

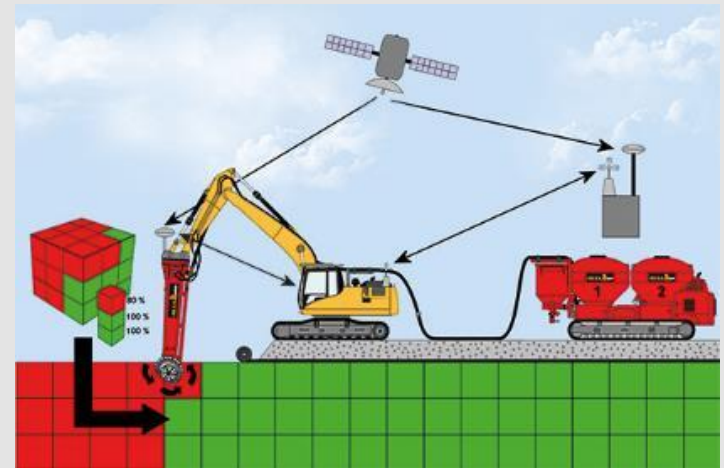
ALLU - ADVANCED MASS STABILIZATION MACHINERY FOR MIXING DRY BINDERS

Complete mobile solution:

- Mixing head
- pressure feeder
- control system
- 3 D positioning system (NEW!)

Benefits

- New business possibilities and profits
 - Cost effective & high production rate
- Environmentally friendly method



ALLU Stabilization Equipment



WHERE TO USE MASS STABILIZATION?

- IN-SITU IMPROVING OF SOFT SOILS
- REMEDIATION OF CONTAMINATED SOILS
- IMPROVING AND UTILIZING CLEAN AND CONTAMINATED SOFT SEDIMENTS



ALLU Stabilization Equipment

WHY TO USE MASS STABILIZATION?

ECONOMICAL ASPECTS

Cost savings

- No excavating and backfilling
- No transports and dumping of old material
- No need to buy replacement material

Great business opportunities!!!!

- High production rate
- Suitable for many applications
- With certain contaminated and sticky materials only possible applicable method
- Less competition than with traditional methods



Amusement park in Turkey

ALLU Stabilization Equipment



WHY TO USE MASS STABILIZATION?

ENVIRONMENTAL ASPECTS

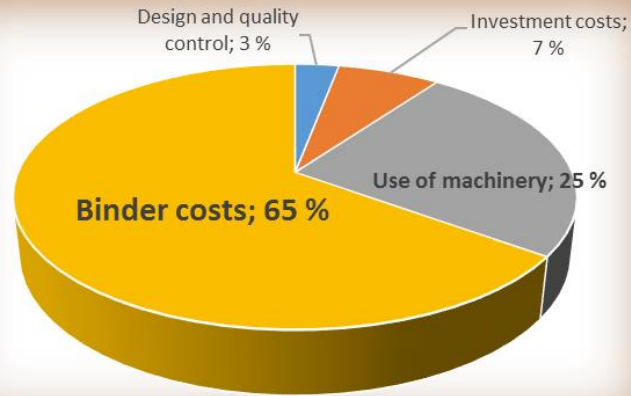
Environmental friendly and sustainable method

- No transport of hazardous waste on roads
- Savings in natural resources
- Savings in dumping to landfills
- Good image of the project



ALLU Stabilization Equipment

MASS STABILIZATION COSTS



Binder cost is key to project economy!

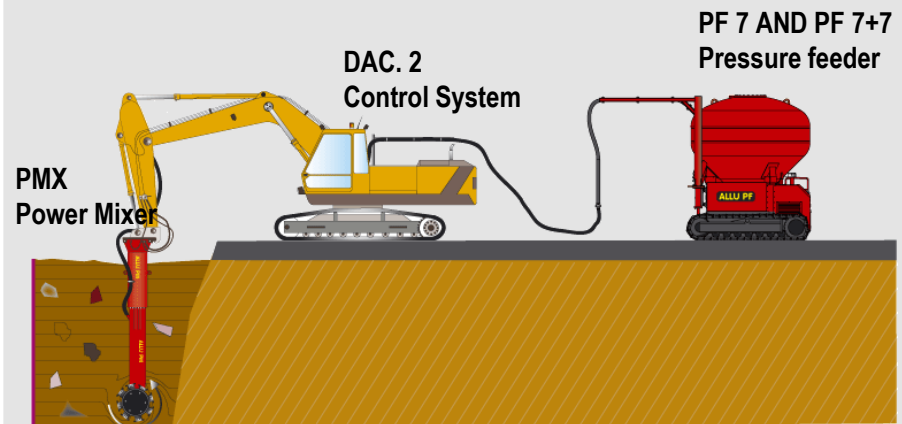
- Type and needed amount of binder
- Accuracy of binder feed
- Quality control and quick reaction to deviations

ALLU Stabilization Equipment

WHY ALLU AS A PARTNER?

ALLU IS A GLOBAL SUPPLIER

- For ALLU customer comes first!
- Own offices in 7 countries
- Partnership network in more than 30 countries
- Whole equipment concept is developed by ALLU together with customers to meet their needs
- Only supplier of special designed machinery for mass stabilization
- Close co-operation with top specialist companies like Ramboll, Lemminkäinen etc.



ALLU Stabilization Equipment



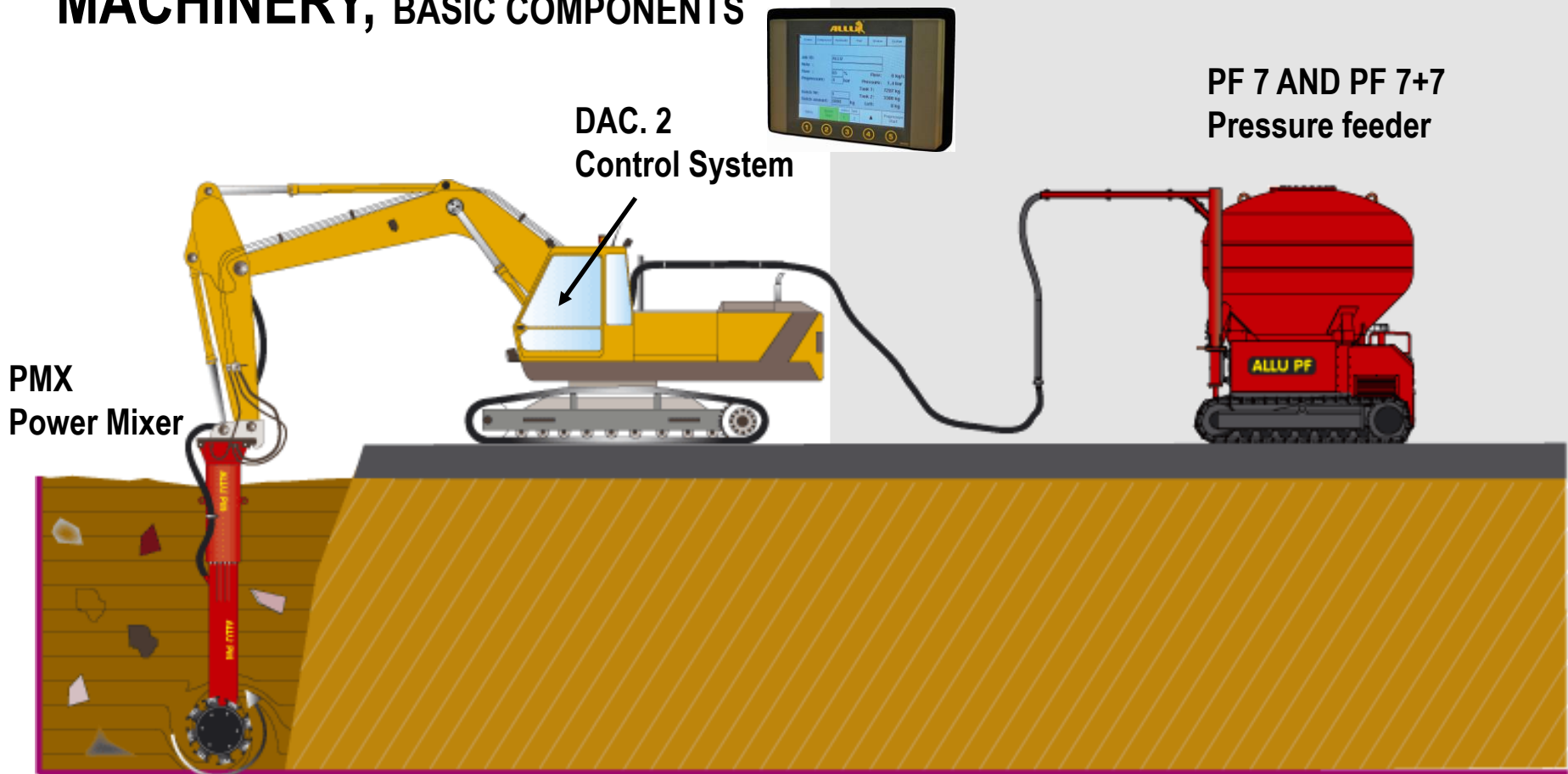
WHY ALLU AS A PARTNER?

**ps. ALLU SCREENER CRUSHER
IS A STABILIZING UNIT, TOO!**

- **For soft and harder dug up soils**
- **Most typical binder is lime**
- **Commonly used in France and Germany
in communal piping under streets**



ALLU MASS STABILIZATION MACHINERY, BASIC COMPONENTS



ALLU Stabilization Equipment

ALLU PMX MIXING HEAD – THE HEART OF MASS STABILIZATION MACHINERY

ALLU PMX IS MADE TO WORK UNDERGROUND

- Patented design to work under pressure and in contaminated muds
- Strong, power max 160 kW
- Drum drive 2 x hydraulic motors
- Arm length 3 or 5 m (+ 2 m extension available)
- Manoeuvred by 25 – 40 tn excavator
- Hydraulic power from excavator's pump
- Equipped with drum rpm and temperature sensors and display



ALLU Stabilization Equipment

ALLU PF PRESSURE FEEDER WORKS IN ULTIMATE CONDITIONS

ALLU PF IS DESIGNED FOR MASS STABILIZATION

- Track driven units for difficult terrains
- Special designed for feeding binder up to 10 m depth
 - High feeding accuracy ensures remarkable savings in binder costs
- Full adjustability (air pressure, air flow, binder flow, etc)
- The operator controls directly the work procedure
 - Continuous feedback of work process to operator
- Can work also with column stabilization rig



ALLU Stabilization Equipment

WHEN TO SELECT SINGLE POD AND WHEN TWIN POD FEEDER?

ALLU PF 7 (single pod) pressure feeder

- Agile on soft and rough terrains
- Lower investment cost
- 2 x PF 7 very effective concept when distance to cement truck is long

ALLU PF 7+7 (twin pod) pressure feeder

- Effective when binder can be brought close to feeder
- While emptying one pod you can fill the other one

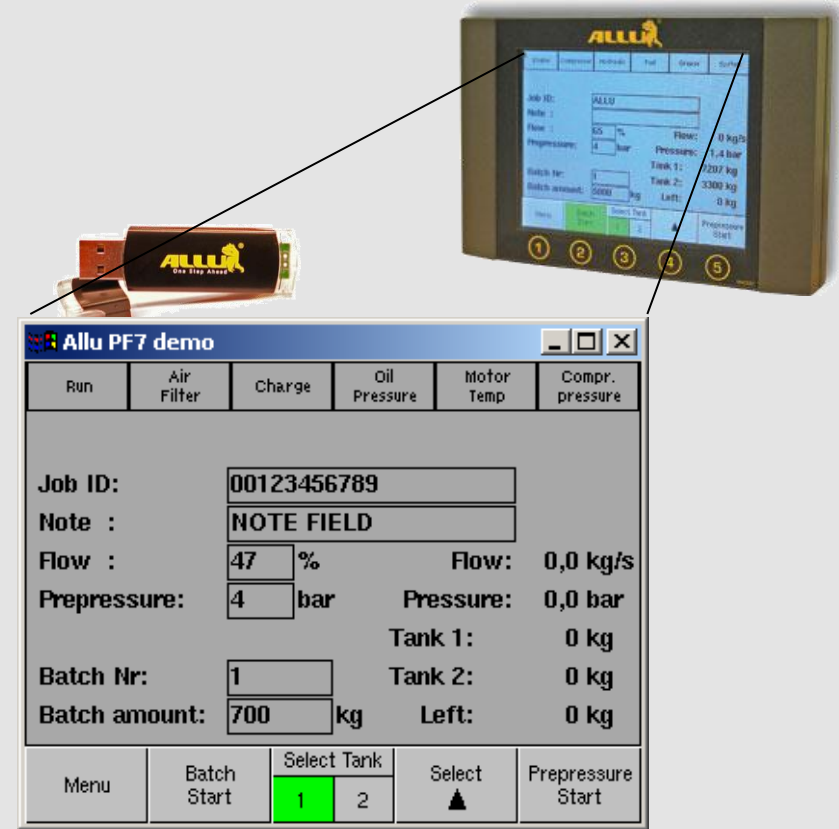


ALLU Stabilization Equipment

ALLU DAC. 2 CONTROL SYSTEM - QUARANTEE FOR HIGH QUALITY

ALLU DAC. 2 – ENSURES PROMPT BINDER FEED

- Designed for mobile working conditions
- Control of all main functions (tank pressure, air flow, binder feed, etc.)
- Reporting program gives data of each batch (batch identification, time, air pressure and flow, amount of injected binder to each batch, etc)
- Data available by USB –stick to quality control



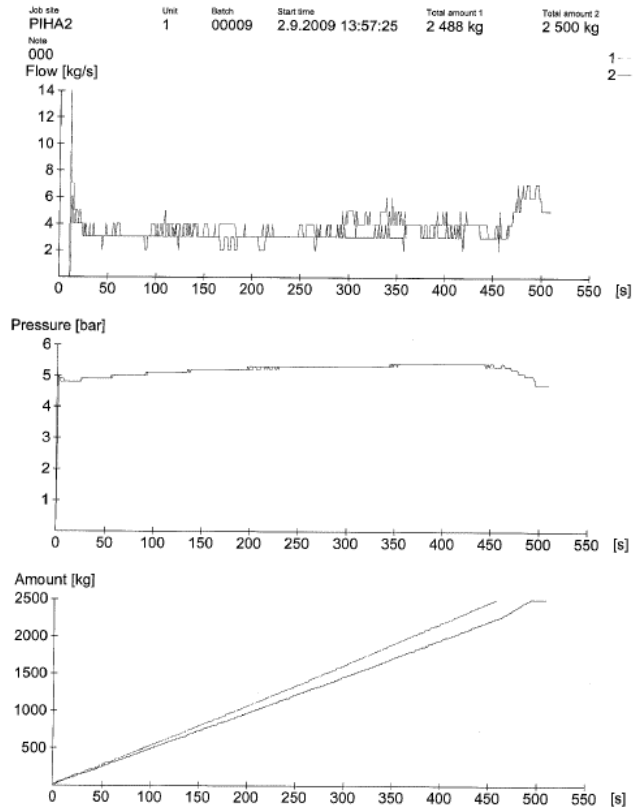
ALLU Stabilization Equipment



ALLU DAC. 2 REPORTING SYSTEM

All necessary reports made automatically

STABILIZING REPORT



MEAN VALUE REPORT

Page 1 (2)

Job site		Date range		Total amount 1		Total amount 2	
PIHA2				53 591 kg		59 064 kg	
Date	Unit	Batch	Started	Feed time	Flow 1 Flow 2 [kg/s]	Pressure 1 Pressure 2 [bar]	Amount 1 Amount 2 [kg]
2.9.2009	1	00009	13:57:25	00:08:29	4,89 4,91	4,69 5,20	2 488 2 500
2.9.2009	1	00010	14:55:43	00:06:28	0,00 6,44	0,00 4,04	0 2 500
2.9.2009	1	00011	15:05:40	00:06:22	6,54 0,00	4,05 0,00	2 500 0
2.9.2009	1	00012	15:40:05	00:08:37	4,84 4,84	4,84 4,61	2 500 2 500
						Total 1	7 488
						Total 2	7 500

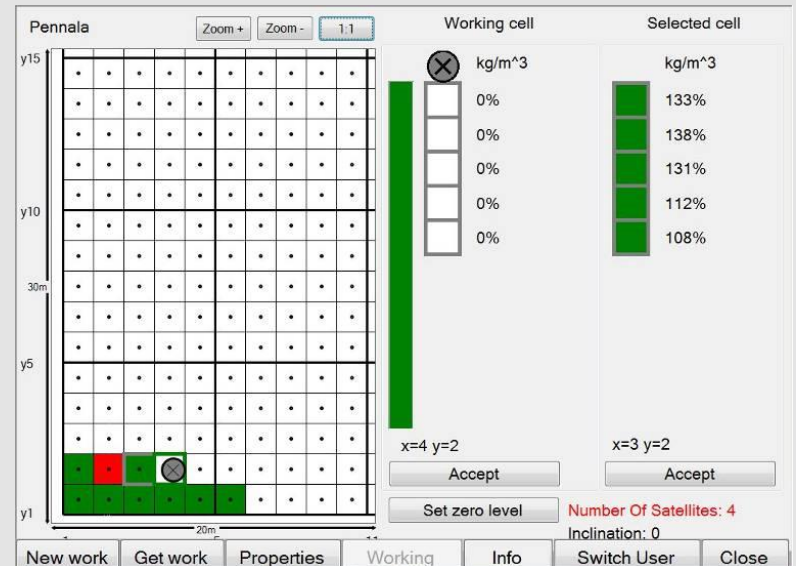
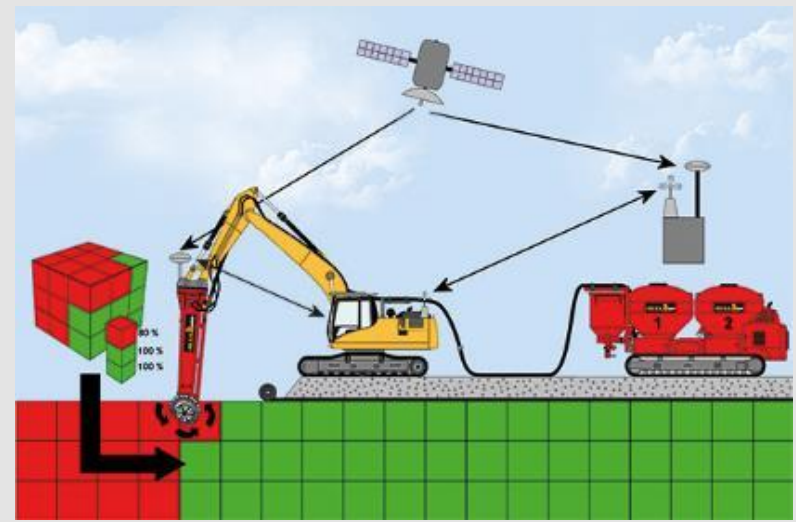
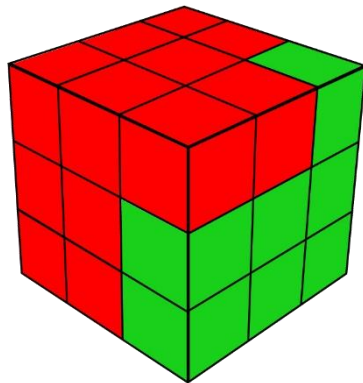
ALLU Stabilization Equipment



ALLU 3D POSITIONING SYSTEM

ALLU 3D assists to execute and document stabilisation work

- The system guides operator where the mixing head is located and where to move it to
 - XYZ -dimensions
 - Adjustable block dimensions
- 3D informs what is the status of the process parameters and when they are reached in each block
 - Amount of injected binder
 - Mixing result etc.



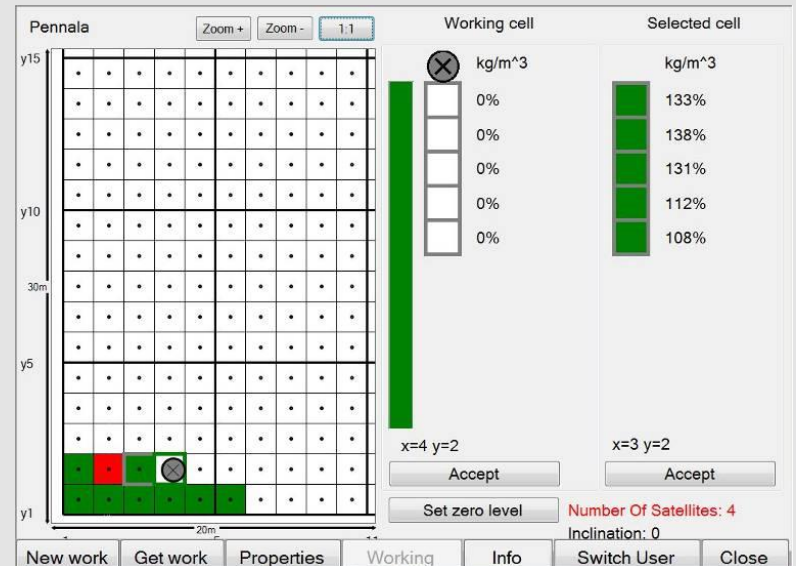
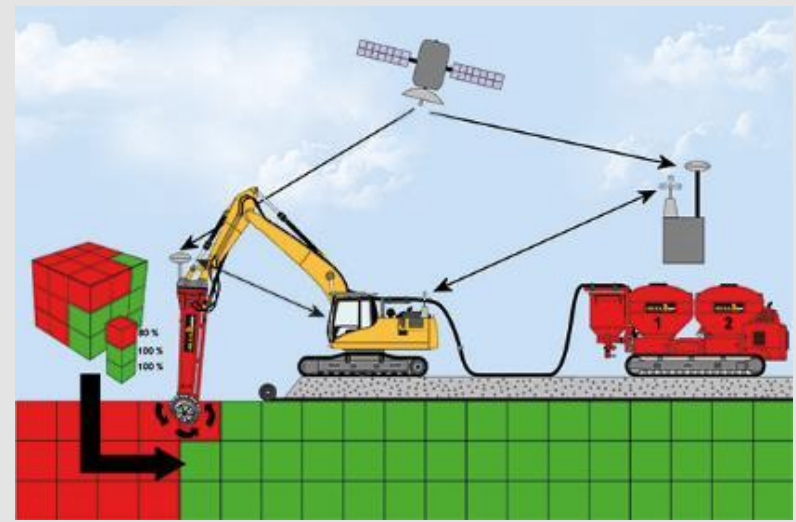
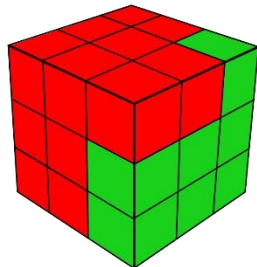
ALLU Stabilization Equipment



ALLU 3D POSITIONING SYSTEM

Benefits

- Higher production rate
 - No need for pre marking the blocks
 - Faster placement of mixing head
- Better quality
 - Homogenous binder feed and mixing result
 - Reporting system eases quality control
 - **Helps designer to rely on mass stabilization concept!**
- Cost effective
 - Reduced binder costs
 - Eases the binder feeding



ALLU Stabilization Equipment



IN-SITU STRENGTHENING OF SOFT SOILS

- Roads, streets, railroads
- Pipelines
- Parking areas, sport fields
- Commercial, residential and industrial areas

Benefits

- No soil exchange / no dumping costs
- Cost effective
- Saves natural resources



ALLU Stabilization Equipment



IMPROVING AND UTILIZING DREDGED MUD AND OTHER SOFT SEDIMENTS

- Harbors, storage areas
- River embankments
- Winning land from sea

Benefits

- No transports / dumping costs
- Cost effective
- Getting new land for at low costs



ALLU Stabilization Equipment

REMEDIATING CONTAMINATED SOILS AND TAILINGS

- Harbors, storage areas
- Mines
- Recycling centers
- Old industrial areas, gasoline stations

Benefits

- Environmentally friendly method
- Processing hazardous waste at place
- No transports / dumping costs
- Cost effective



ALLU Stabilization Equipment



**ALLU MASS STABILIZATION
MACHINERY – FOR NEW
BUSINESS POSSIBILITIES
AND BETTER WORLD!**

**THANK YOU FOR YOUR
INTEREST!**



ALLU Stabilization Equipment

ALLU OFFERS BUSINESS POSSIBILITIES!

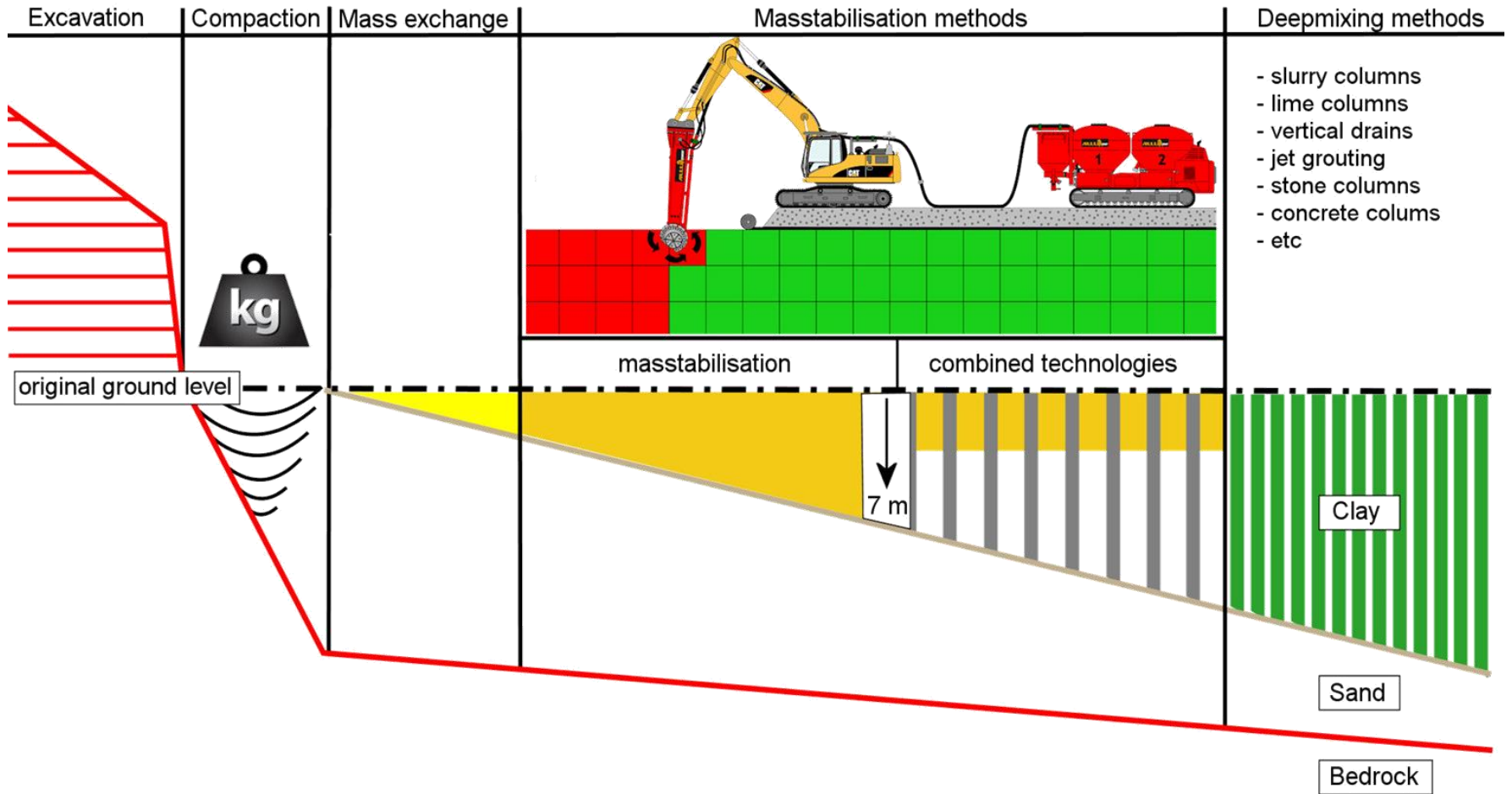
SUMMARY OF APPLICATIONS

- Improvement of bearing capacity
- Reduction of settlements (embankments, structures ...)
- Improvement of stability
- Support of slopes and excavations
- Reduction of vibrations
- Encapsulating and/or utilising clean or contaminated soft soils and sediments

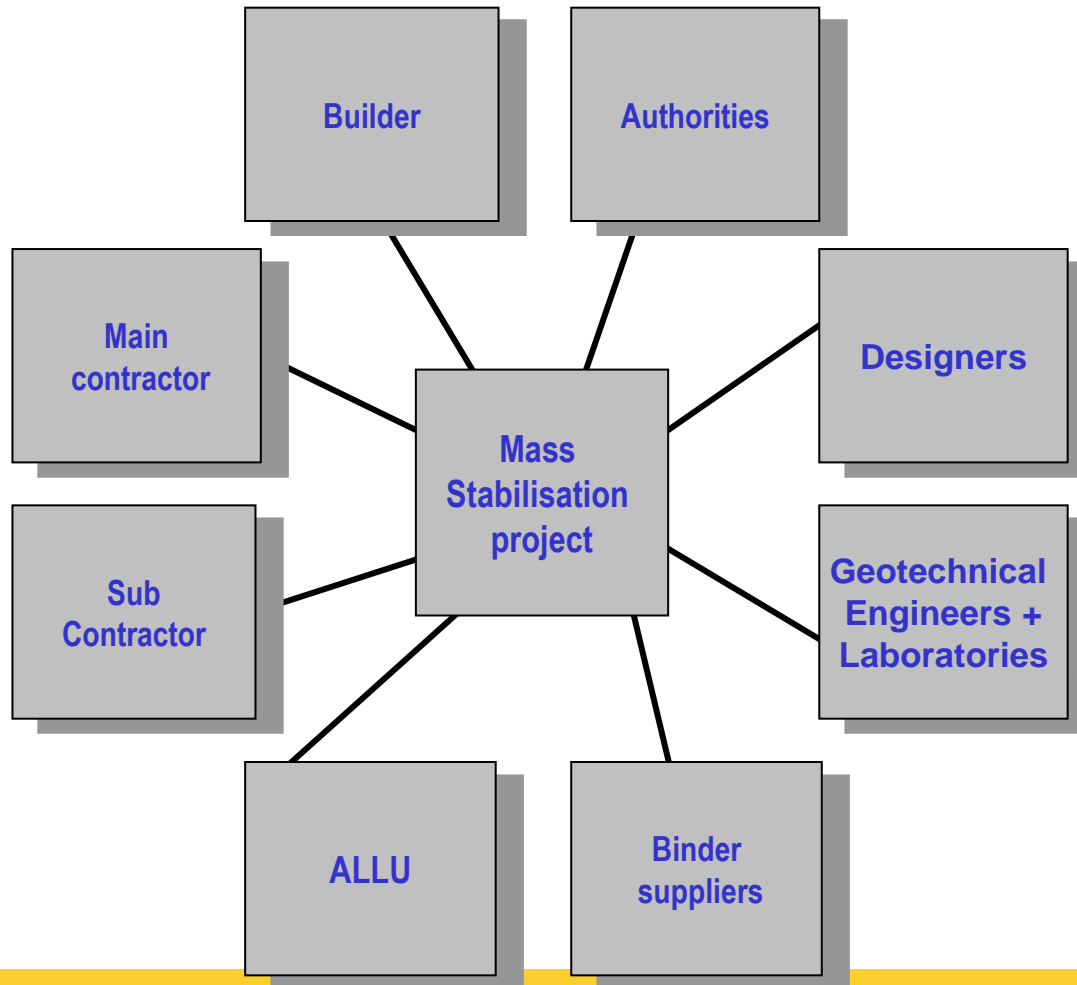


ALLU Stabilization Equipment

WHAT IS MASS STABILISATION



MASS STABILISATION PROJECT – BRINGING ALL TOGETHER



INITIAL SOIL CONDITIONS

Applicable soil types: clay, mud, peat, dredged sediments, contaminated soils

- $w_o = 50 \dots 2\,000 \%$ (from dry weight)
- $\tau_o = 1 \dots 25 \text{ kPa}$
- Organic content = $0 \dots 97 \%$ (from dry weight)
- Bearing capacity = no capacity low
- Contamination = clean ... heavily contaminated



PARAMETERS OF MASS STABILISED SOIL

Parameter	Normal value	Test Method
Shear Strength τ	50... 100 kPa	1-axial compression test
Modulus, E_{50}	5...15 MPa When $\tau = 50 \dots 100$ kPa	Design guides $E_{50} = 50 \dots 150 \times \tau_{\text{stabilised}}$
Water permeability, k	$1 \times 10^{-8} \dots 10^{-10}$ m/s	CRS-test, Flexible wall permeameter



MACHINERY, binder feeding

ALLU PF, track driven binder feeding unit

ALLU PF 7



Weight: 7,9 t
Gross Volume: 7 m³

ALLU PF 7 + 7



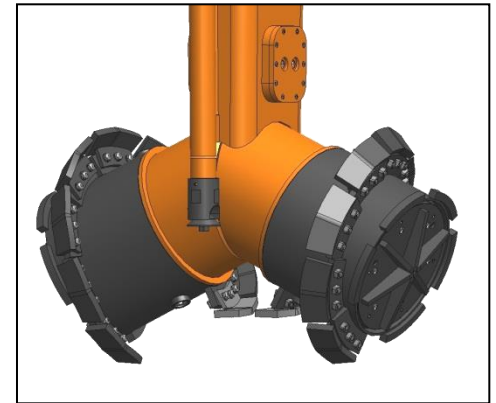
Weight: 13,5 t
Gross Volume: 14 m³ (7 + 7)

- Max. feeding distance 75 m at full 5 kg/s feeding capacity.
- On site transport with own engine / tracks.
- Public road transport by carriage.
- The binder feed is controlled and fully recorded on the DAC. 2 System.
- Modular CAN-bus technology.

MACHINERY, effective soil mixing

ALLU PMX 300HD and PMX 500HD power mixers

- Power max 160 kW
- Drum drive 2 x hydraulic motor with bewel gear
- Length 3 or 5 m
- 2 m extension available
- For 25 – 40 tn excavator
- Works with the excavator hydraulics
- Equipped with drum RPM sensor
- Equipped with temperature sensor
- Equipped with a display



MACHINERY, effective soil mixing



MIXING ENERGY/SHEAR



SPOON FOLDING ACTION

V.S.

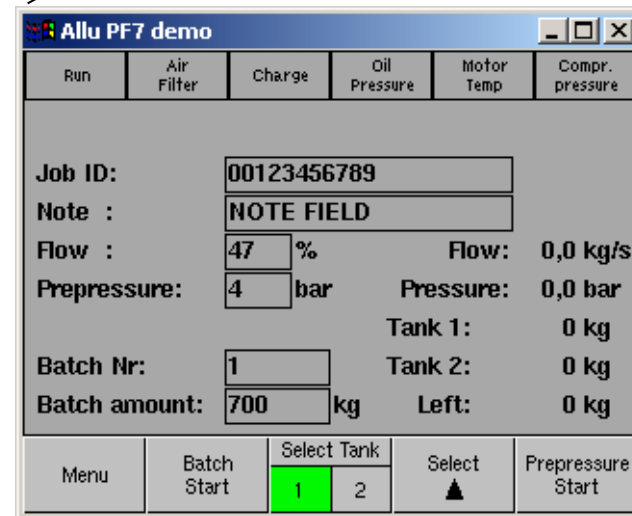


CONTROL SYSTEM

ALLU PF is controlled by DAC. 2

DAC stands for data acquisition and control

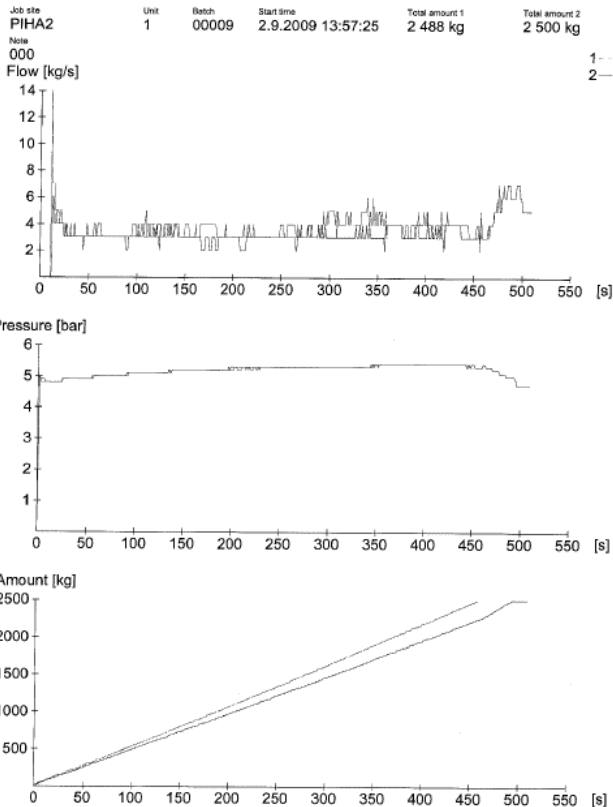
- ALLU DAC.2 controls the stabilisation process.
- Includes:
 - Reporting program
 - ALLU-control devices
 - ALLU-control logic



CONTROL SYSTEM

All necessary reports automatically

STABILIZING REPORT



MEAN VALUE REPORT

Page 1 (2)

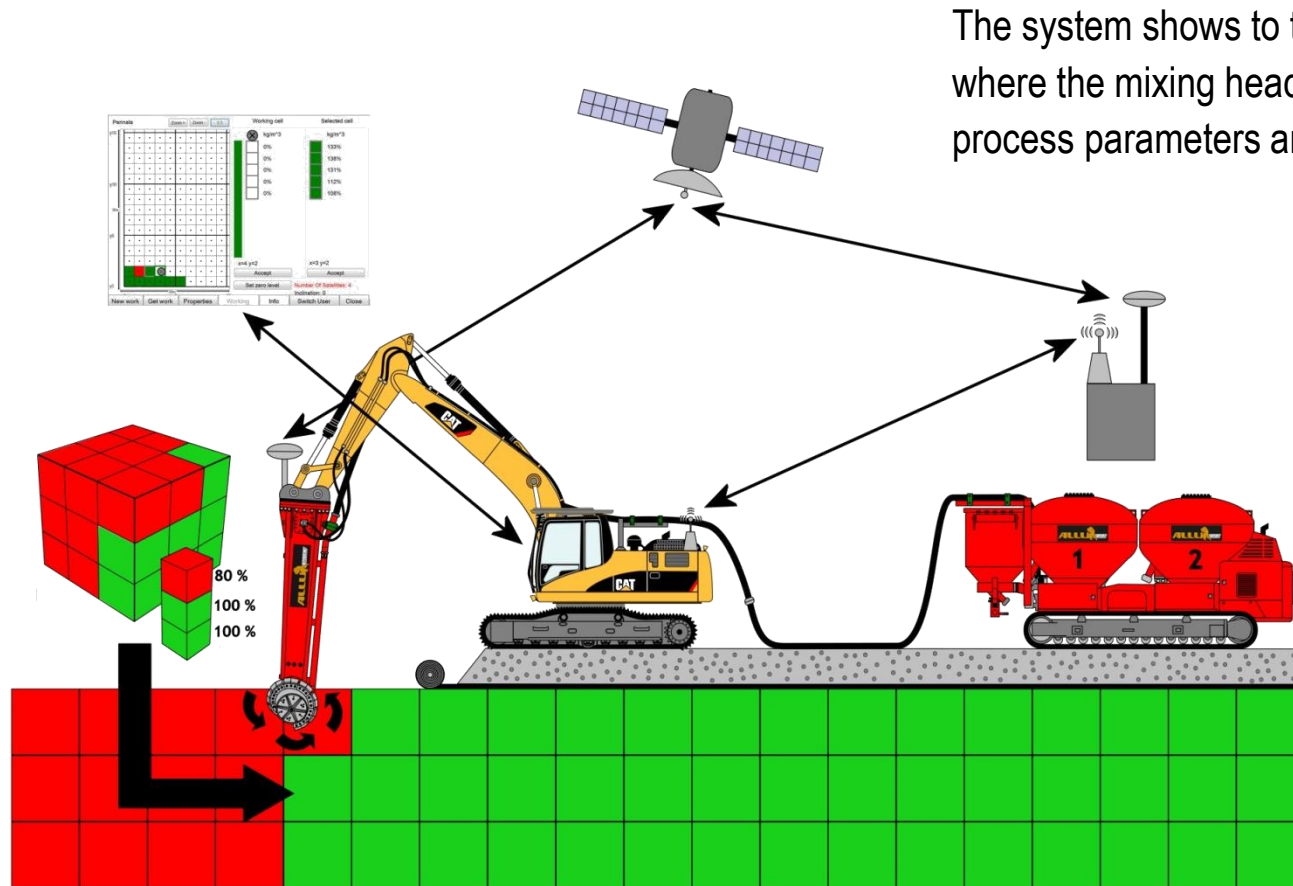
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							Total 1	7 488
							Total 2	7 500

DAC system gives numerical and graphical reports for quality control purposes.



CONTROL SYSTEM

ALLU 3D Positioning System



BINDERS

Typical binders / amounts for Mass Stabilisation

- Cement
- Lime
- Fly ash
- Furnace slag
- Industrial by-product
- Special mixtures



SOIL TYPE	TYPICAL AMOUNT
<i>Mud</i>	<i>100...200 kg/m³</i>
<i>Peat</i>	<i>100...250 kg/m³</i>
<i>Sediment</i>	<i>70...200 kg/m³</i>

BINDERS

Binders do matter!

- Most of the cost in a mass stabilisation project comes from the binder, which can represent about **50-70 % of the total project cost.**
- The ALLU system provides an advantage in terms of cost savings in mass stabilisation projects by its extremely accurate binder feeding.

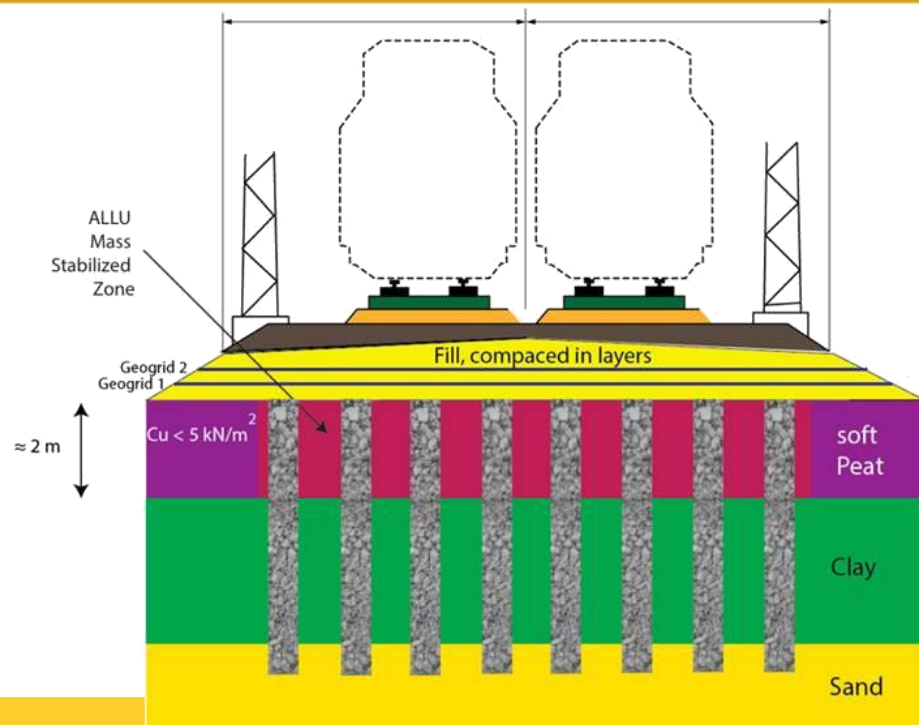


COMBINED TECHNOLOGIES

- Mass stabilization can also be used in combination with deep stabilisation or even other ground improvement methods
- The top part of the soil layer is stabilized by mass stabilization while deeper soil layers are reinforced by deep stabilization, concrete column's, lime column's etc.

Combination of Stone Columns and Mass Stabilization

- If the peat layer is of limited thickness and near surface, Mass Stabilization can be combined with Stone Columns.
- Firstly, Mass Stabilization is installed to improve the top 2 m and provide a work platform for later Stone Column installation.
- Secondly, Stone Columns go through the Mass Stabilization to reduce creep settlements in the Clay.



STABILISATION APPLICATIONS

Geotechnical applications

MASS STABILISATION OF SOFT SOILS

Clay, mud, peat...

Environmental applications

MASS STABILISATION OF DREDGED SEDIMENTS

Soft sediments, clean

MASS STABILISATION OF CONTAMINATED SOILS

Application areas:

ROADS, STREETS, RAILROADS, PIPELINES, PARKING AREAS, SPORT FIELDS, COMMERCIAL AREAS, RESIDENTIAL AREAS, INDUSTRIAL AREAS, HARBOURS, STORAGE AREAS, RIVER EMBANKMENTS, SOIL SOLIDIFICATION AND REMEDIATION



MASS STABILISATION OF DREDGED SEDIMENTS

Soft Marine Sludge Treatment in Harbour Construction



MASS STABILISATION OF DREDGED SEDIMENTS

Vuosaari, Finland

All cargo operations have been moved to the new Vuosaari harbour from the city centre



MASS STABILISATION OF DREDGED SEDIMENTS

Vuosaari, Finland

Building the TBT safety wall, forming the TBT-lagoons and transporting mud to the lagoons.



MASS STABILISATION OF DREDGED SEDIMENTS

Vuosaari, Finland

Stabilising the lagoons.



MASS STABILISATION OF DREDGED SEDIMENTS

Vuosaari, Finland

- Mass stabilisation was used as a method for processing TBT-contaminated dredged mud to be a part of new harbour structures.
- Environmental:
 - TBT-contaminated dredged mud
- Site facts:
 - Area: 11 ha
 - Depth max. 6 m
 - Volume: 500.000 m³
- Project for three ALLU stabilization systems



MASS STABILISATION OF DREDGED SEDIMENTS

Valencia harbour, Spain

- Project to extend freight container storage area
- Project for two ALLU stabilisation systems



MASS STABILISATION OF DREDGED SEDIMENTS

Valencia harbour, Spain

- Environmental:
 - Dredged mud
 - 1...1,5 m dry crust
- Site facts:
 - Area: 5 ha
 - Depth max. 5 m
 - Vol: 250.000 m³



MASS STABILISATION OF DREDGED SEDIMENTS

Coal harbour, Australia

- Dredged Marine Sludge :
 - 2 to 5 meters depth
- Site facts:
 - Storage area for coal
 - 140 kg/m³ binder
 - Depth max. 5 m
 - Vol: 300.000 m³
- Project for two ALLU stabilisation systems



MASS STABILISATION OF DREDGED SEDIMENTS

Kokkola harbour, Finland

- Dredged contaminated silt
- Total 12.500 m³
- Binder 30 kg cement + 100 kg fly ash/m³



MASS STABILISATION OF DREDGED SEDIMENTS

Harbour construction, Brasil

- Marine Sludge
- Max. depth 6-18m
- Mass stabilisation depth 3-6 m
- Binder cement 120kg/m³
- Area 50x120m



MASS STABILISATION OF DREDGED SEDIMENTS

Solidifying dredged mud, Italy



MASS STABILISATION OF DREDGED SEDIMENTS

Processing dredged mud in a basin, Italy



MASS STABILISATION OF SOFT SOILS

Mass stabilisation of residential and industrial areas



MASS STABILISATION OF SOFT SOILS

Sundet, Finland

- Project to construct new residential area on top of wet clay area.
- Mass stabilisation was used as a foundation for the streets, parking areas and pipelines.
- Site facts:
 - Depth max. 3 m
 - Volume: 18.000 m³
- Project for one complete ALLU stabilisation system



MASS STABILISATION OF SOFT SOILS

Kivikko, Finland

- Project to construct new industrial area on top of wet peat/clay area.
- Site facts:
 - Area abt. 12 ha
 - Depth max. 3 m
- Project for one ALLU stabilisation system .



MASS STABILISATION OF SOFT SOILS

Haaga, Finland

- Project to construct new sport park and residential area on top of wet peat area. Most part of the sports field areas and sewer network were founded on mass stabilised soil.
- Site facts:
 - Depth max. 4 m
 - Vol: about 100.000 m³
- Project for two complete ALLU stabilisation systems.



MASS STABILISATION OF SOFT SOILS

Residential area Helsinki, Finland



MASS STABILISATION OF SOFT SOILS

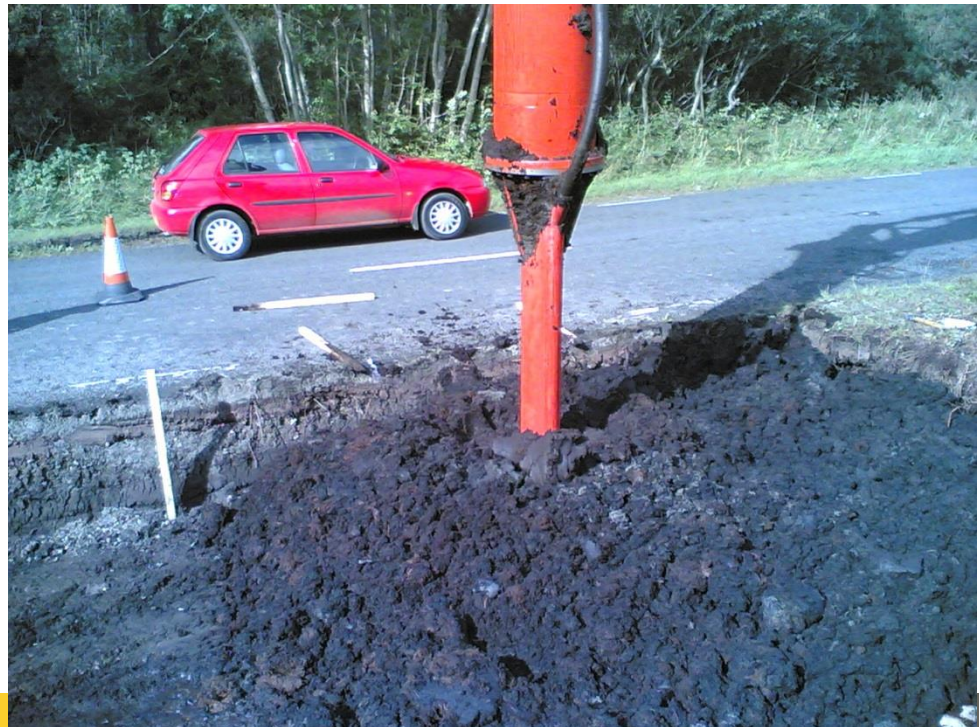
Sundsberg, Finland

Trenches for communal piping



MASS STABILISATION OF SOFT SOILS

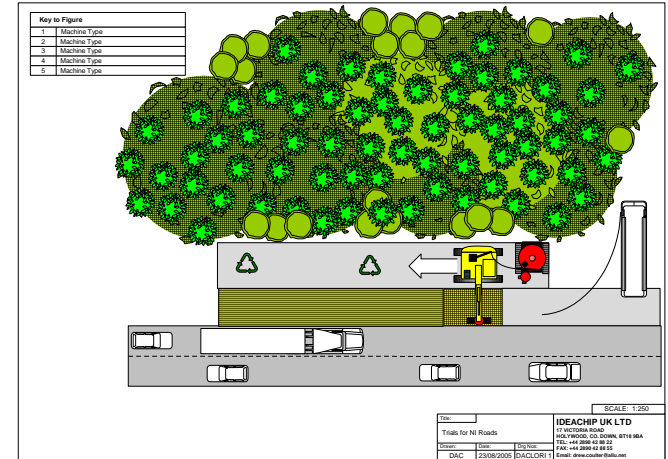
Road and Railway Foundation Construction



MASS STABILISATION OF SOFT SOILS

Road construction, Ireland

- Test area for re-inforcement the road winter 2006
- 10 m peat and under that 4 m of soft silt
- Road bends and the surface is cracking
 - More asphalt every year, max asphalt thickness at that moment 1,5m
- Stabilised to 5 meters, 200 kg/cubic m³



MASS STABILISATION OF SOFT SOILS

Road construction, Ireland



MASS STABILISATION OF SOFT SOILS

Road construction, Russia



MASS STABILISATION OF SOFT SOILS

Strengthening foundation of Sao Paulo ring road, Brazil



MASS STABILISATION OF SOFT SOILS

Widening existing road, Florida USA

- Project to widen existing road from two lane to four lane. New road will used for possibly evacuation.
- Environmental:
 - High water level
 - Soil rich of peat and vegetation
- Site facts:
 - Length 14,4 km
 - Width 12...20 m
 - Depth max. 4 m
- Project for one complete ALLU stabilization system



MASS STABILISATION OF SOFT SOILS

Widening existing road, Florida USA



MASS STABILISATION OF SOFT SOILS

High speed railroad, Finland

- Soft peat area was hardened by mass stabilisation to carry heavy piling machines
- Project for one complete ALLU system
- Mass stabilisation by numbers:
 - Size n. 40 m * 300 m
 - Depth max. 5 m
 - Approx. 50.000 m³



MASS STABILISATION OF SOFT SOILS

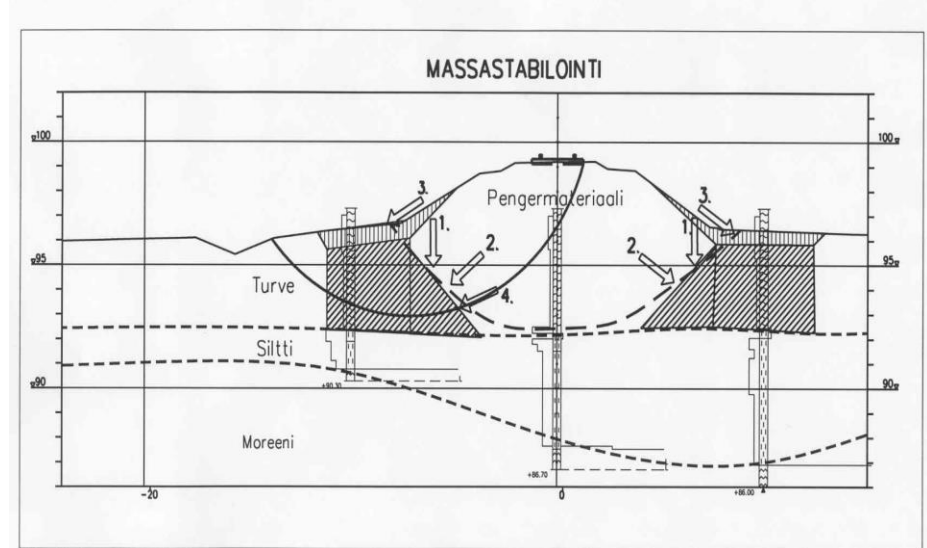
High speed railroad, Finland



MASS STABILISATION OF SOFT SOILS

Railroad support, Peräseinäjoki Finland

- Project to support railway embankment so that the trains maximum speed can be increased. Personal trains to 200 km/h and cargo trains to 100 km/h.
- Site facts:
 - Depth max. 5 m
 - Length: 3 *300 m
- Project for one complete ALLU stabilisation system



MASS STABILISATION OF SOFT SOILS

New railroad, Joensuu Finland

- New railroad besides the old one
- 13 m deep peat
- Stabilisation to 5 m, after that piling and a concrete layer
- Stabilisation was the cheapest, fastest and the only way to do the work.



MASS STABILISATION OF SOFT SOILS

New railroad, Joensuu Finland



MASS STABILISATION OF SOFT SOILS

Railway embankment, Seinäjoki Finland



MASS STABILISATION OF SOFT SOILS

Railway embankment, Vallentuna Sweden



MASS STABILISATION OF SOFT SOILS

Railroad embankment support, Nokia Finland

- 150 x 10 m x 7 m deep
- Rapid cement
- Challenging job site due to a very limited space
- Stabilisation work in $-20\text{ }^{\circ}\text{C}$ temperature



MASS STABILISATION OF CONTAMINATED SOILS

Contaminated soil
solidification and remediation



MASS STABILISATION OF CONTAMINATED SOILS

Ostrava, Czech Republic

- Highly contaminated lagoons
- Industrial area
- 400000m³ of sludge, total 1 M m³
- Binder: Quick lime
- After stabilising/solidificating screened, burned and recycled



MASS STABILISATION OF CONTAMINATED SOILS

Montana, USA

Processing mining waste/gold tailings



MASS STABILISATION OF CONTAMINATED SOILS

Processing acid tar, UK



MASS STABILISATION OF CONTAMINATED SOILS

Processing contaminated soil, Montenegro



MASS STABILISATION OF CONTAMINATED SOILS

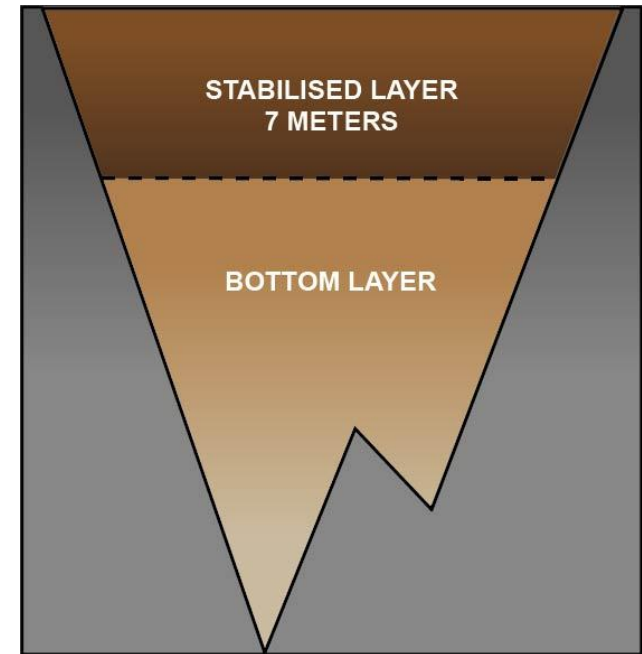
Processing oil spill waste, Spain



MASS STABILISATION OF CONTAMINATED SOILS

Stabilising contaminated sludge, Istanbul Turkey

- Vialand theme park jobsite, Istanbul. First international theme park in Turkey
- Jobsite includes complete theme park, shopping center and park area
- Stabilised area app. 150000m³
- Binder quick lime
- 2 complete systems with PF7 and PMX 700HD (2m extensions)



MASS STABILISATION OF CONTAMINATED SOILS

Stabilising contaminated sludge, China

-Project of 300 000m³ soft soil



Other Applications



PROCESSING MINE TAILINGS

Check Republic

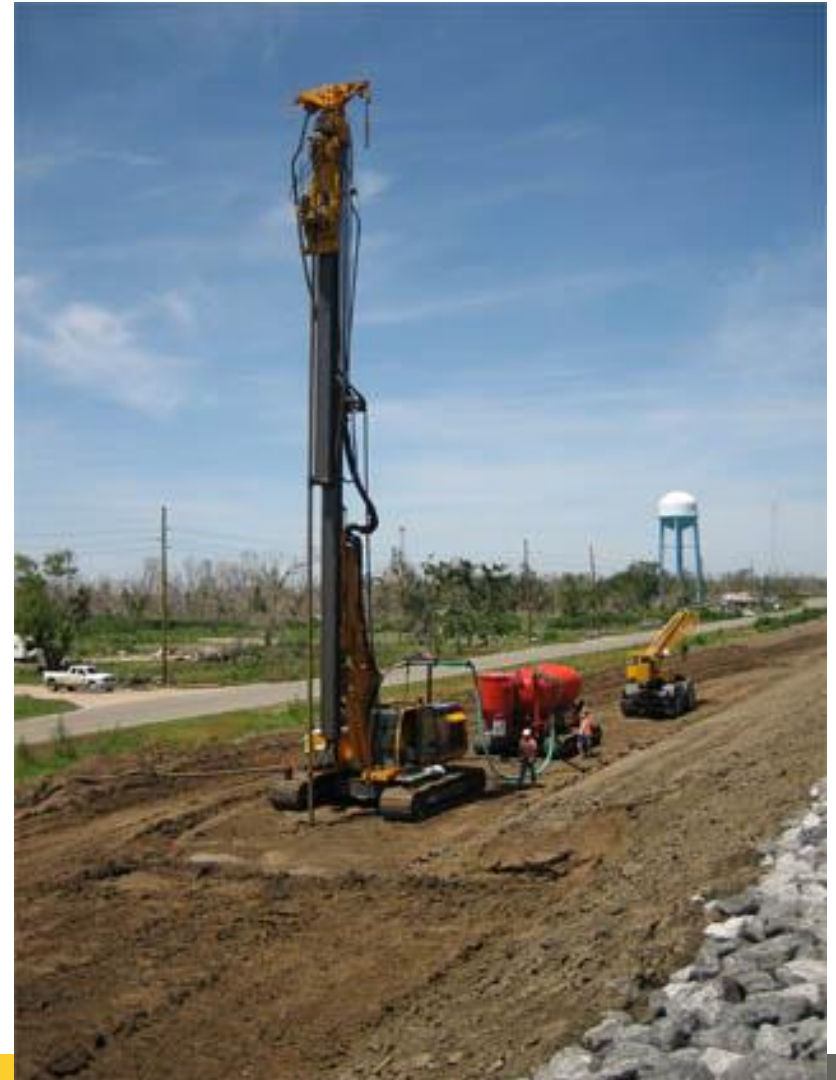
- Solidifying and hardening mine tailings
- One ALLU PF 7+7 and PMX 700 are working in a huge open mine



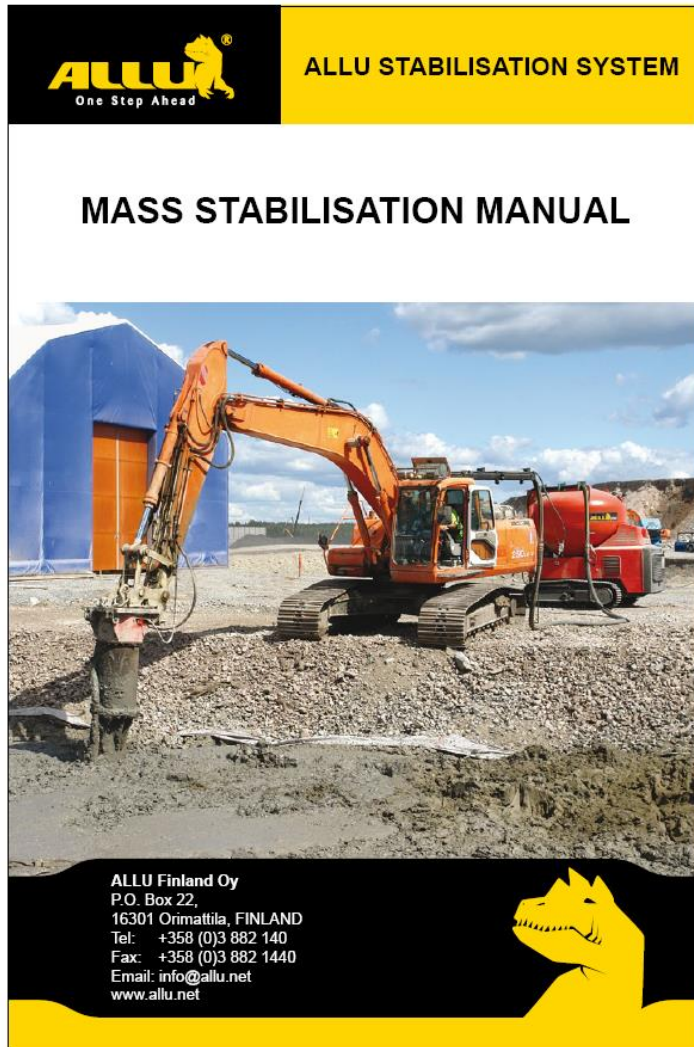
OTHER APPLICATIONS

New Orleans, USA

- Building of the new safety walls around New Orleans
- In 2005 dams were broken because of hurricane Cathrina
- 2 ALLU PF 7+7 were working on the site as feeders for the column stabilisation machines



RECOMMENDED READING



EuroSoilStab



Development of design and construction
methods to stabilise soft organic soils

Design Guide Soft Soil Stabilisation

CT97-035 I

Project No.: BE 96-3177

ALLU Group – business idea

ALLU

- ☞ Develops
- ☞ Manufactures and
- ☞ Sells

processes and equipment for the needs of environmental and earth construction fields

Main products:

- ☞ Mass stabilisation equipment
- ☞ Screener Crusher processing attachment

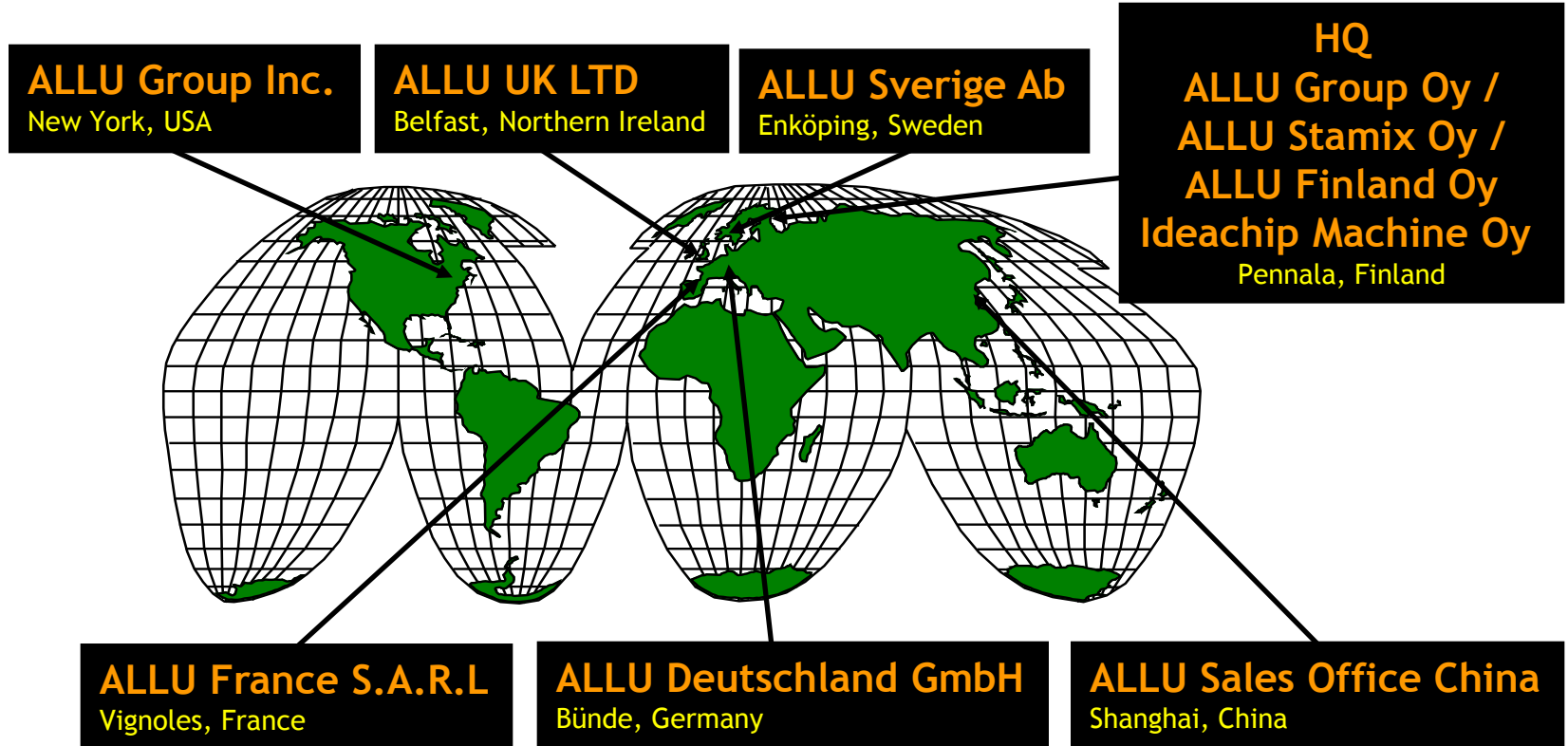


Head office & production

- Official name ALLU Stamix Oy
- Daughter company of ALLU Group Oy
 - Private limited company
 - Founded 1985
- Sister company of ALLU Finland Oy
 - Supplier of ALLU Screener Crushers
- Located in Pennala, Finland



ALLU Group companies



THANK YOU

