

8th IWM 2007 Toronto



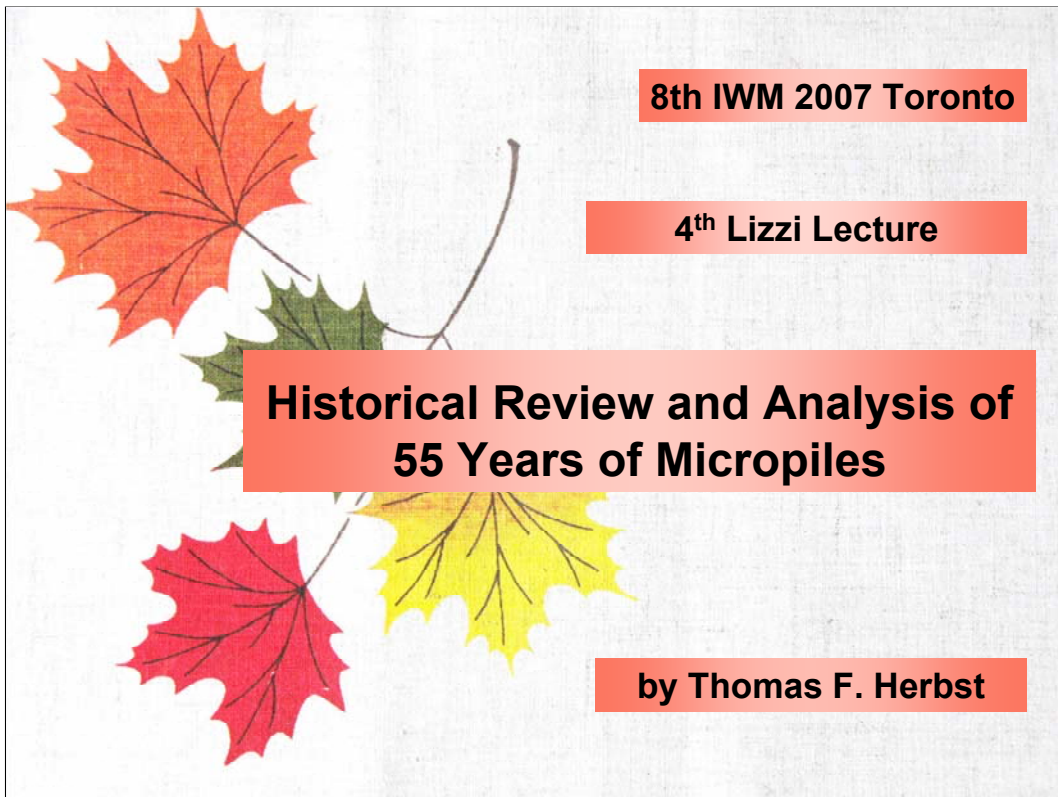
Good morning

Bon jour

Grüß Gott

Hyvää huomenta

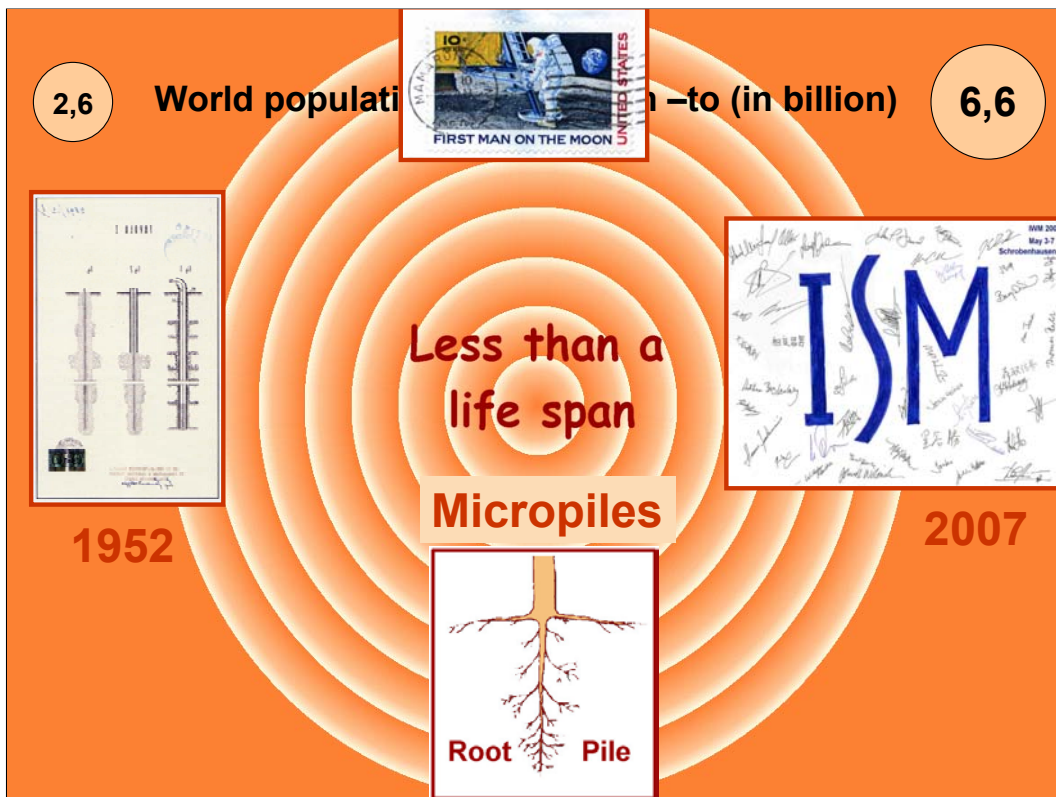
おはようございます。



- A Lizzi Lecture may be dedicated to the life and work of Lizzi it may as well deal with other topics but commemorating his inspiration to the field of micropiles. So far his work and his inspiration to further research work were treated in the preceding 3 Lizzi Lectures.

- I like to invite you to reflect on the development of Micropiles from their origin up to present days in focusing on people and institutions who were pushing the technology.

Fernando Lizzi's life as origin and inspiration for the field of micropiles shall be highlighted with this historical review which covers an epoch of 55 years.



The historically short epoch from 1952 to 2007, the date of Lizzi's patent to present day, in which this special technology of micropiles with its applications has evolved is marked by global developments which have changed our world radically. Just 2 examples shall be mentioned to underline this:

- The world population has increased by 4 billion to about 6,6 billion people within this extremely short span of 55 years which shall be covered here, however, a time of 1,8 million years was needed for the growth and spreading of 2,6 billion people since homo erectus left Africa.
- Man has left for the first time his home planet for a short visit to the moon, a huge scientific and technical step for the mankind.
- Both stand for dramatic changes on our planet earth. The increase of population is a continuing challenge for food supply, lodging, infrastructure, education and employment, the second shows the unbelievable progress of science and technology.

Micropiling is influenced by both of them:

Infrastructure has to be adapted to the needs and urbanisation of a growing population, soil properties have to be improved to cope with the requirements of existing and new civil engineering structures.

The technological advances are used for a safe and economic application of micropiles and a continuing development of the technology.

Outline of the lecture

1. Fernando Lizzi: his life, his vision, his impact

2. Micropile activities spread over Europe: new systems and applications, research, guidelines

3. The American approach to Micropile technology

4. The International Workshops on Micropiles

5. The big research works and data bases

6. Knowledge dissemination and education

Changing gear:



- The idea of this lecture is to show the base on which we stand now.
- So far development and spreading of the micropile technology was left to individuals, academics, firms and committees in different countries which all contributed to the present state-of- the-art. From the beginning to present day we may discover that Lizzi’s inspiration has been guiding or influencing the micropile activities.
- The micropile activities shall now be enhanced by the newly formed “International Society for Micropiles, ISM”. This indicates a change of gear in the attempt to organize knowledge dissemination and communication for the geotechnical community. The past shall be reviewed and analysed for the future activities of ISM.



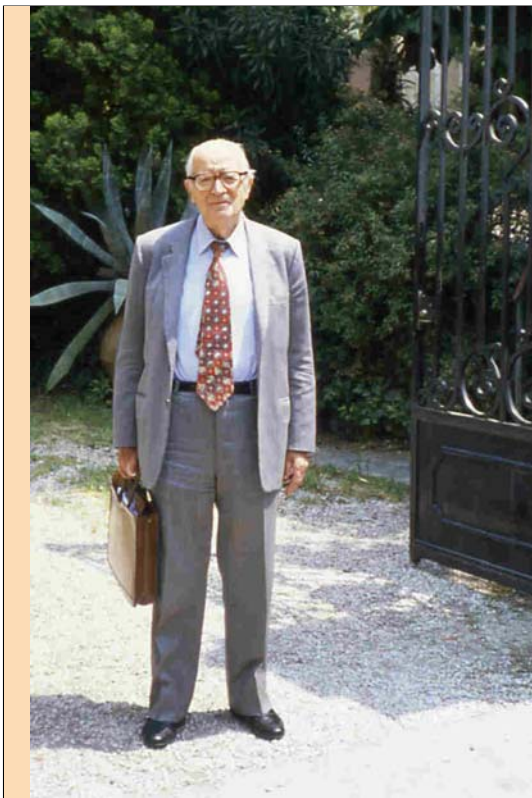
Dr.Eng. Fernando Lizzi

2.01.1914 – 28.08.2003

From age 4 to 18 in Napoli/ Italy, then military academy in Torino to become lieutenant at 22 , posted to Tripoly/ Lybia, wounded at age 28, studies civil engineering as POW in Afghanistan, returns 1946 to Napoli and gets his diploma with summa cum laude.

1947 becomes Technical Director of the newly founded contractor Fondedile where he develops the root pile technology for the restoration of damaged monuments and buildings. He conceives the consolidation with Reticulated Root Piles. He exports his ideas to many countries and becomes “father of the micropiles”

- Fernando Lizzi is considered the “father of micropile technology” and his curriculum vitae shall be kept in mind for future generations.
- He was born on January 2, 1914 in Castelnuovo di Porto, Italy near Rome. His father was a civil servant and his mother a housewife, both originally from Apulia, Italy. The family lived in Castelnuovo for just a few months and then moved to central Italy for another brief period.
- He retired from Fondedile in the late 1980s but remained active in consulting and related activities nearly until the time of his death, on August 28, 2003 in Napoli. He is survived by his wife, Italia Fauche', and his sons, Fedele and Fulvia.
- He is even mentioned in the internet encyclopaedia “en.wikipedia.org”



An engineer, in the beginning not even a foundation engineer, observed the nature and reflected on the slogan „Back to the roots“. The result was, 55 years ago, Fernando Lizzi’s „root pile“ which interacts with the ground in a dense network and changes the engineering properties of soils.

This idea is his heritage which still needs continuous evaluation and spreading in the profession.

He edited 2 books besides many publications:

-The static restoration of monuments (1982)

-Il consolidamento del terreno e dei fabbricati (1989)

• Italy owns a fantastic amount of medieval and antique structures and buildings as cultural heritage for the entire western world. Lizzi’s daily life was surrounded by the creations of master builders of Napoli and Italy. The structures and buildings started to deteriorate not only due to damages of World War II but by long term settlements of the ground and earth quakes. So he got involved with retrofitting these historic structures and conceived the formerly called “palo radice” as a response to this serious national cultural need. He combined his cultural concerns with a philosophy for a technical approach. His philosophy was based on his respect for the original designers and constructors and he developed a simple and succinct set of strategies that guided his actions.

•The successful execution of the restoration works is based on 4 principles:

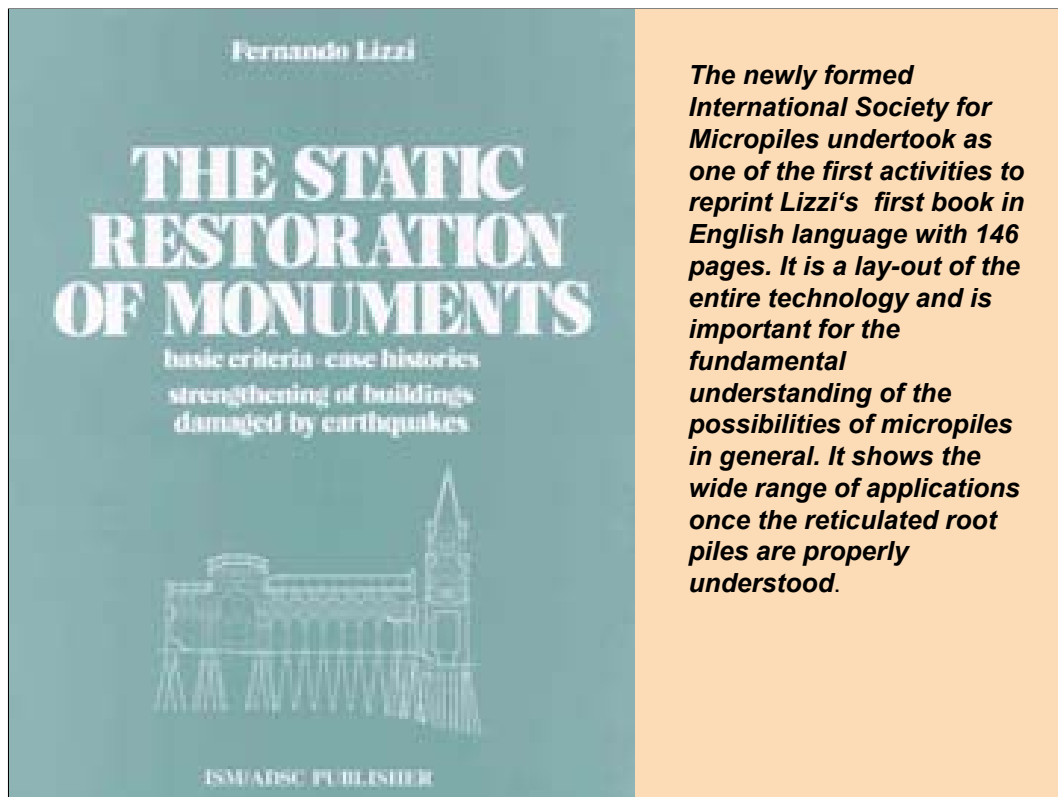
•*“Primum non nocere”(Latin). First, do no harm.*

•*Maintain the existing equilibrium.*

•*Reinforce both the soil and the existing structure.*

•*Strictly preserve the construction scheme and the original aesthetic designed by the original architect / engineer.*

•He always dealt with both the restoration of existing structures and the consolidation of existing ground. He even started first with the restoration of historical structures but was aware that the works had to include the consolidation of the foundation. The combination of both made his concept so unique.



•His concept of restoration and consolidation was used first in Napoli, then spread all over Italy, then Europe and to many other countries. Many well known restored and rehabilitated structures benefited from his artistic and engineering skill, e.g.,

Ponte a Tre Archi di Venezia,

Campanile di Burano,

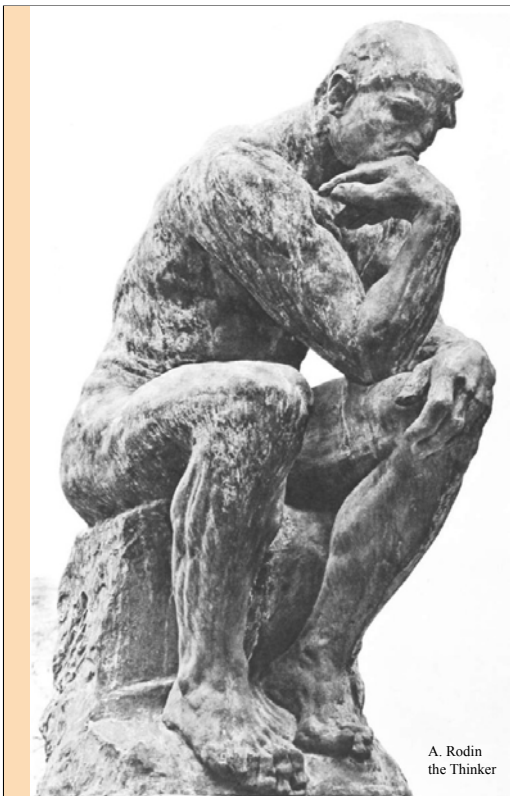
Hal Hadqua Minaret in Mosul (Iraq),

Tempio di Cerere di Paestum,

Notre Dame Cathedral in Paris.

Some of the typical works are described in Lizzi's two books: "The Static Restoration of Monuments" and „Il consolidamento del terreno e dei fabbricati" (1989)

The newly formed International Society for Micropiles undertook to reprint Lizzi's first book (in English language) with 146 pages. It is a lay-out of the entire technology and is important for the fundamental understanding of the possibilities of micropiles in general. It shows the wide range of applications once the reticulated root piles are properly understood.



A. Rodin
the Thinker

Lizzi's Farewell for IWM 2002 in Venice

„As for myself I am now only at the window, very far from the forefront. Therefore the only comment I can supply is some reflections to our younger colleagues:

In order to deal with any matter it is essential to deeply know the way already covered by others... that is the State-of-the-Art... In Theory and Practice.

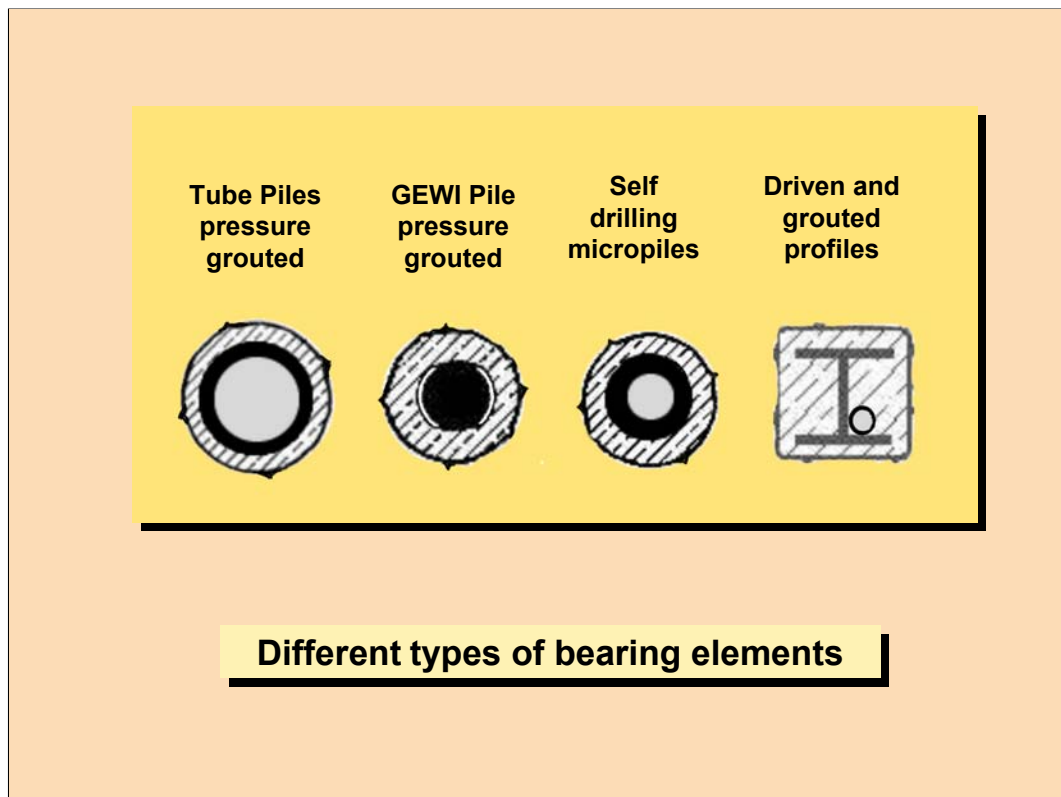
Ignorance does not pay. Beyond what has been already done there is probably something better to do.

This is based on the knowledge, but sometimes is stimulated by phantasy, by the imagination..“

**„IMAGINATION IS BETTER THAN
KNOWLEDGE“**

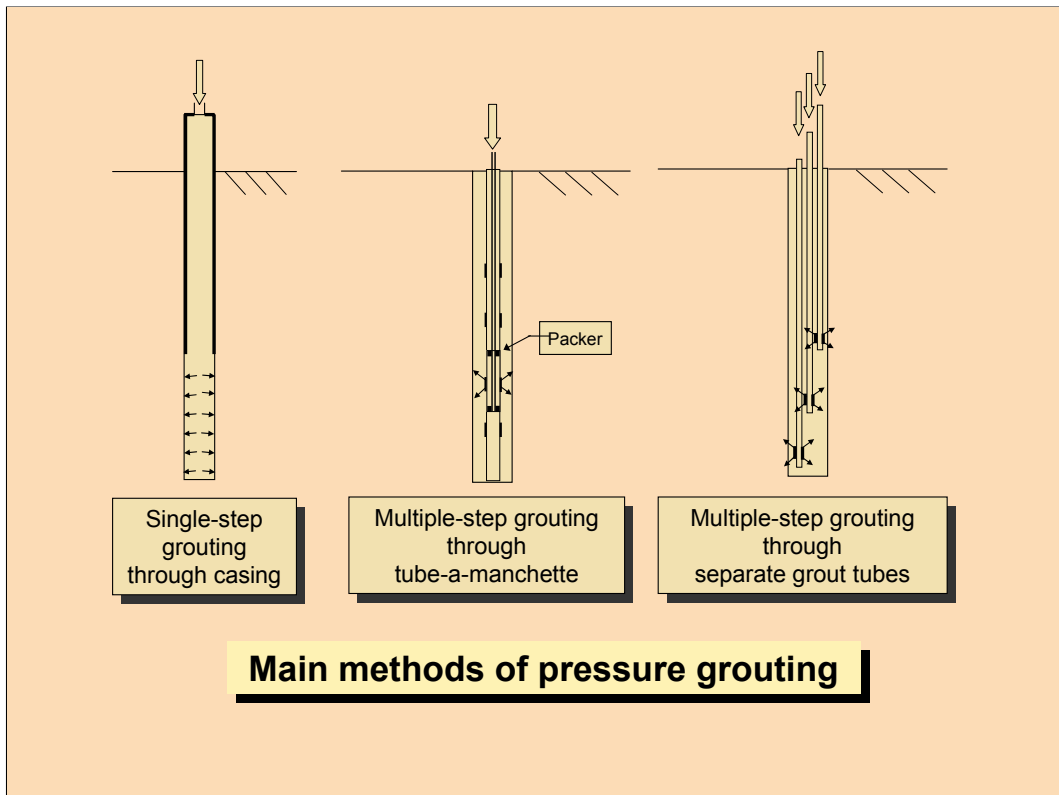
says Einstein

- Lizzi's professional life is marked by a feature which is less common nowadays in construction profession: At an early time in his professional life he became involved in the development of an idea which he was able to continue over his entire life time i.e. even almost 25 years beyond the age of official retirement.
- As he was member of a contractor his efforts of publication to promote the new technology are remarkable, however were necessary for the spreading of the technology.
- 1 year before his passing he sent to the delegates of the IWM 2002 in Venice a contribution with the following final remarks including the photo of Rodin's sculpture „the Thinker“ where he addressed the ingenuity of an engineer.



- While Fondedile spreads the Reticulated Root Pile concept from Italy to other European countries and elsewhere, the first competing micropile system, the Tubfix of Rodio is conceived in Italy as well. The spreading following the root pile and reticulated root pile concept is strongly marked by the variation of micropile designs.

- The differences which evolved in different European countries relate mainly to the type of reinforcement or bearing element. Most common are nowadays centrally placed single bars with high bearing capacity and a high bond to grout by threaded ribs like the GEWI pile. The other principal designs are all



- Main methods of pressure grouting which were already developed for ground anchors use either the drill casing or the tube of the bearing element or separately added grouting tubes.



Grouting in granular and cohesive soils

- The different soils require an adaption of the pressure grouting method to their properties. Granular soils which are pervious to cement grout allow big diameter grout bodies, cohesive soils are radially compressed by a confined grout pressure or fine fissures are cracked open by the grout pressure .



Corrosion and corrosion protection

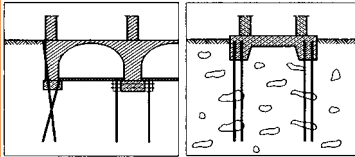
- Corrosion of steel determines the service life time of a micropile and appropriate measures of corrosion protection have to be applied. Very safe is a double corrosion protection system which is easy to be applied for centrally placed bars.

Year of issue	Country	Designation	Type	Organisation
1983	Germany	DIN 4128	Standard	DIN
1987	Great Britain	Specification for the Constr. of Minipiles	Recommendation	Fed. of Piling Specialists
1992	France	DTU 13.2, chapt.7	Standard	AFNOR
2001	USA	Guide for Drafting a Spec. for.....Micropiles for Struct. Support	Guideline	Deep Foundation Institute
2004	Europe	EN 14199 Execution of special geotechnical works – Micropiles	European Standard	CEN

Guidelines, recommendations, standards

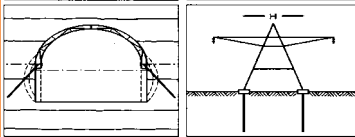
Designers and industry needed rules for the application and execution of micropiles. They were established after a big amount of research had been carried out in different countries. After the issue of even their preliminary drafts a spreading of the new technology and a wide application was observed. In Germany additional certificates of approval were required which were granted as early as in the mid 1970s.

- Underpinning
- Execution under confined working conditions
- Upgrading of load bearing capacity
- Seismic retrofitting



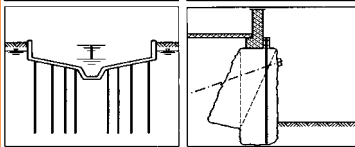
- New foundations
- Difficult ground conditions
- Light weight drilling rigs
- Any inclination
- Environmentally sensitive conditions: ground water, noise, excavation disposal

- Settlement control
- Foot support of tunnel headings
- Side wall strengthening of tunnel benches



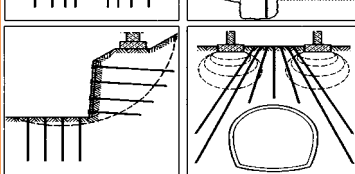
- Alternating compression and tension loads
- Easy connection to superstructures

- Uplift securing
- Controlled underwater drilling and grouting
- Tie down for horizontal jet grouted diaphragms



- Combination of micropile installation with jet grouting
- Retaining structures

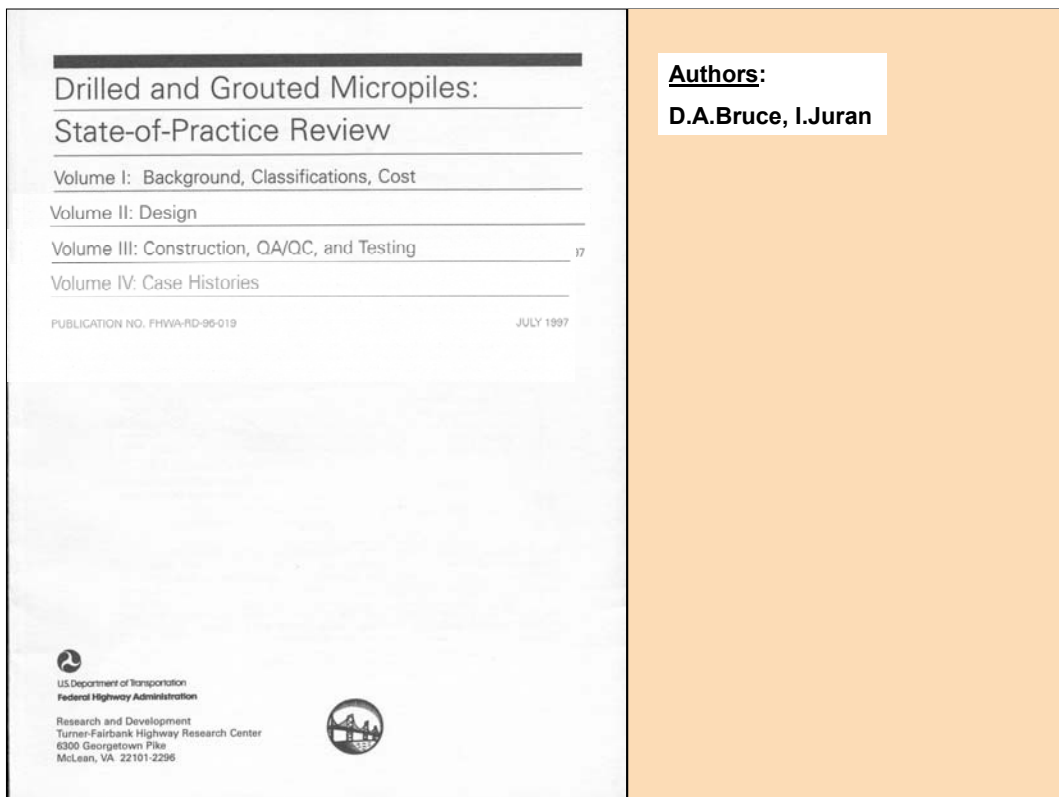
- Slope and embankment stabilization
- Combination with soil nailing



- Reinforced soil
- Strengthening of ground properties

Fields of application

The field of application was widening when design rules were established and the the execution methods were improved



- Only when technical publications started in the USA 1987 a wider professional public became aware of the potential of the new ground improvement technology and its merits for urban rehabilitation and infrastructure.
- It was felt, however, that the knowledge of the so far existing technology which was mainly spread over Europe had to be compiled in order to set a basis for American application. FHWA with Al Dimillio sponsored 1994/95 a “State-of-Practice Review on Drilled and Grouted Micropiles” under the chairmanship of D.A. Bruce and I. Juran consisting of 4 volumes. It constitutes even up to date the most comprehensive document on micropiles and combines the historical background with the state of knowledge of 42 years of micropiles until 1994. Even F. Lizzi, the father of micropiles, was at this time part of the international advisory group.
- This initiative started to involve a wider group of professionals, industry and DFI, the Deep Foundation Institute in the USA. In 2002 the ADSC with Scot Litke joined in and actively supported the efforts in particular by publishing frequently in their wide spread periodical “Foundation Drilling” and opening their Technical Library for micropiles.



- The American colleagues of the international advisory group for the FHWA Report became soon aware that maintaining the contact with the international experts for micropiles is a unique chance to further advance the technology. Moreover interest had increased substantially by the beginning of the French national project FOREVER on groups and networks of micropiles for dynamic loadings. After the Hyogoken-nanbu earth quake in Japan 1995 with tremendous destructions Japanese geotechnical experts discovered the Micropile technology on their search for tools to rehabilitate and safeguard structures.
- Under the leadership of Dr. Donald Bruce and Mary Ellen Bruce as secretary the idea of the International Workshop on Micropiles was born. The concept was to gather experts from different professional sections and active countries in order to collect and disseminate the knowledge among them and to optimise the progress of the technology.
- So far 8 IWMs were initiated with alternating lieus of venue in North America, Japan or an European country starting in 1997.
- We celebrate 10 years of successful IWM which was so far the name for all activities and involved persons . Within this period many delegates



IWM 1997 Seattle, delegates in front of Doubletree Inn

- You may recognize several faces just 10 years younger who actively promoted the Micropile technology

**INTERNATIONAL
WORKSHOP
ON
MICROPILES**

SEPTEMBER 26-28, 1997

**DOUBLETREE INN
SEATTLE, WASHINGTON**

**DEEP FOUNDATIONS INSTITUTE
FEDERAL HIGHWAY ADMINISTRATION
JAPANESE ASSOCIATION OF MICROPILES**

Organizers:

Dr. D. Bruce (USA) , K. Kimura
(Japan), JAMP, FHWA, DFI

Introductions to first IWM:

Dr. Al DiMillio (FHWA)

Prof. M. Hoshiya (JAMP, Japan)

Mr. G. Compton (DFI)

Dr. M. Okahara (PWRI, Japan)

Prof. I. Juran (ISSMFE)

Prof. F. Schlosser (FOREVER)

Dr. D. Bruce (ECO Geosystems, Inc.)



IWM 1999 Ube, Japan, delegates at banquet



IWM 1999 Ube

**Visit to Public Works Research Institute (PWRI)
Research Center in Tsukuba**

A most impressive visit to the research facilities of PWRI which included not only geotechnical testing but also wind channel tests for a new suspension bridge or a car race track



Second International Workshop on Micropiles

Proceedings

October 4 - 5, 1999
Ube City Culture Hall



'99IWM Executive Committee
Yamaguchi University

Organizers: Prof. Fusanori Miura and
staff of Yamaguchi University

Welcome remarks:

Prof. M. Hoshiya, Musashi Institute
of Technology

Prof. H. Osaka, Dean of Faculty of
Eng., Yamaguchi University

Dr. Albert F. Dimillio,
U.S. Department of Transportation /
FHWA

Session chairs:

- Prof. I. Juran
- Dr. A. Dimillio and J. Fukui
- T. Armour and Prof. K. Miura
- F. Pagliacci and Prof. K. Nakagawa
- Prof. F. H. Kulhawy and M.
Kawamura
- A. Kleiber and Prof. Y. Maeda

IWM 2000
Turku,
Finland



Conference rooms in Old City Hall and on the boat, typical cottages



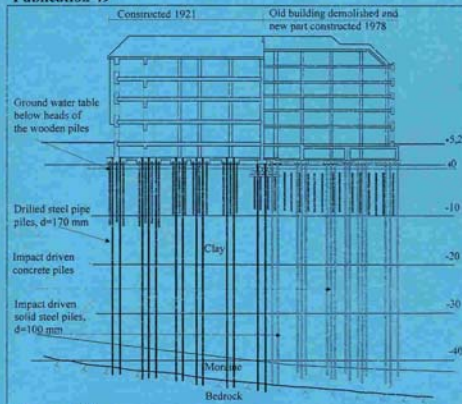
IWM 2000 Turku, attendees in front of the Old City Hall



TAMPERE
UNIVERSITY OF
TECHNOLOGY
Geotechnical Laboratory

Proceedings of
**Third International
Workshop on Micropiles**
June 4-7 2000
Turku

Publication 49



Organizers:

Jouko Lehtonen, Prof. Jorma
Hartikainen, Pasi Korkeakoski, TUT
Tampere, Rautaruukki Oyj

Session chairs:

- Prof. Fusanori Miura, Japan
- Prof. Jorma Hartikainen, TUT, Finland
- Dr. Roger Frank, France
- Dr. Thomas Herbst, Germany
- Dr. Al DiMillio, FHWA, USA
- Prof. Fred Kulhawy, Cornell Univ, USA

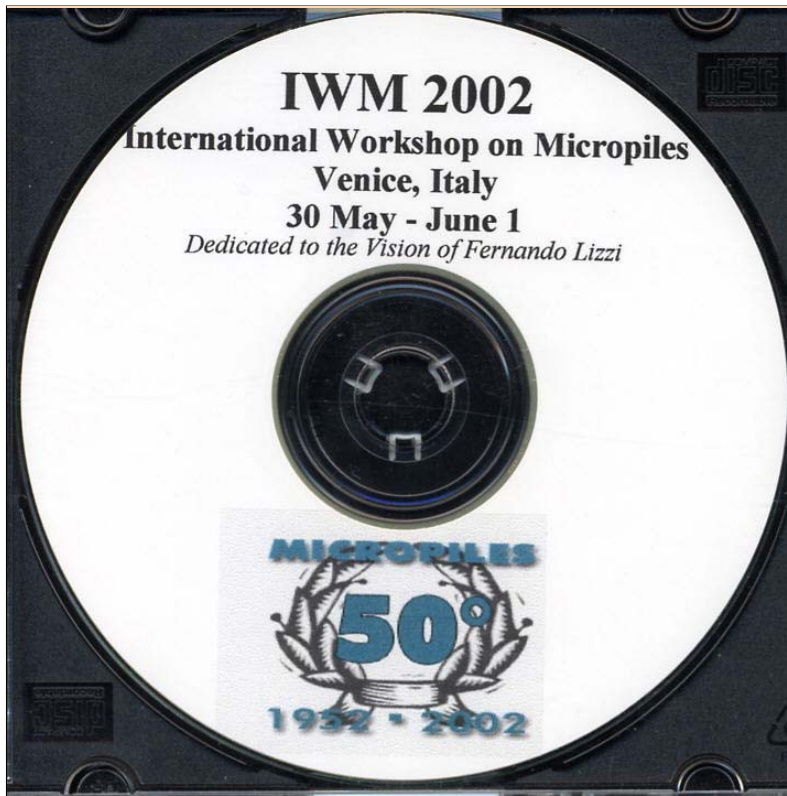


- The IWM 2002 held in Venice honored the 50th anniversary of the development of micropile technology. This conference was dedicated to the Vision of Fernando Lizzi, given that so many current practitioners and researchers continue to be inspired by his concepts.



Companion's program in Venice

The attraction of Venice increased the group of companions to half of the number of the delegates



Organizers:

Renato Fiorotto,
Casagrande

Session chairs:

- Dr. Donald Bruce, USA
- Prof. Roger Frank, France
- Horst Aschenbroich, Canada
- Robert Traylor, USA
- James Mason, USA
- Prof. Ilan Juran, USA
- Dr. Thomas Herbst, Germany
- Dr. Al DiMillio, USA
- Tom Armour, USA

5th IWM 2003 Seattle



Humankind has not
woven the web of life.
We are but one thread within it.
Whatever we do to the web,
we do to ourselves.
All things are bound together.
All things connect.

-Chief Seattle-



IWM 2003 Seattle, attendees at ferry to Tillikum Village

IWM 2003



IWM 2003
International Workshop on Micropiles
Seattle, WA, U.S.A.
September 24-27, 2003

Organizers:

Dr. Donald Bruce, Scot
Litke, Tom Armour,
ADSC, DBM

Session chairs:

- Dr. D. Bruce, USA
- Bob Traylor, USA
- A. Rodriguez-Marek,
USA, Prof. Y. Maeda,
Japan
- Horst Aschenbroich,
Canada

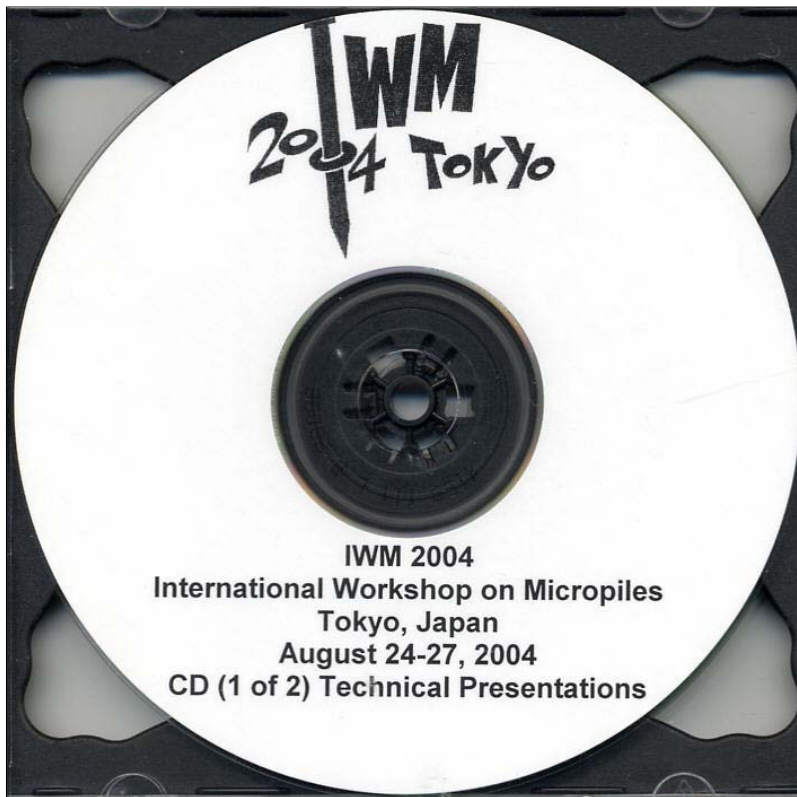
1st Lizzi Lecture:
James Mason, USA

Break-out sessions:

T. Armour, D. Bruce,
A. Cadden, A. DiMillio,
R. Frank, Th. Herbst,
M. Ishida, E. Loehr,
J. Lehtonen, K. Miura,
T. Shantz, J. Wolosick,
P. Woodfield, T.
Yamane,



IWM 2004 Tokyo, all attendees



Organizers:

Prof. Masaru Hoshiya,
Musashi Institute of
Technology

Session chairs:

- Dr. D. Bruce (USA)
- Prof. F. Miura (Japan)
- Dr. Jiro Fukui (Japan)
- Prof. Kinya Miura (Japan)

2nd Lizzi Lecture:

Prof. F. Schlosser,
France

Break-out sessions:

T. Armour, D. Bruce,
R. Frank, J. Lehtonen,
E. Loehr, F. Schlosser,
M. Turner, T. Yamane,
G. Weinstein,
J. Wolosick,



IWM 2006 Schrobhausen, attendees at test site visit



**IWM 2006 Schrobenhausen
Companion's tour to Nymphenburg Castle in Munich**



IWM 2006 Schrobhausen, Bauer equipment show



Organizers:

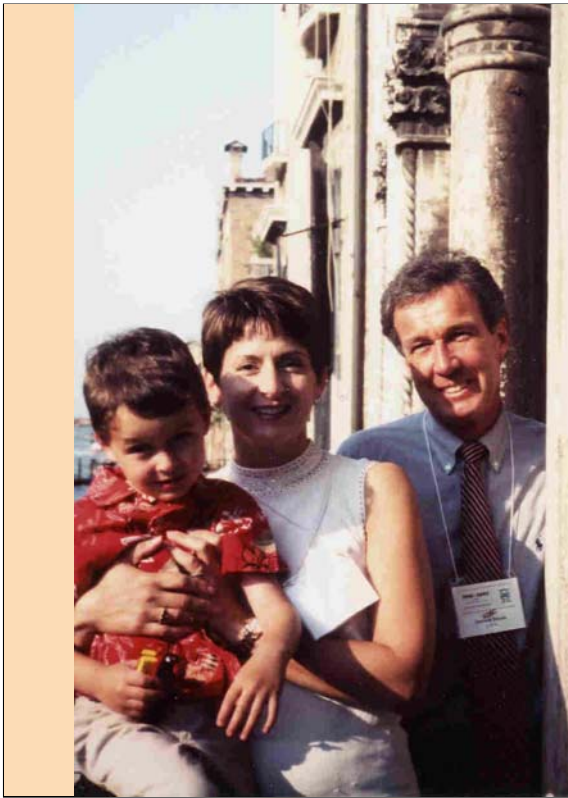
Prof. Wolfgang
Brunner,
Dr. Thomas Herbst,
Prof. Norbert Vogt

Session chairs:

- Dr. Donald Bruce, USA
- Allen Cadden, USA
- Jouko Lehtonen, Finland
- Horst Aschenbroich, Canada
- Paul Woodfield, U.K.
- Prof. Masaru Hoshiya, Japan
- Dr. Jesús Gómez, USA

3rd Lizzi Lecture:

Dr. Jiro Fukui, Japan



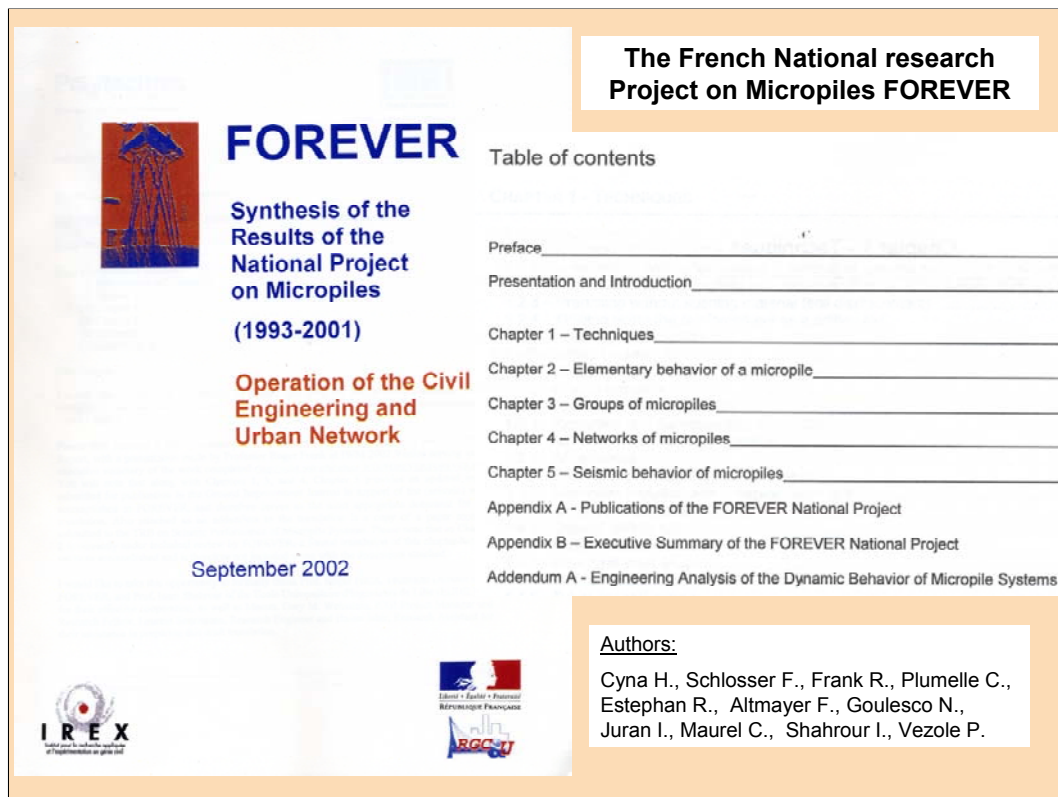
At the 1st IWM they just started to become a family, our two key IWM inspirational persons Donald and Mary Ellen Bruce with Max, their treasure and our mascot.

2002



2006

- Donald and Mary Ellen Bruce initiated the IWMs and were the promoters for advancing the technology by organizing the regular meetings of the experts at the IWMs and Max accompanied them from age 4 on.



The French National Research Project FOREVER (Fondation REforcée VERticalement), Soil Reinforcement by Micropiles 1993 – 2001

The initial idea of the research project evolved after discussions with F.Lizzi at the end of the 1970s. Obviously it was considered necessary that the only limited research carried out by Lizzi on groups and networks of micropiles had to be extended. The seismic response was not yet quantified even if observations after earth quakes showed encouraging results.

The research was funded by the French government (15%), French Partners (73%), US-FHWA (12%), totalling 7,1 Mio. USD.

The objectives were:

- Technology and Performance Assessment
- Evaluation and Development of Design methods
- Isolated, groups and networks behaviour (static and seismic loading)
- New fields of application

Research tools were:

- Full scale tests,
- Centrifuge tests,
- Calibration chamber,
- Numerical study

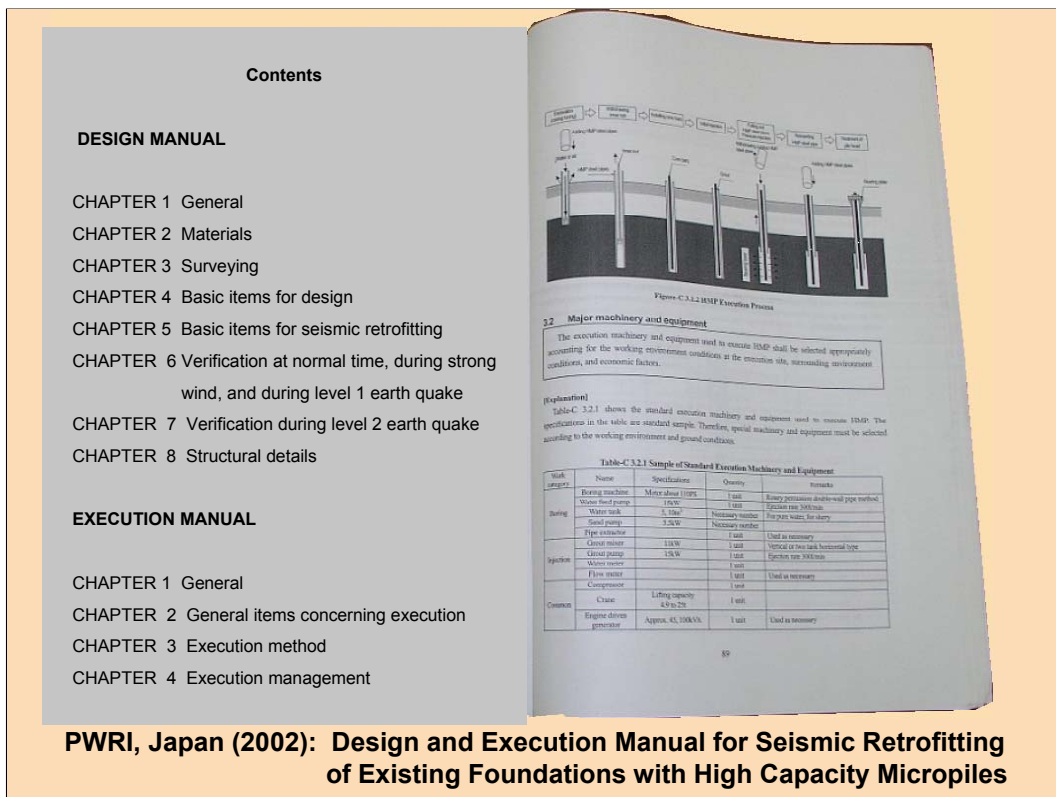
Conclusions: The results are summarized by F. Schlosser in the 2nd Lizzi



Hyogoken-nanbu earth quake, Japan 17.1.1995

•The Japanese Joint Research on the Development of Seismic Retrofit Method for Existing Bridge Foundations with High Capacity Micropiles (HMP), 1999-2001

The special Japanese interest in micropiles started after the Hyogoken-nanbu earthquake 1995 with tremendous destruction in infrastructure like bridges and buildings in Japan. A Japanese delegation attended already the 1st IWM in Seattle which was also sponsored by JAMP.



PWRI, Japan (2002): Design and Execution Manual for Seismic Retrofitting of Existing Foundations with High Capacity Micropiles

•PWRI, Advanced Construction Technology Center and 12 private contractors joined for an extensive research program on the potential of micropiles to withstand seismic solicitations. The research period was: 1999-2001.

The research objectives were:

- Development of New Seismic Retrofit Method
- Establishment of Design & Construction Manual

The Research focused on single micropiles and groups of micropiles as:

- Loading Test of an Isolated Micropile (vertical, horizontal)
 - Loading Test of Group Piles
 - Shaking Table Test of Group Piles
 - Centrifugal Loading Test of Group Piles
 - Static & Dynamic Analysis for Group Piles
 - Loading Test of a Connection Part of Pile Head and Footing
- Examination of Design Method for Group Piles

Special research items included

- Vertical Loading Test of HMP



Data Bases

•The widely distributed knowledge on micropiles needs to be collected and compiled in data bases in order to retrieve and disseminate it, in order to define research needs and to continue developing the technology. Valuable work has been done so far by the big research programs and the FHWA State-of-Practice Review.

Data bases need permanent maintenance. A reliable person has to be the addressee for such a task and the geotechnical community should be aware of him/her. E-mails facilitate nowadays the contact.

The International List of References for Micropiles (ILRM)

It is a data base for all publications which are related directly to micropiles.

Some features should be noted: Only entries containing the term "Micropile" are listed (exception: early papers), the 2-letter-key assists retrieving topics, English titles are preferred. More than 500 titles are listed so far.

International List of References for Micropiles

Extensive publications on Micropiles (with English titles)

Author/s	Original Title	Published in	2-letter key, key words	Country of author/s	Year
Lizzi F.	The Static Restoration of Monuments	Sagep Publishers, Genova, Italy		Italy	1982
Gruber N.; Koreck H.W.; Schwarz P.	Bearing behaviour of cyclic loaded micropiles (tension / compression) (Beiträge zum Tragverhalten axial zyklisch belasteter Pfähle)	Lehrstuhl und Prüfamf für Grundbau... , Techn. Univ. München (Munich), Heft (Publ.) 5, 116p.		Germany	1985
Lizzi F.	Il consolidamento del terreno e dei fabbricati (The strengthening of ground and structures)	Dario Flaccovio Editore, 132 p		Italy	1989
Bruce D.A.; Juran I.	Drilled and Grouted Micropiles: State-of-Practice Review	US DOT, FHWA-RD- 96 - 016 to -019, Washington DC, Vols.1-4,		USA	1997
Armour T., Gronneck P.	Micropile Design and Construction Guidelines Implementation Manual	US DOT, FHWA, Priority Technologies Program, FHWA-SA-97-070, Wash.DC		USA	1997
Finnish Road Administration	Instructions for Drilled Piling Design and Execution Guide Guidelines for design and implementation	Edita Prima Oy Helsinki 2003, 71p.		Finland	2001
Cyna H. et al	FOREVER Synthesis of the Results and Recommendations of the French National Project on Micropiles	IREX, Septembre 2002, 308p.		France	2002
Public Works Research Institute	Design and Execution Manual for Seismic Retrofitting of Existing Pile Foundations with High Capacity Micropiles	Proc. IWM 2003, Seattle, on CD-ROM, ADSC Tech.Library, Dallas TX, USA, 118p.		Japan	2002

Some extensive publications have been extracted from the Intl. List of References for Micropiles to show that they deserve special attention. They contain substantial knowledge on the technology.

The format of the list shows that with search routines for the columns the entries may be sorted.

A description of the organisation of the ILRM is given in:

Herbst T.F., A Further Step to the Data Base on Micropiles, Proc. 6th IWM 2004, Tokyo, on CD-ROM, ADSC Tech. Library, Dallas TX, USA,

- **MIDA:**

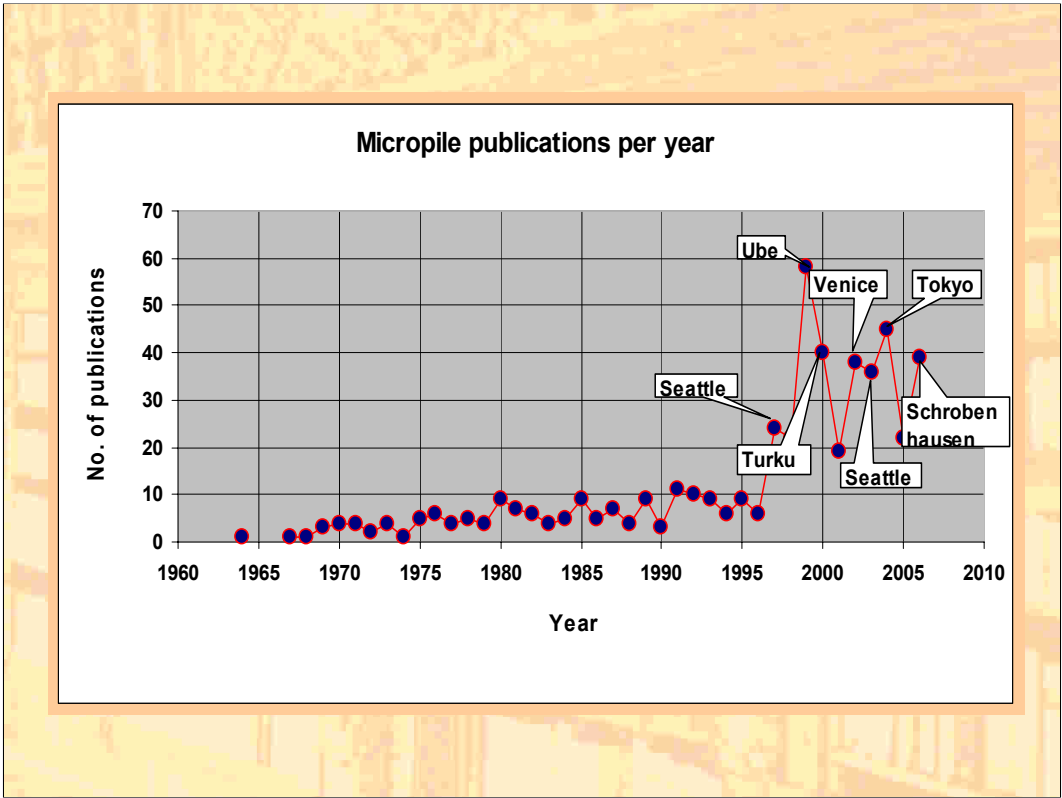
The new data base for load tests performed on micropiles

This data base has just been launched and may be extremely helpful for researchers and practitioners. It deserves full support from the geotechnical community. For more detail see:

Lehtonen, J., Hyyppä, V., Hattara, J., MIDA (Micropile Database), Proc. 7th IWM, Schrobenuhausen, on CD-ROM, ISM, Venetia, PA, USA,

The data bases established during the French and Japanese research program.

Big quantities of test results have been produced during the research programs and it is desirable that they are made available to other researchers as has been pointed out already by the researchers of



The development of publications per year can be seen from this chart. With beginning of the IWMs their amount has increased substantially. Micropile technology has gained increasing interest

Knowledge dissemination and education

Oral instruction:

Workshops organized by ISM, short courses initiated by ADSC (e.g. US), ISM (e.g. U.K.), teaching by academia (university courses)

Publications on CDs, as hard copy, or in internet:

in scientific and professional magazines like „Foundation Drilling“, „Bond zone“ (USA), reports and reviews, manuals and guide lines, proceedings of meetings and conferences, chapters in or entire foundation engineering lecture books

Addressees:

Experts, consultants, architects, supervisors, students, industry, insurance companies

Main targets:

Regions, countries with undeveloped markets, with low level knowledge, with high need for infrastructure, with historical monuments, with seismic risks

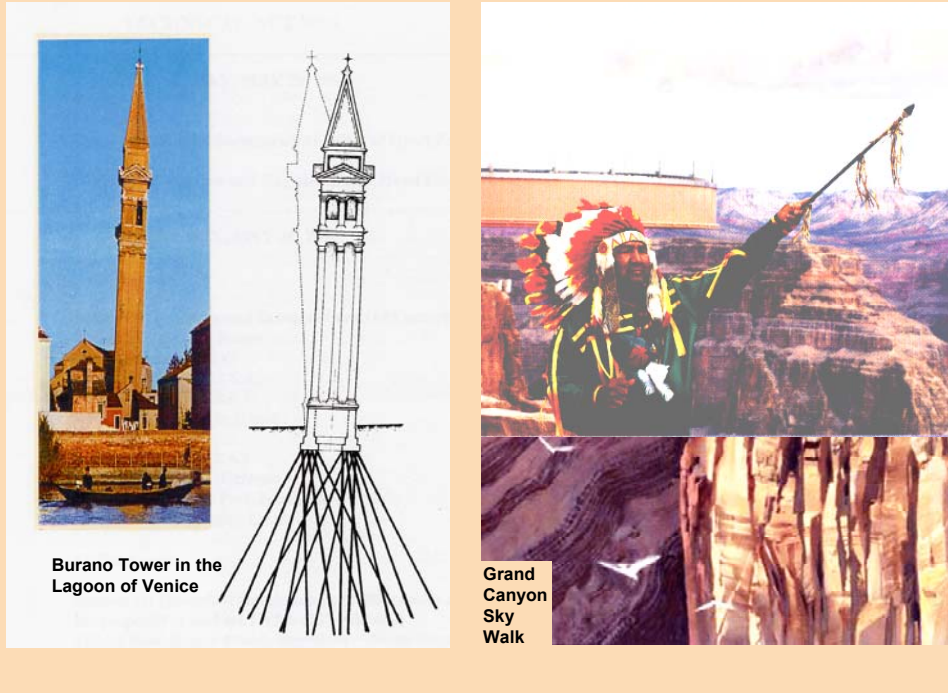
- Knowledge dissemination and education is a permanent goal. An awareness is needed that it has to be managed for the benefit of the profession and the industry.
- Knowledge dissemination and education is a permanent goal. An awareness is needed that they have to be managed for the benefit of the profession and the industry.
-
- There is a consent that in the profession agreed design rules as tools for the design engineer are required for the further spreading of the micropile technology. They do not yet exist for groups and networks of micropiles under static, cyclic and dynamic loading. F. Lizzi's vision of the soil reinforced by micropiles still waits for completion.
- In many countries the technology is completely unknown, strategies are required to involve local key persons to introduce the micropile technology to the new markets.

Chronology by Decades of Micropile Activities

1950 – 1960	Lizzi sees a need for the restoration of historical monuments and develops Reticulated Root Pile technology which spreads from Napoli all over Italy
1960 – 1970	Fondedile spreads it from Italy to other European countries, Tubfix of Rodio is conceived in Italy
1970 – 1980	increasing interest in Europe and overseas, new systems emerge like GEWI-Pile in Germany, Pieu Aiguille (I.M.Pile) in France,
1980 – 1990	recommendations and DIN 4128 norm edited, increasing acceptance, further systems like self-drilling tube piles appear, US interest in technology for broad national application
1990 – 2000	the big push: FOREVER, FHWA State-of-Practice Review and IWMs gather experts, Japan steps into technology for seismic retrofit
2000 –	reports on French and Japanese research programs are edited, short courses on micropiles address designers and industry mainly in the US, IWMs continue with FHWA and ADSC sponsoring, ISM is founded 2006

Let me summarize the historical development of the micropile technology by decades:

Views and Vision



- If the possibilities which are inherent to the micropile technology are widely known even more spectacular applications may be encountered.
- Lizzi's early safeguarding of the Burano tower in the lagoon of Venice deserves the same admiration as the more famous inclining tower of Pisa.
- The visions of engineers and architects may become reality as recently in the case of the Grand Canyon Skywalk which has been opened this year as a great tourist attraction. David Jin of Las Vegas together with the Hualapai Indians conceived this skywalk, D.J. Scheffler proposed micropiles as the most appropriate solution for anchoring the cantilever U-beam to the rock.
- In both cases the efficiency of a completely buried foundation system can even be felt. This certainly is the greatest satisfaction for a foundation engineer who usually suffers from the invisibility of his works. The more the knowledge of the possibilities of the micropiles is disseminated the more we can hope to see further spectacular applications, in future.



The new

ISM power

Chairman:

Jouko Lethonen

Executive Director:

Mary Ellen Bruce

•55 years of micropiles are a sound basis to continue with enthusiasm. With new visions and imagination as Lizzi taught us, and with the power of a new organisational concept we look forward, with your help, to new efforts and successes for the world wide growth and acceptance of a fascinating technology. ISM is the right answer to change gear in the effort to further promote the micropile technology with its roots to the ancient piling practice.

•Good luck to the new management of ISM for all the forthcoming activities and challenges!



- Thank you all who have come to the 8th IWM in Toronto, thank you, Canada, for hosting us!