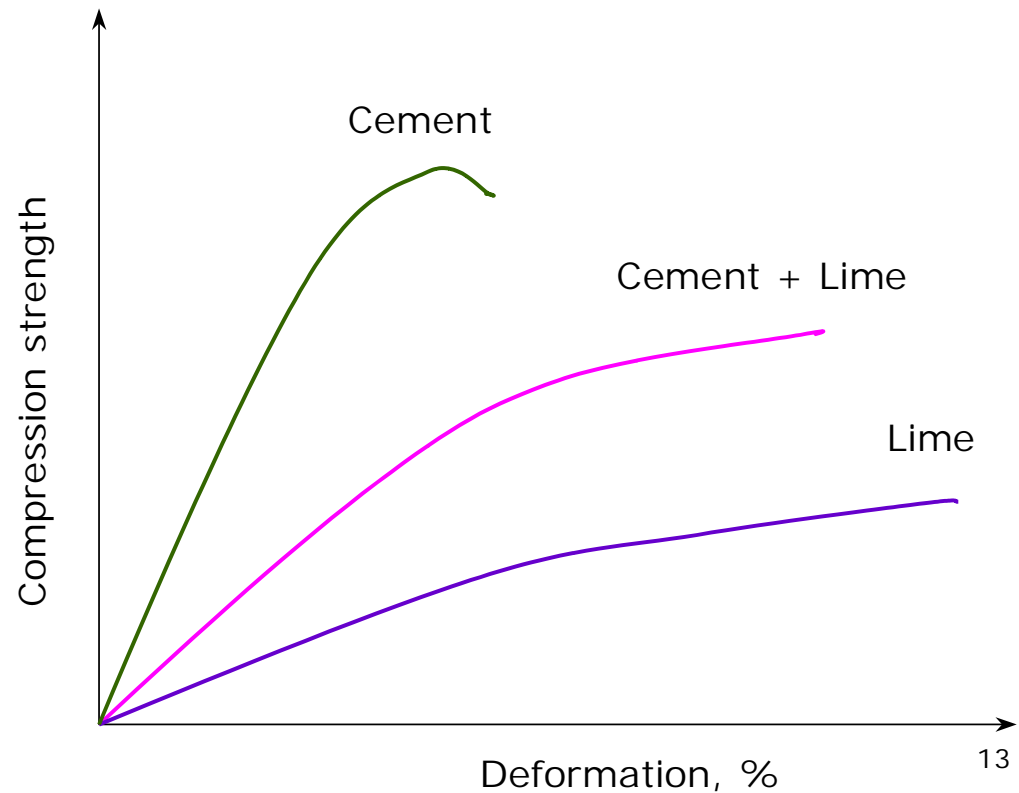
SEALING LAYER MATERIAL VUOSAARI HARBOUR



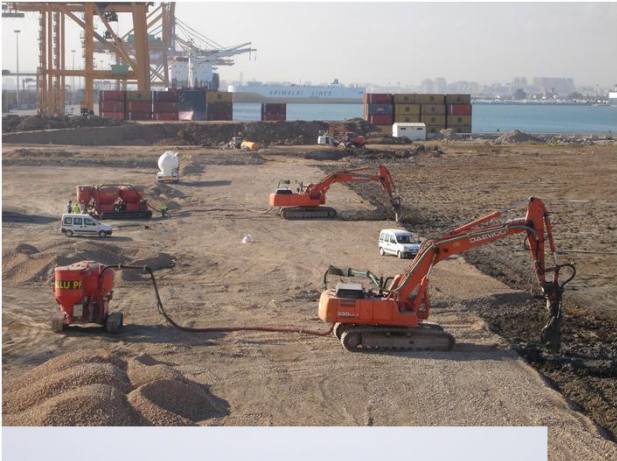
BINDERS

- Lime
- Lime + Cement
- Cement
- (Fly-ash)
- (Gypsum)
- (Blast-furnace slag)
- Mixture of several binders

SOIL	TYPICAL QUANTITY OF BINDER [kg/m ³]
Clay	120-200
Peat	150-250
Dredged sediment	70-200



Thank You.



RAMBOLL