

Jouko Lehtonen

DATU

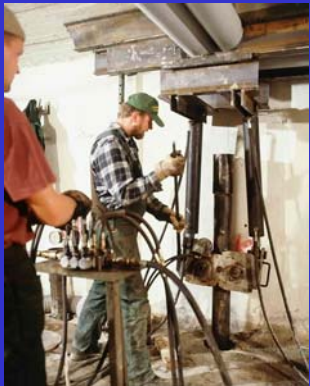
DATABASE ON TURKU UNDERPINNING PROJECTS



TURUN AMMATTIKORKEAKOULU
TURKU POLYTECHNIC



THE LOCATION OF TURKU



OBJECTIVES



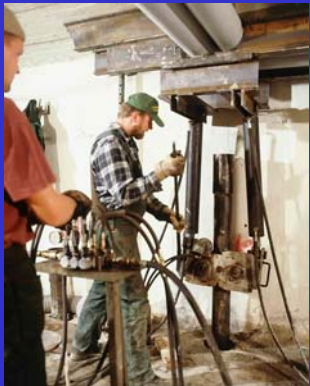
2004...2006:

To collect a database covering all finished underpinning projects in Turku. Monitoring of existing projects will be included to the DATU project as well.

To survey different underpinning techniques regarding the owner's point of view

To compare influence of variable underpinning techniques to the superstructures, to use of the existing building and to costs of underpinning project

To survey underpinning cases in Amsterdam, Venice, Stockholm and St Petersburg from the owner's point of view



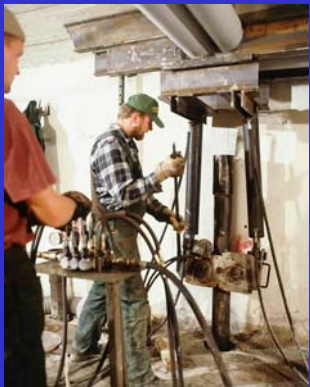
The second phase 2006...2007:

To develop ideal timing for an underpinning project based on demands of life cycles of different materials and based on ideal costs on the underpinning project

To develop a decision system in order to get adequate information to the owner concerning technical and economical results based on variable underpinning techniques



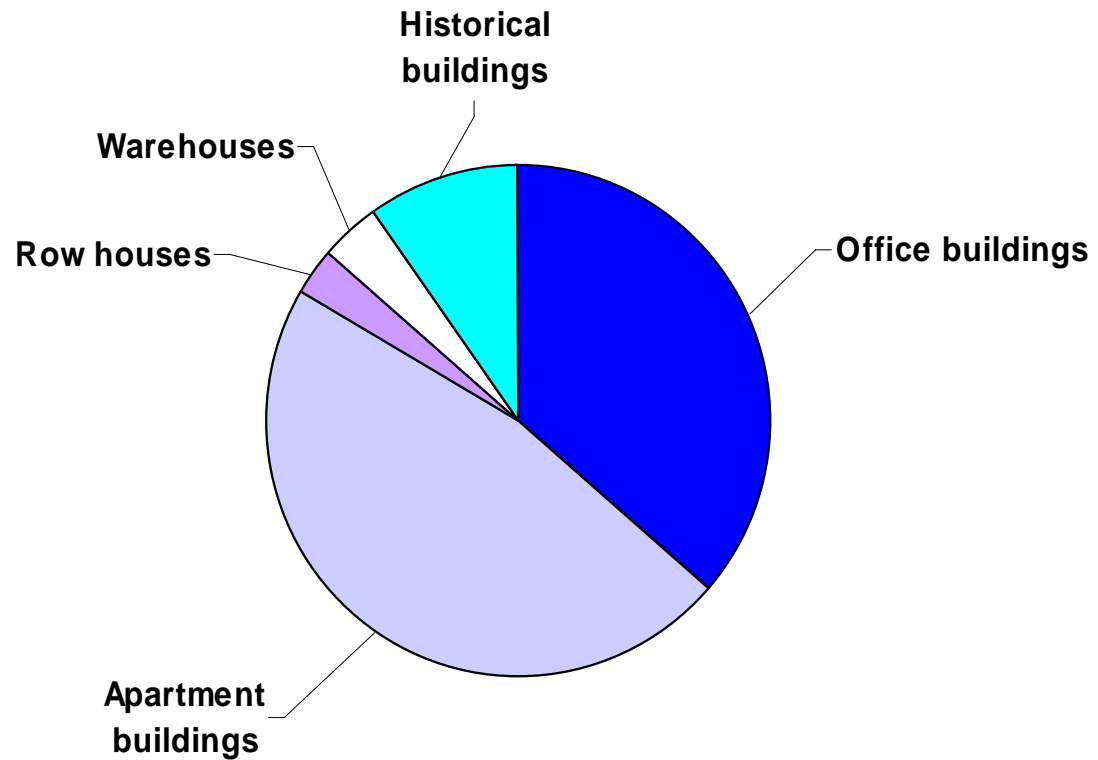
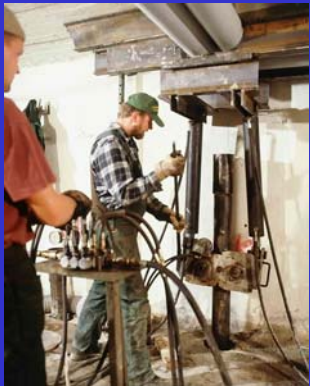
TIMETABLE



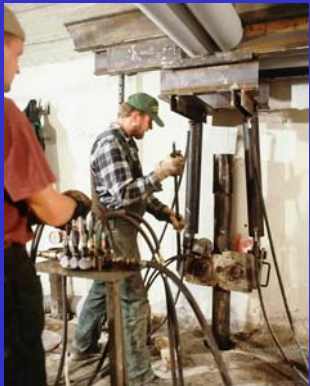
	2004	2005	2006	2007
Creation of the database				
Project monitoring				
Development of the decision-making system				

NUMBER OF THE DATU PROJECTS

- Current number of projects: 102
- About 5 new projects every year



THE PARAMETERS IN THE DATU DATABASE



GENERAL INFORMATION

- Location of the site
- Contractors and planners
- Documents
- Duration of underpinning

ORIGINAL BUILDING

- History
- Size
- Building materials
- Type of foundation
- Reason for underpinning

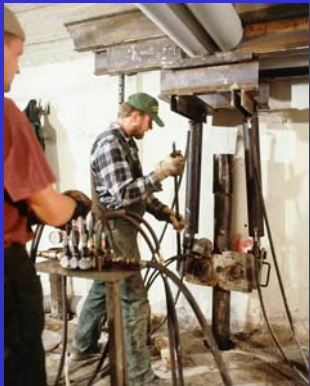
SOIL INFORMATION

- Earth layers
- Elevation of ground
- Soil parameters

FOUNDATION MAINTENANCE

- Boron protection
- Groundwater feeding

THE PARAMETERS IN THE DATU DATABASE



MICROPILES

- Type
- Bearing capacity
- Length
- Used elements
- Quality assurance

JET GROUTING

- Size
- Length
- Bearing capacity
- Follow-up measurements
- Consumption
- Quality assurance

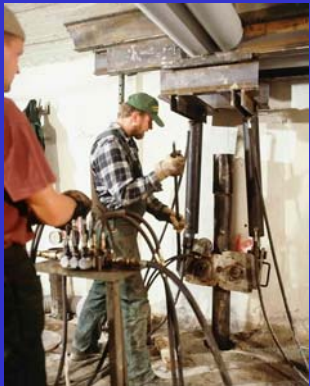
QUALITY ASSURANCE

- Inclination
- Lamp observations of straightness
- Initial curvature
- PDA, Static loading tests

LOAD TRANSFERRING SYSTEMS

- Used materials
- Specifications
- System analysis

THE PARAMETERS IN THE DATU DATABASE



GROUNDWATER

- Upper and lower groundwater
- Observation tubes
- Dates and observations

SETTLEMENS

- Observation points
- Dates and observations

CRACKS

- Dates
- Sizes
- Plaster bridges

EXPERIMENTAL HOLES

- Specifications
- State of decay

VIBRATION

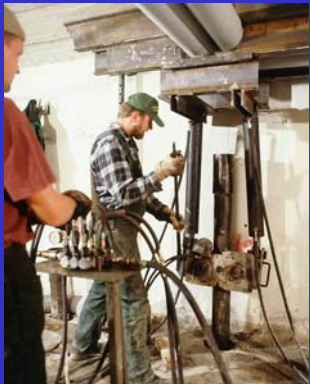
- Maximum degree

THE PARAMETERS IN THE DATU DATABASE



NOISE

- Maximum degree



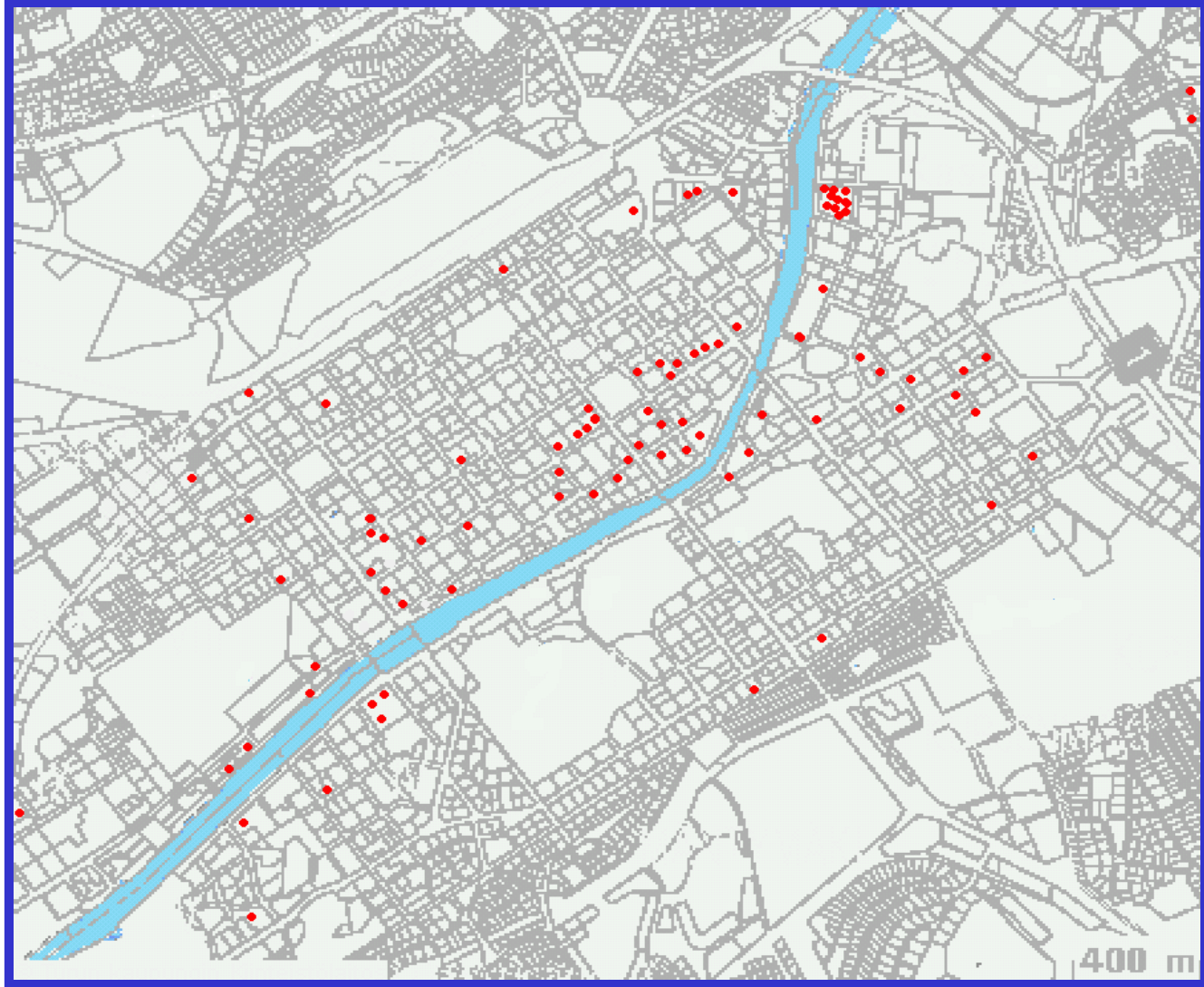
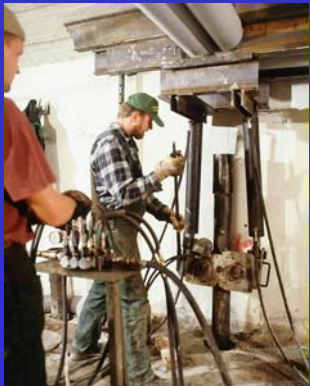
COSTS

- Total costs
- Costs per meter
- Costs per pile
- Costs per square meter
- Costs divided to factors

All together over
200 parameters

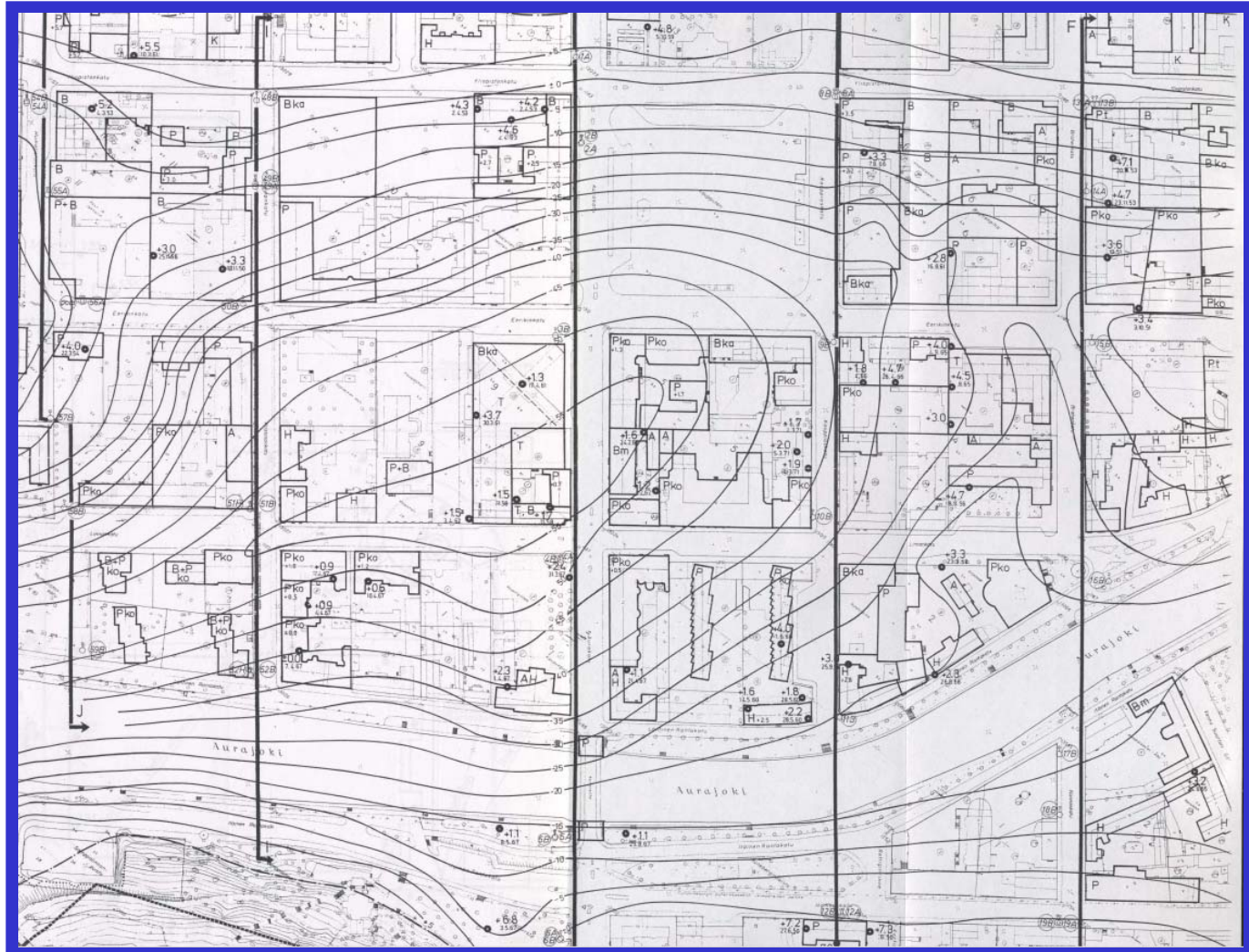
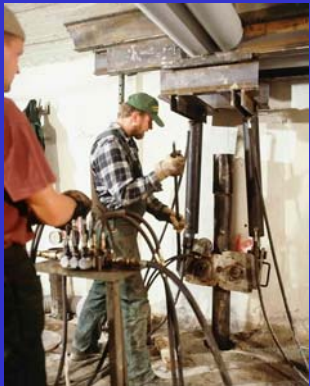


LOCATION OF THE DATU PROJECTS



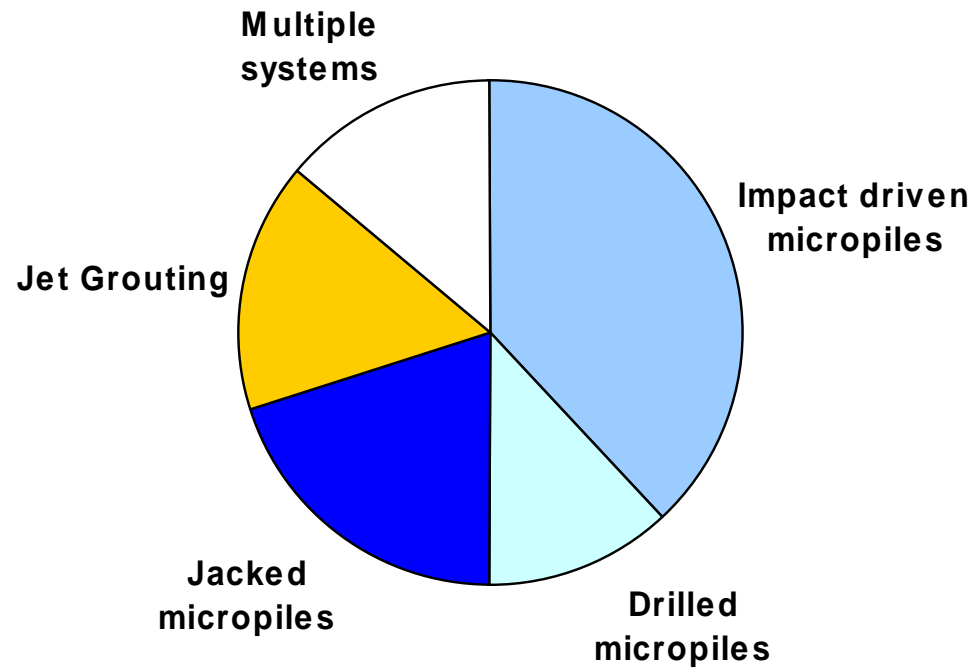
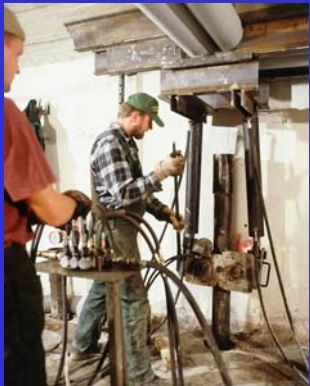
92 of 102 projects are located in the vicinity of Aura river
IWM 2004 Jouko Lehtonen

LOCATION OF THE DATU PROJECTS



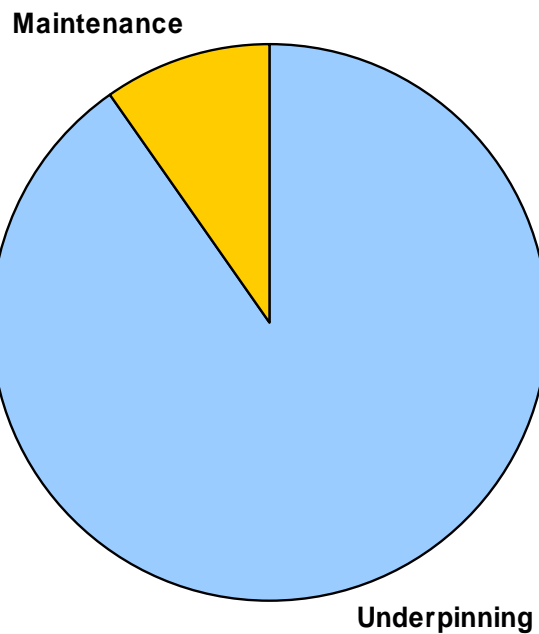
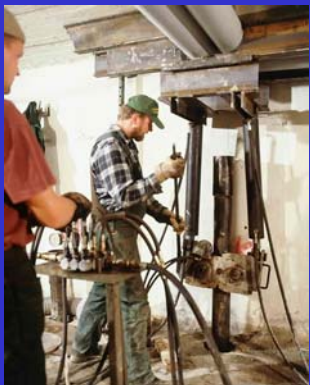
The thickness of the clay layer is from 5 to 55 meters

INSTALLATION METHODS IN THE DATU PROJECTS



Based on 58 projects

UNDERPINNING AND MAINTENANCE IN THE DATU PROJECTS

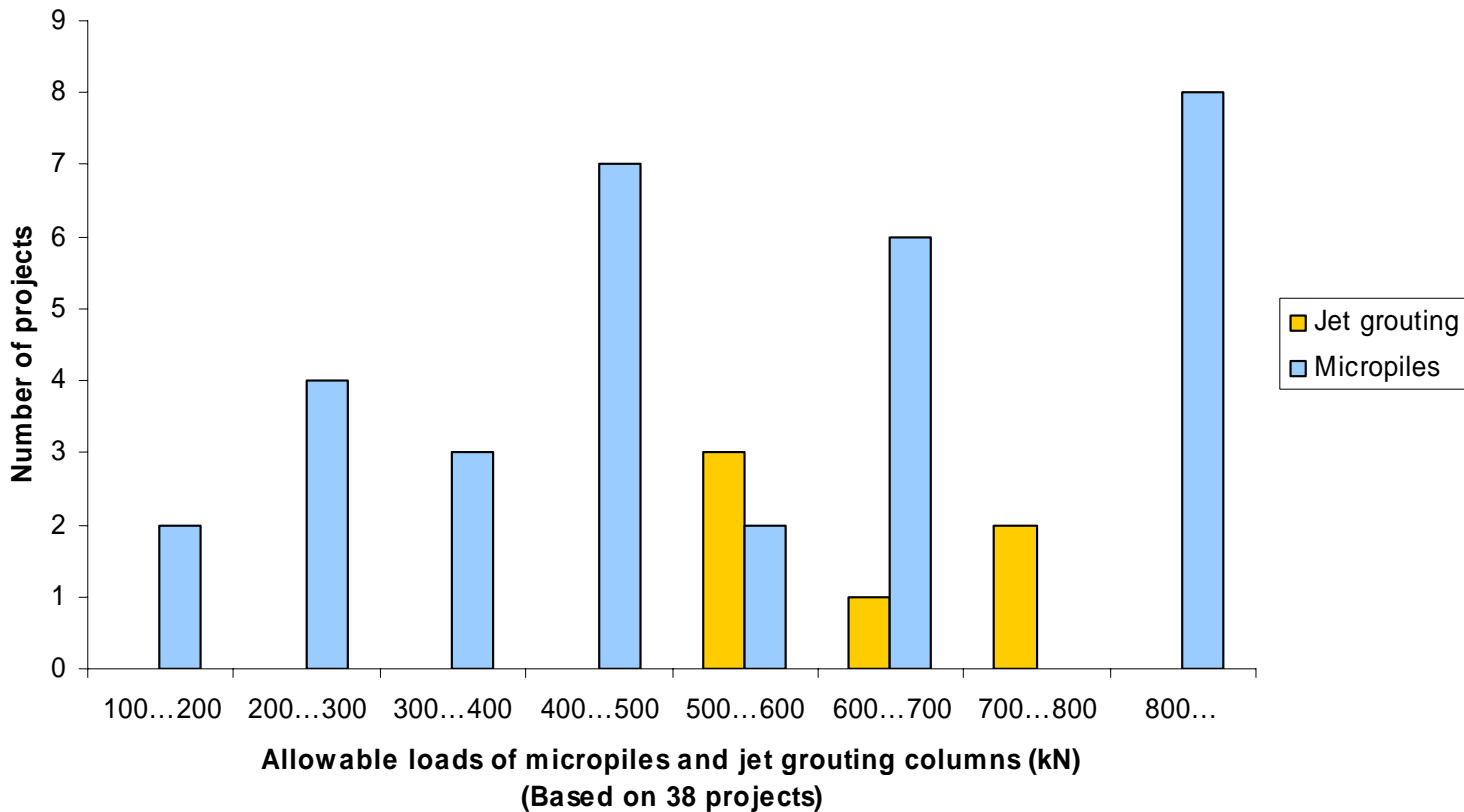


Maintenance includes:

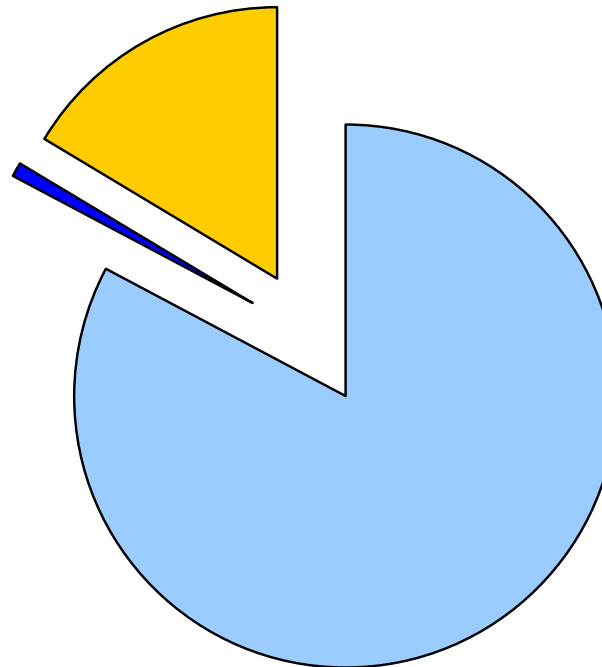
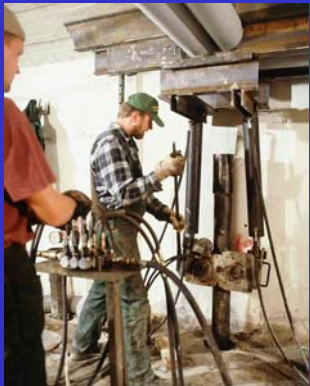
- Boron protection
- Groundwater feeding

There are 10 projects out of 102 in maintenance

ALLOWABLE LOADS OF THE DATU MICROPILES AND JET GROUTING COLUMNS



BEARING FEATURES OF THE DATU MICROPILES

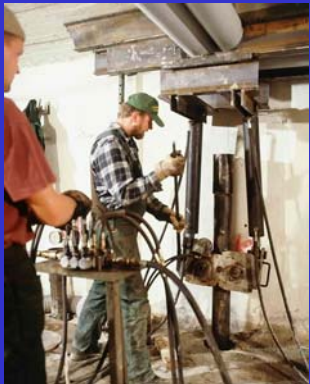


- End bearing
- Shaft bearing
- Combination bearing

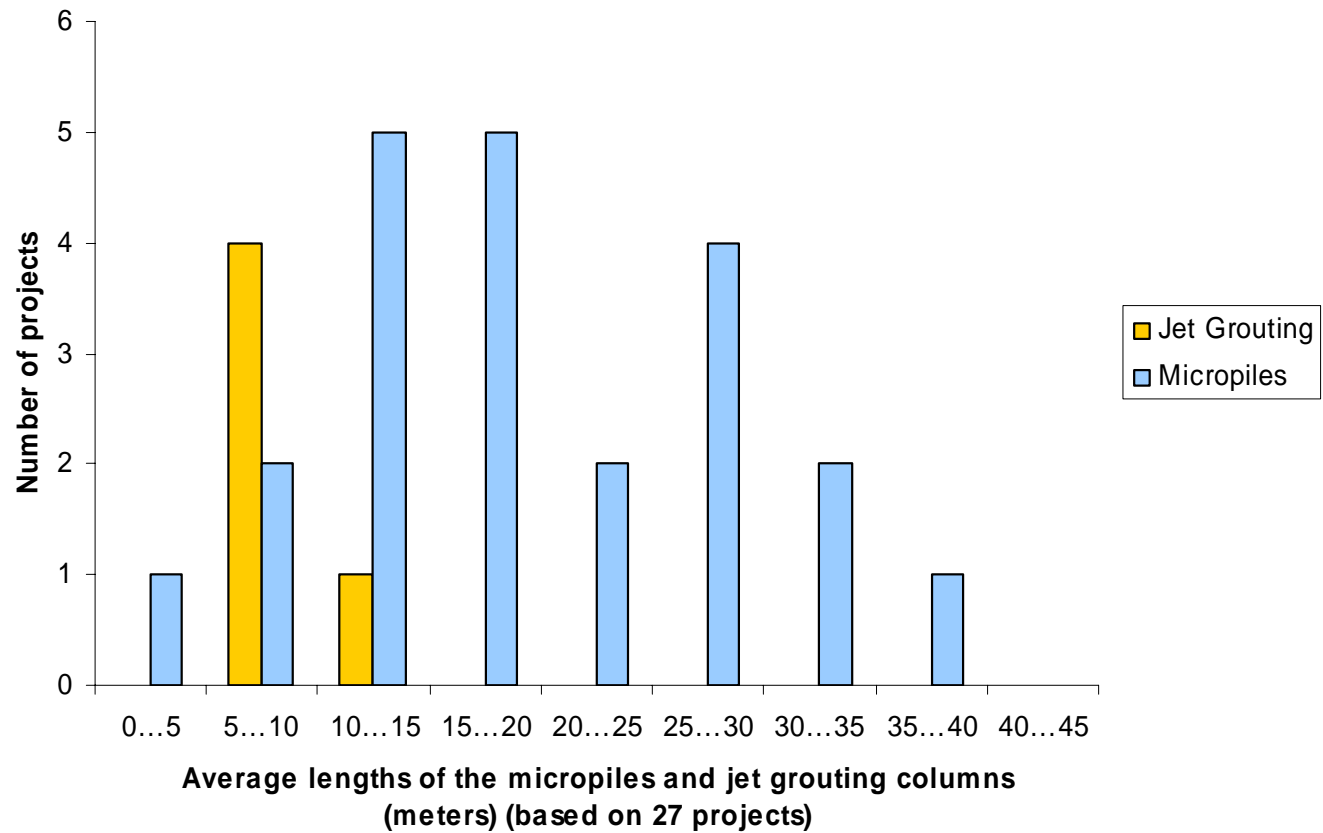
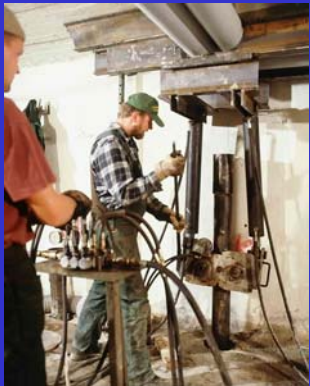
The chart is based on information
from 41 projects

PILE TYPES

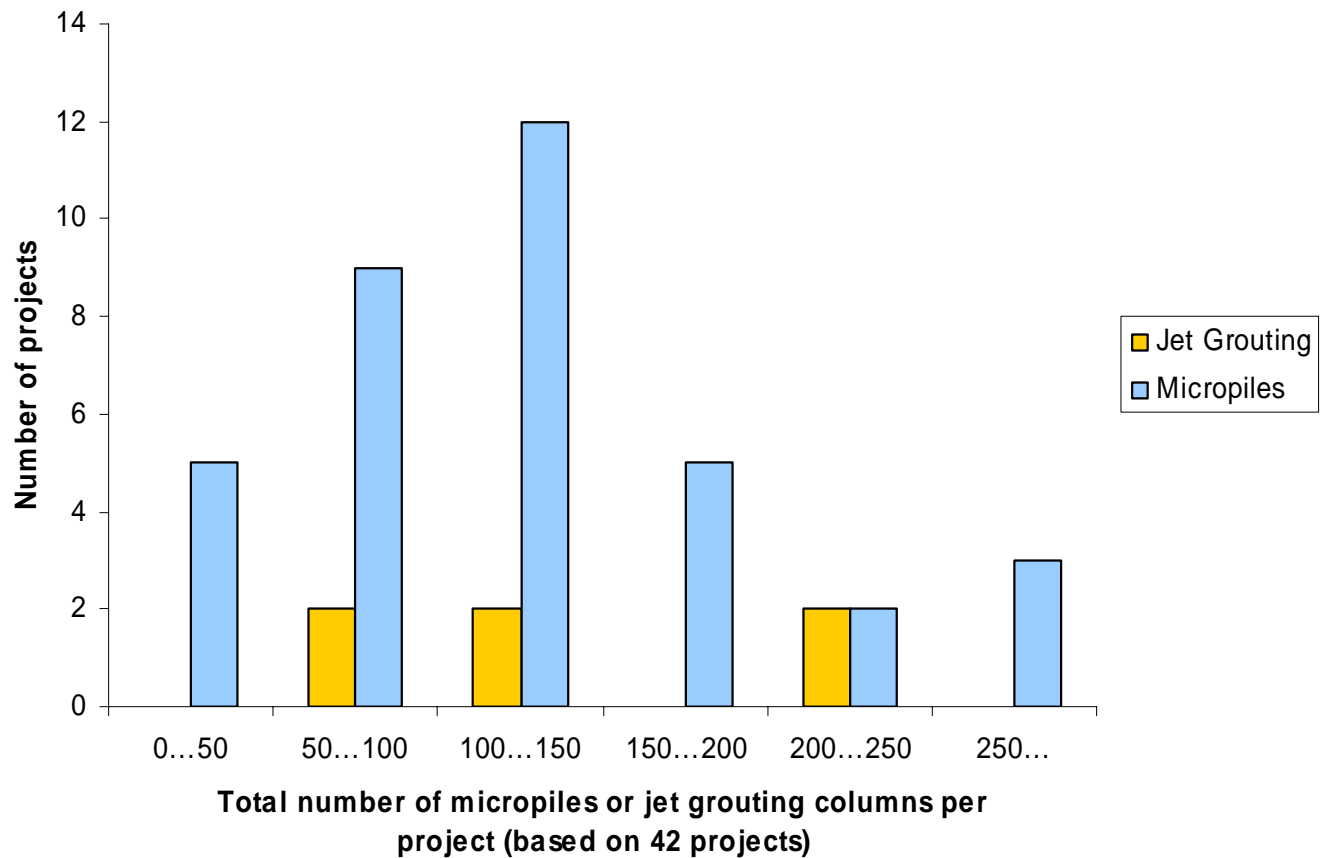
Type	Manufacturer
RR-piles	Rautaruukki
RD-piles	Rautaruukki
CSG-piles	Rautaruukki
X-piles	Rautaruukki
G-piles	Gustafsberg
Titan-piles	Ischebeck
MAI-piles	MAI International GmbH
Mega-piles	Pre-cast concrete pile manufacturer



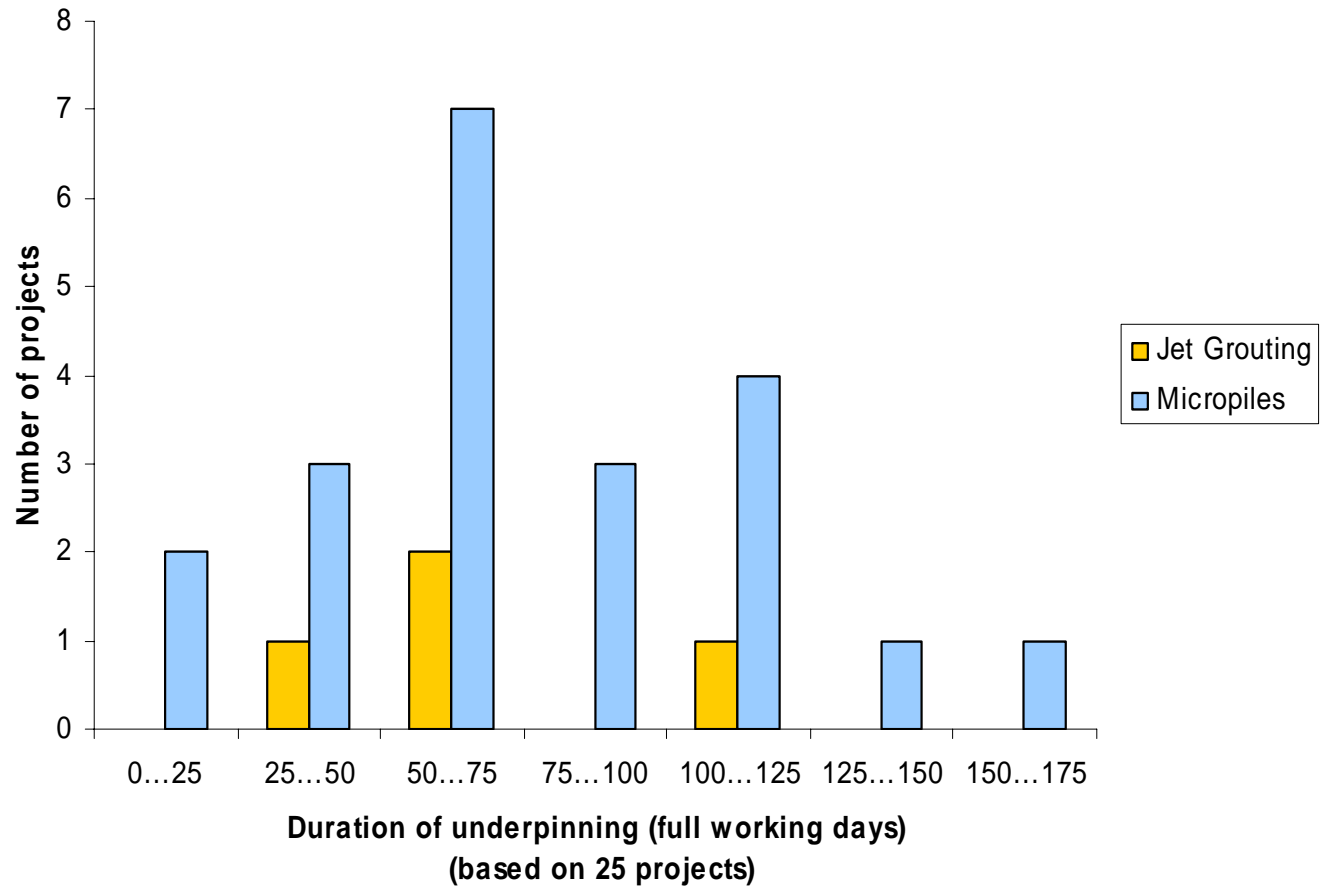
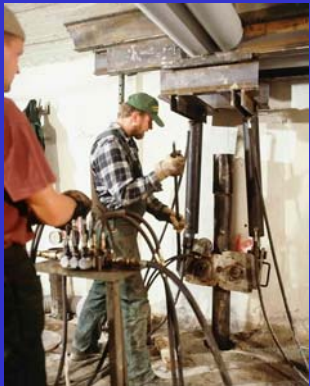
LENGTH OF THE DATU MICROPILES AND JET GROUTING COLUMNS



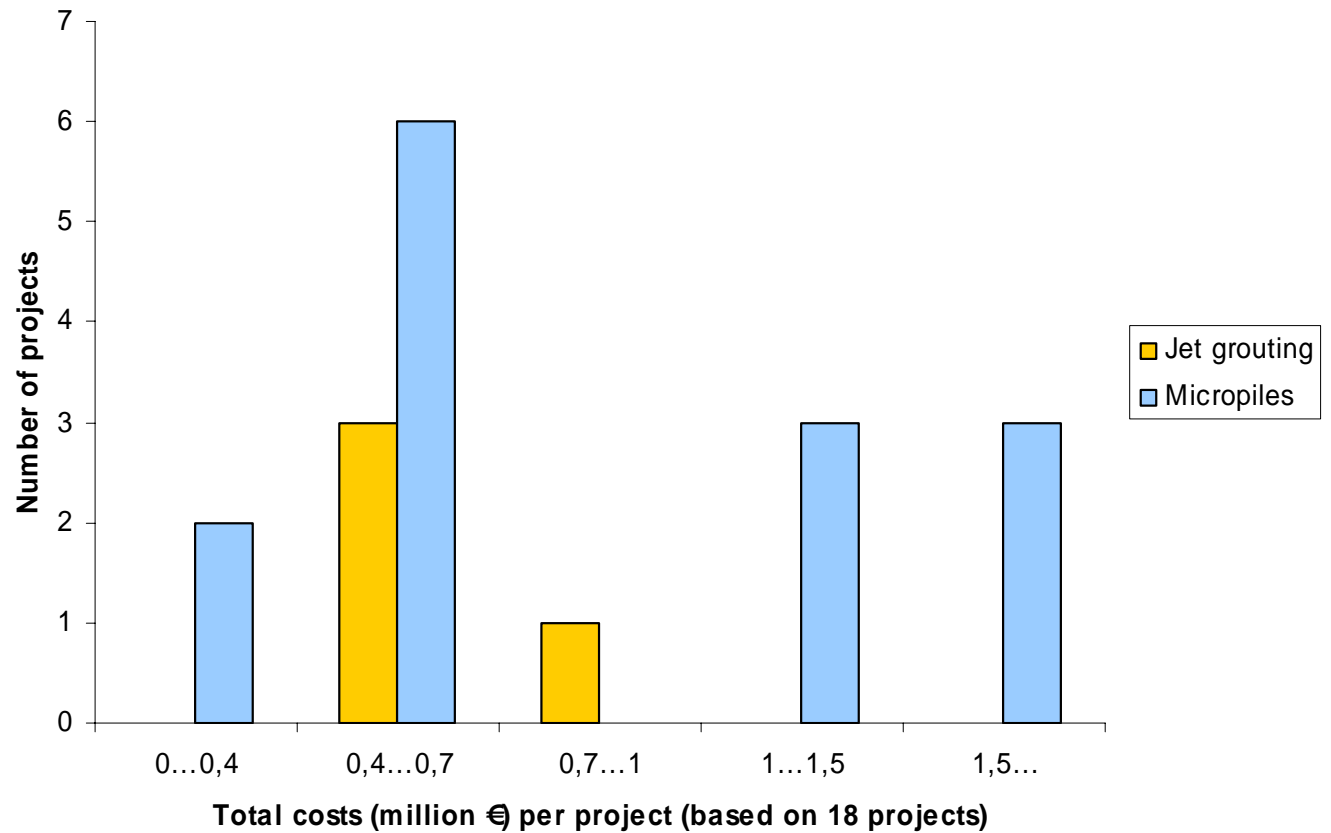
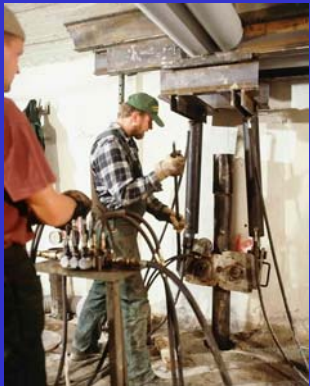
SIZE OF THE DATU PROJECTS



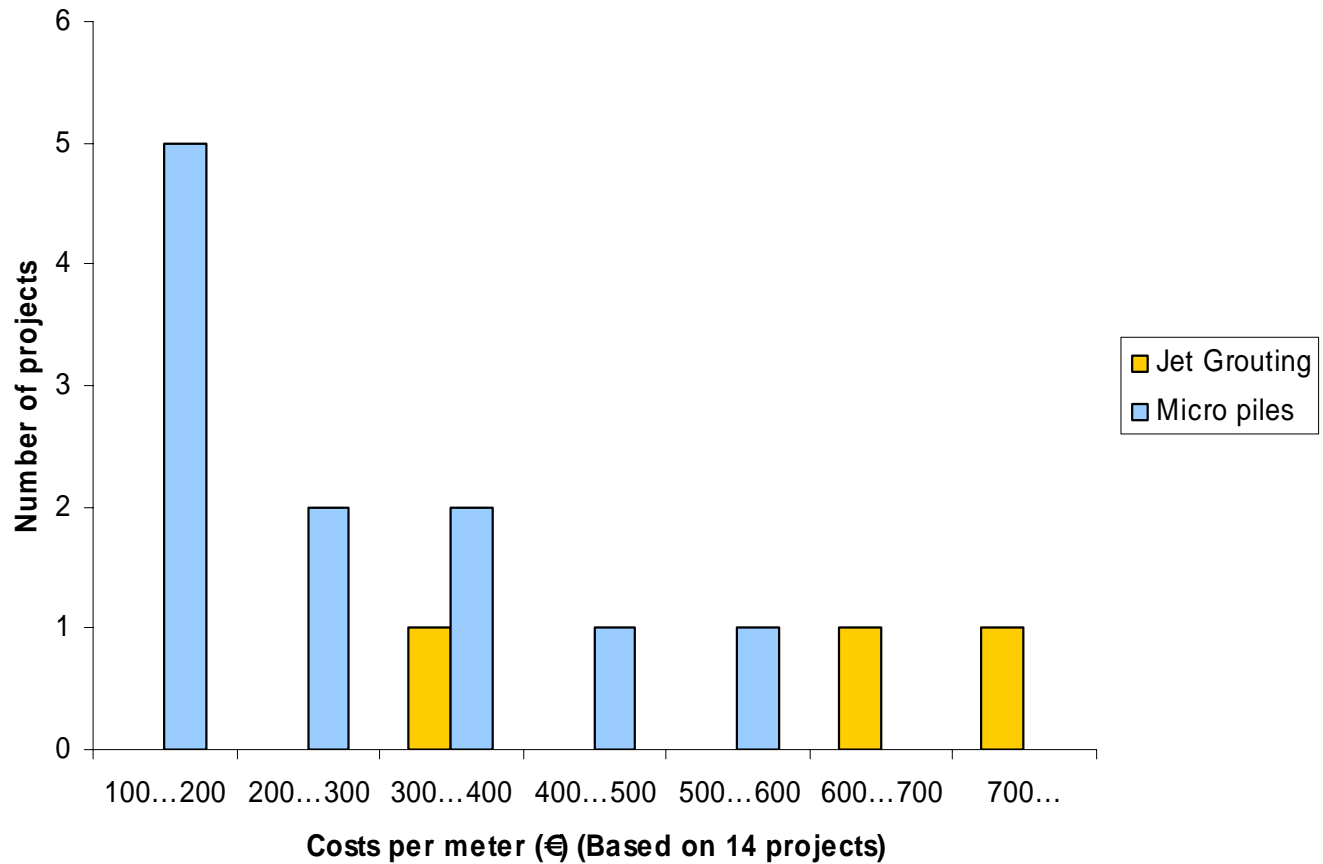
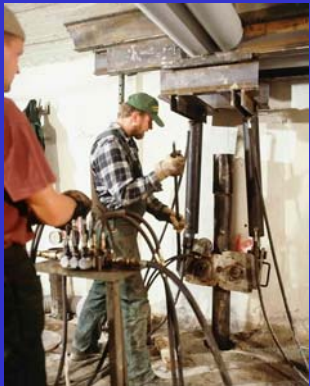
DURATION OF UNDERPINNING



COSTS OF THE DATU PROJECTS



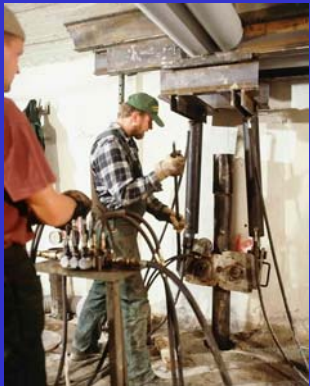
COSTS OF THE DATU PROJECTS





PARTNERS

- Turku Polytechnic
- Tekes
- Tampere University of Tehcnology
- Turku City Council
- Senaatti Real Estates
- The real estate association of Varsinais-Suomi (Turku)
- Narmaplan Oy
- Rautaruukki Oyj
- Skanska
- Lemminkäinen



MICROPILE ARTICLES DELIVERED TO DR HERBST

- Jouko Lehtonen: Shaft bearing micropiles, lisensiaatin tutkimus, Tampereen teknillinen korkeakoulu, pohja- ja maarakenteiden laboratorio 2001.
- J. Lehtonen, J. Rantala, S. Eronen, M. Koskinen: Finnish Experiences from Superstructures Supported Directly on Steel Piles, Proceedings of the XV ICSMGE Istanbul 2001.
- Eronen S. & Hartikainen J. Drilled steel pipe piles in effective bridge construction. Proceedings of XIIIth European Conference on Soil Mechanics and Geotechnical Engineering. Prague 2003. Volume 2. s. 140-146.
- 10. Hartikainen J., Pitkänen J. & Jokiniemi H. Effective steel foundation system for detached and row houses. Proceedings of XIIIth European Conference on Soil Mechanics and Geotechnical Engineering. Prague 2003. Volume 2. s. 179-184.
- Eronen Sami. Drilled steel pipe piles in underpinning and bridge foundations. Lisensiaatintyö. 2001. 170 s.
- Koskinen Mauri. Composite Action of Steel Pipe Pile. Research Report. 1997. 27 s.
- Muhra Henning. Micropiles in Northern and Middle Europe. Tutkimusraportti. 1997. 71 s.
- Hartikainen, J., Classification of Micropiles Types. Third International Workshop on Micropiles. Turku. June 4. - 7.2000.
- Korkeakoski, P., Underpinning with jacked piles. Baltic Piling Days 3 s. Pärnu, Estonia. 1-2 February 1999.
- Korkeakoski P., Jacked steel pipe piles in underpinning. DFI 98 7th International Conference and Exhibition on Piling and Deep Foundations. Vienna. 1998.
- Korkeakoski, P., Eronen, S., Development of Rautaruukki Micropiles. Second Int. Workshop on Micropiles. Ube. 1999.
- Korkeakoski, P., RR Pile Design, Third International Workshop on Micropiles. Turku. June 4. - 7.2000.
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MICROPILE ARTICLES DELIVERED TO DR HERBST



- Korkeakoski, P., Kataja, J. (toim.) (nro 49) Proceedings of the 3rd International Workshop on Micropiles. Turku. June 4. - 7. 2000.
- Korkeakoski, P., Lehtonen, J., Heikinheimo, R., Underpinning with Steel Pipe Piles. Twenty-fifth Annual Meeting and Eighth International Conference and Exhibition. DFI 2000 New York. 2000.
- Lehtonen, J., Korkeakoski, P., CMG pile, a new driven pile for underpinning. Baltic Piling Days, 3 s. Pärnu, Estonia. 1-2 February 1999.
- Hartikainen, J., Why wooden piles in Turku are decaying?, Third International Workshop on Micropiles. June 4. - 7.2000, Turku.
- Hartikainen, J., Koskinen, M., Suomalainen, J., Effective construction of railway underpass bridges on steel pipe piles. S. 141-146. The Twelfth European Conference on Soil Mechanics and Geotechnical Engineering. Amsterdam 1999.
- Korkeakoski P., Eronen S., Railway bridge Foundations with High Capacity Drilled Piles DFI 98 7th Internatinoal Conference and Exhibition on Piling and Deep Foundations Vienna. 1998.
- Korkeakoski, P., Eronen, S., Heinonen, J., Reliable foundations for railway bridbes with drilled steel pipe piles. S. 1779 -1782. The Twelfth European Conference on Soil Mechanics and Geotechnical Engineering. Amsterdam 1999.
- Lehtonen, J., Korkeakoski, P., CSG pile, a new application for soil nailing and micropiling. 4th International Conference on Ground Improvement and Geosystems. Helsinki. 2000.
- Eronen Sami, Hartikainen Jorma, Lehtonen Jouko: *Improved Competitiveness of Drilled Piling*, Rakennustekniikka 6/97
- Jouko Lehtonen: *CMG piles for underpinning works*, First Baltic seminar and exhibition supported by Deep Foundations Institute, Pärnu 1999

MICROPILE ARTICLES DELIVERED TO DR HERBST

- J. Törnqvist, J. Lehtonen: *Estimation of corrosion rate in durability design of steel piles*, XII European Conference on SMGE, Amsterdam 1999
- Jouko Lehtonen: *CMG piles, a new application for driven micropiles*, the 6th International Conference on "Modern Building Materials, Structures and Techniques", Vilnius Gediminas Technical University 1999
- Jouko Lehtonen: *Jacked CSG piles*, the 2nd international workshop on jacked piles, Turku 1999.
- Jouko Lehtonen: *CSG pile - a new application for impact driven micropiles*, the 2nd International Workshop on Micropiles '99IWM, Ube 1999
- Jouko Lehtonen, Pasi Korkeakoski: *CSG piles, a new application for micropiles and soil nailing*, the 4th GIGS, Helsinki 2000
- Jouko Lehtonen: *Steel pile development in Northern Europe*, Baltic Geotechnics, Pärnu 2000.
- Jouko Lehtonen: *Design of CSG piles*, the 3rd international workshop on micropiles, Turku 2000
- Pasi Korkeakoski, Jouko Lehtonen, Reino Heikinheimo: *Underpinning with Steel Pipe Piles*, DFI 2000 Conference, New York 2000
- J. Lehtonen, J. Rantala, S. Eronen, M. Koskinen: *Finnish Experiences from Superstructures Supported Directly on Steel Piles*, Proceedings of the XV ICSMGE, Istanbul 2001.
- Jouko Lehtonen: *Micropile development in North Europe*, IWM Steering Committee Meeting, Lille 2001.
- Jouko Lehtonen: *Design and execution of CSG piles*. TTKK:n paaluseminaari, Tampereen teknillinen korkeakoulu, 2001.
- Jouko Lehtonen, Stefan Aronsson: *Grouting of micropiles in Scandinavia*. The 3rd International Conference on Grouting and Ground Treatment. Deep Foundations Institute. New Orleans 2003.

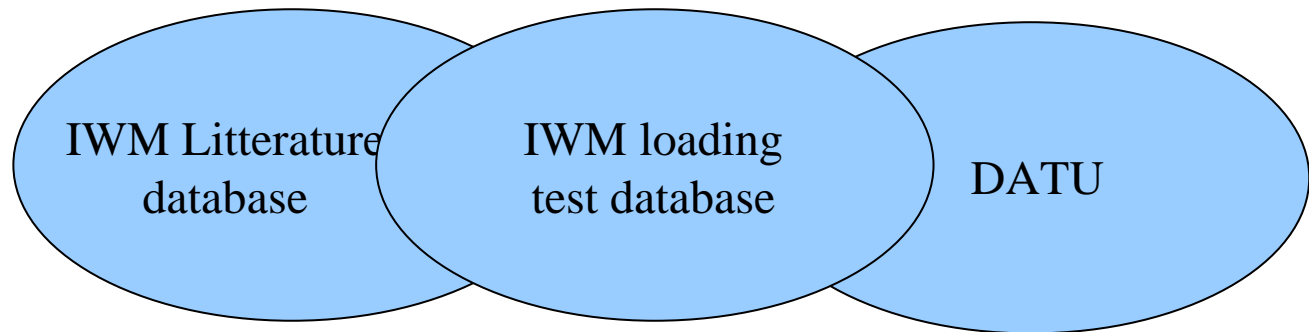
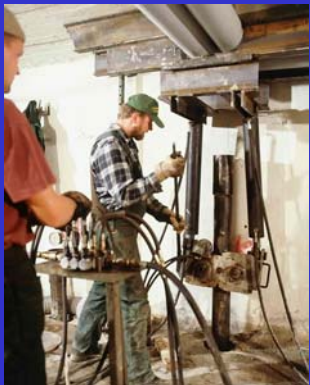


MICROPILE ARTICLES DELIVERED TO DR HERBST

- J. Lehtonen: *Side Grip Piling, a new method for impact driving of micropiles*. Proceedings of the 13th ECSMGE, Prague 2003.
- Jouko Lehtonen: *State of micropile knowledge in Nordic Countries*. IWM2003 Session 1, Seattle.
- Jouko Lehtonen: *Real Estate Management Strategy and Underpinning*. IWM2003 Session 2, Seattle.
- Jouko Lehtonen: *Finnish PRIMA – Technology Programme in Foundation Engineering and Soil Mechanics with Special Emphasis on Micropiles*. IWM2003 Session 3, Seattle.
- Jouko Lehtonen: *Micropiles and Underpinning Education at Turku Polytechnic*. IWM2003 Session 4, Seattle.



FUTURE DATABASES ON MICROPILES





ADDITIONAL INFORMATION

- www.datu.info
- jouko.lehtonen@turkuamk.fi

