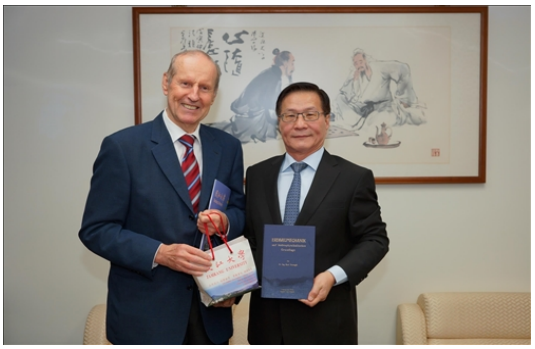
LECTURE 1



Dr. Heinz Brandl

- **Professor Emeritus, Vienna University of Technology**
- **Member, Science, Arts and Engineering Academies in Austria, Belgium, Greece, Russia and USA**
- **The 1st Vice President for Europe, ISSMGE, 1997-2001**
- **President of Austria Geotechnical Society, 1972-2015**
- **The 41th Rankine Lecture, ICE-BGA, UK 2001**

Date: 2018.10.23

INTRODUCTION

- Professor Heinz Brandl was born on June 29th, 1940 in Znojmo (now Czech Republic). He graduated with a master's degree on Civil Engineering (M.Sc.) in 1963 from the Technical University in Vienna (now Vienna University of Technology), and he also obtained his doctoral degree of (PhD) Geotechnical Engineering with summa cum laude in 1966.
- From 1963 to 1966 he was an assistant at the Institute for Soil Mechanics and Ground Engineering at the Vienna Technical University, then Assistant Professor and Head of the Soil Mechanics Laboratory. In 1971 he was appointed as an Associate Professor (with Habilitation) but left the University to pursue comprehensive practices and applied research as a freelance consulting engineer for numerous projects and construction sites in Austria and abroad. In 1977 Dr. Brandl was appointed as the official Professor for Soil and Rock Mechanics and Foundation Engineering (including Tunneling) at the Technical University of Graz.
- From 1978 to 1981 he was Head of the Geotechnical Institute in Graz, and since 1981 he has been Full Professor at the Technical University

of Vienna chairing until 2009 the prestigious Institute for Soil Mechanics and Geotechnical Engineering, which was founded by Prof. Karl Terzaghi in 1928. Since 2008 he is Prof. Emeritus, but still worldwide active.

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www.issmge.org

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Message from the VP for Europe

Professor Heinz Brandl retires from ISSMGE Council - Longest serving president of ISSMGE Member Societies

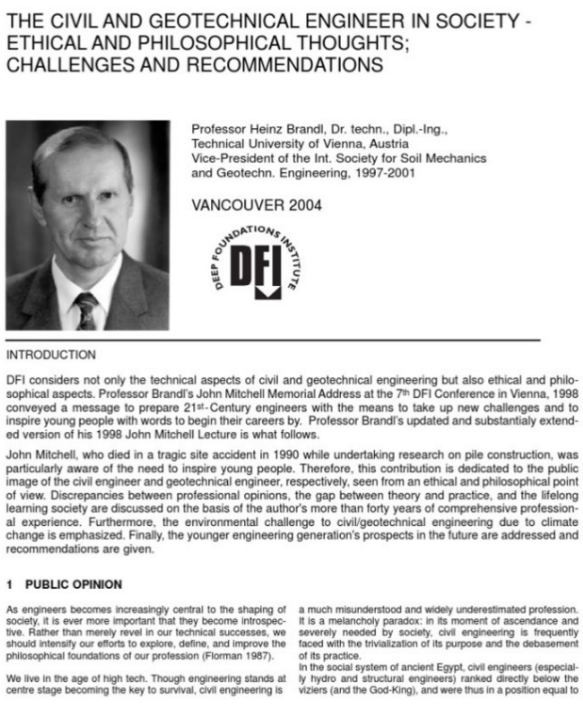
On occasion of the ISSMGE Council Meeting during the XVI ECSMGE in Edinburgh, 13th - 17th September 2015, Professor Heinz Brandl announced his retirement from this body.

For nearly half a century (1968 - 2015) he had been Council Member, voting for the Austrian Member Society of ISSMGE, and also four years as ISSMGE Vice President for Europe. This is worldwide record in the history of ISSMGE. Number two in this "ranking" is Professor Ergun Togrol from Istanbul, who was Council Member between 1965 - 2009, i.e. 44 years.

In his "farewell" speech Professor Brandl described the great honour and his pleasure as being part of the profession for such a long period, also as co-founder of the Danube European Conference in 1964, which is still successfully running. In this long period he had the fortune and honour to have known personally all giants of ISSMGE, and to have been having until now so many close contacts, also to dominating personalities of related Societies such as ISRM, IAEG, IGS. Consequently, he always fostered a close cooperation between ISSMGE and all Sister Societies (including ITA, ICOLD, PIARC).

In 2015 Professor Brandl also handed the chairmanship of the Austrian Member Society of ISSMGE to Professor Helmut F. Schweiger. On this occasion he was appointed Honorary President. Professor Brandl served as Secretary between 1968 and 1972, and as President between 1972 and 2015. This is again a global record in the history of ISSMGE. Based on detailed information from ISSMGE Member Societies an interesting global time-ranking of the by far longest serving Presidents could be found:

Heinz Brandl (Austria)	1972 - 2015	43 years
A. Hamdi Peynircioglu (Turkey)	1947 - 1982	35 years
Vyacheslav Ilyichev (USSR, Russia)	1986	> 29 years
Nicolay A. Tsytovich (USSR)	1957 - 1984	27 years



THE CIVIL AND GEOTECHNICAL ENGINEER IN SOCIETY - ETHICAL AND PHILOSOPHICAL THOUGHTS; CHALLENGES AND RECOMMENDATIONS

Professor Heinz Brandl, Dr. techn., Dipl.-Ing.,
Technical University of Vienna, Austria
Vice-President of the Int. Society for Soil Mechanics and Geotechn. Engineering, 1997-2001

VANCOUVER 2004

DEEP FOUNDATIONS INSTITUTE DFI

INTRODUCTION

DFI considers not only the technical aspects of civil and geotechnical engineering but also ethical and philosophical aspects. Professor Brandl's John Mitchell Memorial Address at the 7th DFI Conference in Vienna, 1998 conveyed a message to prepare 21st-Century engineers with the means to take up new challenges and to inspire young people with words to begin their careers by. Professor Brandl's updated and substantialy extended version of his 1998 John Mitchell Lecture is what follows.

John Mitchell, who died in a tragic site accident in 1990 while undertaking research on pile construction, was particularly aware of the need to inspire young people. Therefore, this contribution is dedicated to the public image of the civil engineer and geotechnical engineer, respectively, seen from an ethical and philosophical point of view. Discrepancies between professional opinions, the gap between theory and practice, and the lifelong learning society are discussed on the basis of the author's more than forty years of comprehensive professional experience. Furthermore, the environmental challenge to civil/geotechnical engineering due to climate change is emphasized. Finally, the younger engineering generation's prospects in the future are addressed and recommendations are given.

1 PUBLIC OPINION

As engineers becomes increasingly central to the shaping of society, it is ever more important that they become introspective. Rather than merely revel in our technical successes, we should intensify our efforts to explore, define, and improve the philosophical foundations of our profession (Florman 1987).

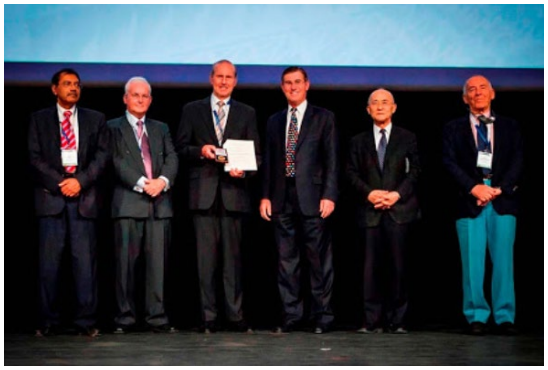
We live in the age of high tech. Though engineering stands at centre stage becoming the key to survival, civil engineering is a much misunderstood and widely underestimated profession. It is a melancholy paradox: in its moment of ascendance and severely needed by society, civil engineering is frequently faced with the trivialization of its purpose and the debasement of its practice.
In the social system of ancient Egypt, civil engineers (especially hydro and structural engineers) ranked directly below the viziers (and the God-King), and were thus in a position equal to

News of The Lecturer published at the Bulletin of International Society of Soil Mechanics and Geotechnical Engineering and Deep Foundation Institute

- Professor Brandl's creative work comprises about 580 scientific publications (mostly as sole author, including 21 books), some published in 18 languages. The subjects cover laboratory and field testing, soil and rock mechanics, foundation engineering, slope engineering, earthworks, tunneling, urban undergrounds, restoration of historical buildings, road and railway engineering, hydro/hydraulic engineering and environmental engineering (landfills, waste deposits, brownfield remediation), geosynthetics, geothermal engineering ("energy foundations", "energy tunnels" etc.), natural disaster mitigation and rehabilitation, etc. He also published on philosophical aspects and on ethics in the profession (e.g. at the DFI Conference in Vienna, 1998; at the 1st International Conference on Geotechnical Engineering Education and Training, 2000 in Romania; then in Australia, Canada, Germany, Russia, USA, etc.).
- From the very outset of his professional work H. Brandl has

been bridging the gap between theory and practice. He has been

Kevin Nash Gold Medal in Paris at The 18th Int. Conf. on Soil Mechanics and Geotechnical Engr. , 2013



fully responsible for nearly 4000 projects of civil engineering, geotechnical and environmental engineering in Austria and elsewhere: e.g. retaining structures up to 70 m height, high motorway embankments (up to 135 m in Austria and Greece), risky slope stabilizations, bridges in unstable terrain, all Danube Bridges in Austria since 1976, Beska Bridge in Serbia (2009) and other challenging river bridges, highways, high-speed railways and metros, deep soil improvements, high-rise structures (Highland Towers in Kuala Lumpur, Millennium Tower in Vienna, etc.), deep excavations, waste disposal facilities, contaminated land rehabilitation, dams, river renaturation, power plants, offshore structures, industrial buildings and buildings under difficult conditions (soft ground, seismic areas, areas of subsidence), flood protection, rockfall and avalanche protection, etc.

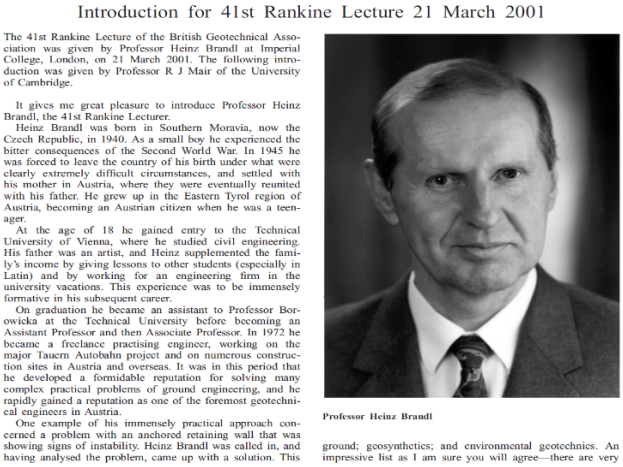
- In 2013 he started to develop a Master Plan for Sudan's Capital Khartoum (8.5 Mio inhabitants).

Medal of Merit for Macedonia awarded by President Republic of Macedonia, Dr. Gjorge Ivanov in June 2018

- By creating a semi-empirical designmethod and taking calculated risks (combined with contingency plans), he achieved not only significant cost savings but could also combine his engineering activities with many opportunities for comprehensive research work leading to numerous theoretical and practical innovations. His innovations in geothermal geotechnics ("energy foundations" and other energy ground structures) are an important contribution to environmental protection. For instance, all new metro stations of Vienna are equipped with

geothermal heating and cooling, which is not only environmentally friendly but also cost saving. Meanwhile this idea has spread worldwide for all kinds of buildings.

- His experience comprises soil and rock investigations, general and detailed planning, design and calculation, construction work, engineering consulting, construction management and control, overall supervision, long-term monitoring and remedial works. This synergy between science and practice has significantly fostered basic research, innovations and applied sciences. Numerous students, scientists and assistants could thus be educated as persons with a wide professional spectrum.
- Prof. Brandl has been active world-wide since 1968 as chairman, general reporter, state-of-the-art reporter, special-, keynote- and opening lecturer, discussion leader and panelist at numerous international conferences on soil and rock mechanics, ground engineering, road and bridge engineering, environmental engineering, geosynthetics, etc.
- Up to now he delivered nearly 600 different invited lectures world-wide (also as visiting professor), covering the entire professional field.



Introduction for 41st Rankine Lecture 21 March 2001

The 41st Rankine Lecture of the British Geotechnical Association was given by Professor Heinz Brandl at Imperial College, London, on 21 March 2001. The following introduction was given by Professor R J Mair of the University of Cambridge.

It gives me great pleasure to introduce Professor Heinz Brandl, the 41st Rankine Lecturer.

Heinz Brandl was born in Southern Moravia, now the Czech Republic, in 1940. As a small boy he experienced the bitter consequences of the Second World War. In 1945 he was forced to leave the country of his birth under what were clearly extremely difficult circumstances, and settled with his mother in Austria, where they were eventually reunited with his father. He grew up in the Eastern Tyrol region of Austria, becoming an Austrian citizen when he was a teenager.

At the age of 18 he gained entry to the Technical University of Vienna, where he studied civil engineering. His father was an artist, and Heinz supplemented the family's income by giving lessons to other students (especially in Latin) and by working for an engineering firm in the university vacations. This experience was to be immensely formative in his subsequent career.

On graduation he became an assistant to Professor Borowicka at the Technical University before becoming an Assistant Professor and then Associate Professor. In 1972 he became a freelance practising engineer, working on the major Tauern Autobahn project and on numerous construction sites in Austria and overseas. It was in this period that he developed a formidable reputation for solving many complex practical problems of ground engineering, and he rapidly gained a reputation as one of the foremost geotechnical engineers in Austria.

One example of his immensely practical approach concerned a problem with an anchored retaining wall that was showing signs of instability. Heinz Brandl was called in, and having analysed the problem, came up with a solution. This

Professor Heinz Brandl

ground; geosynthetics; and environmental geotechnics. An impressive list as I am sure you will agree—there are very

The 41th Rankine Lecture at British Geotechnical Association in London, UK 2001

Keynote Lecture delivered at The 11th Int. Geosynthetics Conference in Seoul, Korea 2018

- Professor Brandl was First Vice-President of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) for the period 1997-2001. From 1968 to 2015 he was ISSMGE-Council Member, and from 1972 to 2015 President of the Austrian Society for Soil Mechanics and Geotechnical Engineering (now

Honorary President). In both positions he was the longest serving person in ISSMGE history worldwide. Furthermore, he is a founding member of the IGS (International Geotechnical Society) and initiated Technical Committees on Environmental Geotechnics already in 1994 (via IGS) and 1998 (via ISSMGE). Since 2015 he has been expert for QS World University Rankings and advisor for UNIDO-projects.

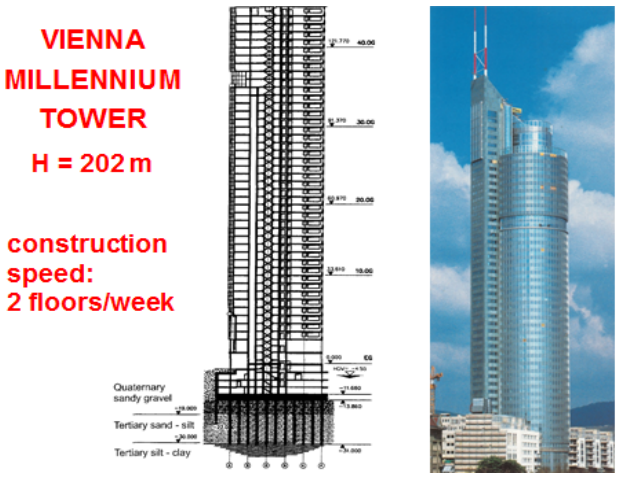
- Since the 1970s he has also been a member of advisory boards, scientific committees and paper review committees of numerous international conferences worldwide, and a member of editorial boards and peer review committees of international scientific journals (presently 38 journals).
- In 1992 Professor Brandl was appointed foreign member of the Royal Academy of Sciences of Belgium, and since 1997 he has been member of the New York Academy of Sciences. He received numerous national and international awards, 18 honorary doctorates and other honours (*e.g.* Austrian Cross of Honour 1st Class for Sciences and Arts; Honorary Professor of the Perm State Technical University).
- He was the Rankine Lecturer of the year 2001 (London) and the Manuel Rocha Lecturer of the year 2008 (Lisbon). Moreover, he was the first K. Széchy Lecturer in Hungary (1994), the first E. Nonveiller Lecturer in Croatia (2000), the L. Suklje Lecturer in Slovenia (2003), etc., and he created the prestigious "Vienna Terzaghi Lecture". He was Millennium Lecturer (Joint World Conference of ISSMGE, ISRM, IAEG) in 2000, Melbourne; the Giroud Lecturer at the World Conference of IGS (International Geosynthetics Society) in 2010, Brazil; the 10th Distinguished CW Lovell Lecturer (Jubilee Event) at Purdue University, USA, 2011; the E. de Beer Memorial Lecturer, Belgium; the 75th Anniversary of ISSMGE Lecturer, Athens 2011; the H. Lorenz Lecturer, Germany, 2013; the 50th Anniversary DECGE Lecturer 2014. Just recently the Italian Geotechnical Society invited him to deliver the prestigious A. Croce Lecture for 2019.
- Since June 2003 Prof. Brandl has been President of the Austrian Society of Engineers and Architects, which was founded already in 1848 and has been the "umbrella" organization of Austria's Engineers and Architects since.

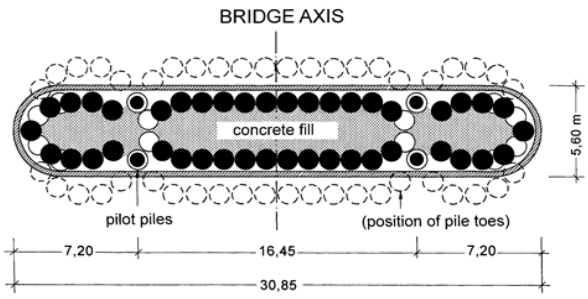
Topic 1：Cyclic preloading of in-situ piles
Topic 2：Box-shaped deep foundations (piles, etc.) improving bearing-settlement and seismic behaviour of structures

ABSTRACT

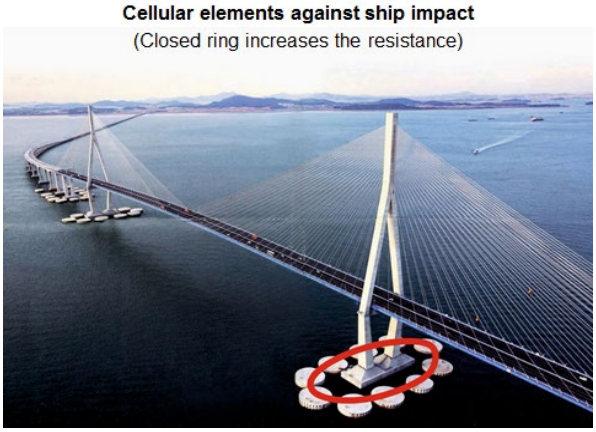
From numerous full-scale tests it is known that the bearing behaviour of individual piles on a site usually differs. This may cause stress constraints within the structure, stress-redistribution with local overloading, and differential settlements. To avoid this and to also reduce absolute settlement, a preloading and load cycling technique was developed which comprises all structural piles of a building without hindering the construction work. It is performed by installing flat jacks on the pile heads, and using the piled raft or capping structure as counter weight. Loading-unloading cycles are conducted until all piles have rather similar gradients along the statically relevant section of the final load-settlement curves under service conditions (usually at least two or three cycles). The maximum load should exceed the design load by at least 20%. This is demonstrated for a Danube bridge and the 202m high Millennium Tower in Vienna (on 151 piles).

The second method to minimize the settlement of pile foundations that can be used also for other deep foundations is a box-shaped arrangement of (bored or auger) piles or diaphragm wall panels, deep mixing columns or jet grouting columns. From theory, comprehensive model tests and numerous in situ-measurements it can be concluded that box-shaped deep foundations exhibit several advantages.





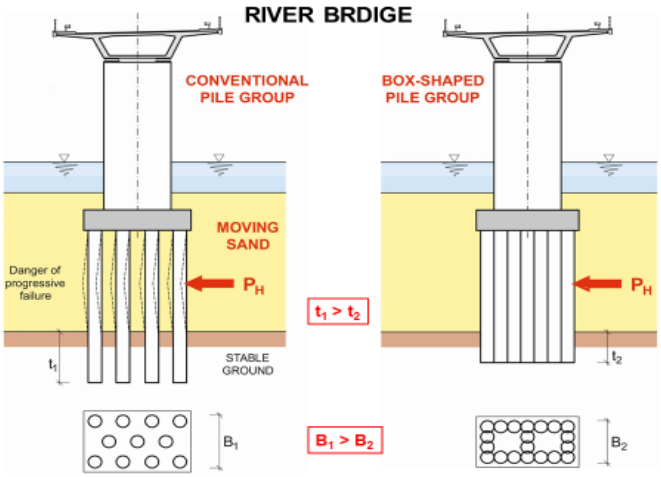
FOUNDATION BOX OF INCLINED PILES
(above river bed filled with concrete)



Box-shaped foundations act as a compound body consisting of vertical structural elements and the enclosed (confined) soil. This quasi-monolith can take high vertical and horizontal forces. Walls and capping raft form a box, which acts physically like a "pot" turned upside down. Consequently, the settlements are smaller than for conventional pile groups, and the earthquake resistance is significantly higher.

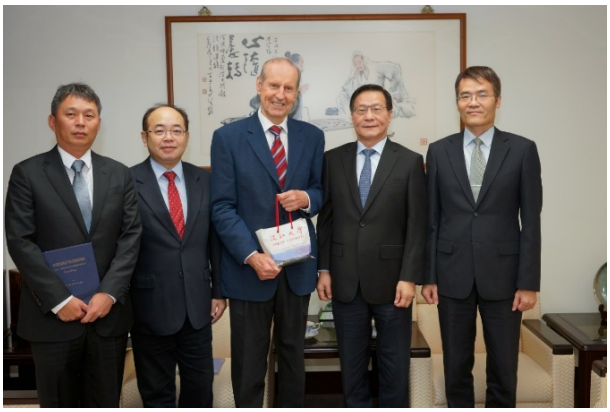
For design and calculation of such deep box foundations several hypotheses have proved suitable: half-space hypothesis, limit case hypothesis, subgrade reaction models, numerical models. Each theory, hence idealization requires different safety factors. The lecture presents diagrams (design charts) for quick settlement analyses, considering slenderness and depth of the "box", inner cell shape, wall thickness, ground parameters.

Box-shaped foundations have proved suitable for high-rise buildings, for bridges, silos, power stations, etc. Special applications are foundations in creeping slopes, strengthening of old foundations (e.g. river bridges against scouring, buildings in seismic zones). The lecture comprises small scale tests, site measurements, theory and examples from engineering practice.



MINUTE

Met with Chairman of the Board, Dr. Flora Chia-I Chang and TKU colleagues

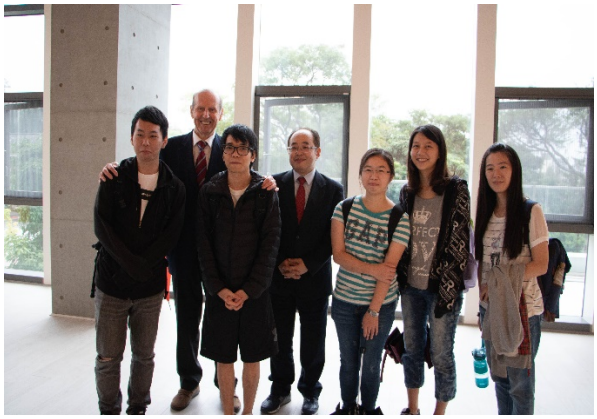


Met with President, Dr. Huan-Chao Keh and TKU colleagues

- Prof. Heinz Brandl visited Tamkang University and Taiwan Geotechnical Society (TGS) on October 21-26 in 2018, his first visit to Taiwan. Prof. Der-Wen Chang at Department of Civil Engineering at TKU made such receptions and accompanied him during his stay as the International Secretary of TGS. His visit was honored by Tamkang Clement and Carrie Chair Lecture Fund and the Ministry of Science and Technology in Taiwan. Besides TKU, he also visited National Taiwan University main campus in Taipei and Chaoyang University of Technology in Taichung during his stay.
- Before the Chair Lecture at TKU, Prof. Heinz Brandl visited President, Dr. Huan-Chao Keh and Chairman of the Board, Dr. Flora Chia-I Chang. Warmest welcomes were presented to The First Chair Lecture. TKU also received a very special gift brought by Prof. Brandl - the fundamental textbook "*Erdbaumechanik auf bodenphysikalischer Grundlage*" written by Karl Terzaghi (The Father of Modern Soil Mechanics), first published in 1925. This is worldwide considered as "Birth of Soil Mechanics". The precious book is to be preserved at the TKU Library as one of her prestigious Collections.
- During the Lectures, engineering faculty and students were crowded at the international conference center to listen to the two-hour chair speech on *Cyclic Preloading of In-Situ Piles and Box-Shaped Deep Foundations*. When delivering his speech, Prof. Brandl received great attentions from the audience, and interacting with the audience during the Q&A session successfully.

Delivering The Tamkang Clement and Carrie Chair Lecture at The International Convention Centre

- During the Lectures, engineering faculty and students were crowded at the international conference center to listen to the two-hour chair speech on *Cyclic Preloading of In-Situ Piles and Box-Shaped Deep Foundations*. When delivering his speech, Prof. Brandl received great attentions from the audience, and interacting with the audience during the Q&A session successfully.
- Though the geological conditions of the engineering sites and the construction technologies commonly used in Austria and in Taiwan are rather different, the audience learnt that the state of art in geotechnical engineering requires long term experiences in engineering practice. Engineers need to solve the problems through the applications. The Lecture indeed revealed the significance to the audience in an excellent manner.



Photos with TKUCE students

- According to Prof. Brandl, he really felt touched when the students encircled him afterwards for nearly half an hour with special questions, asking for advices and taking photos together with them. The visit has established the friendships between Brandl and TKU fellows. Further cooperation between Austrian National Committee of ISSMGE and the Taiwan Geotechnical Society would be expected in the future.

Lecturing at Taiwan Geotechnical Society

Met with TGS President, Dr. Keh-Jian Shou

Honored Scientist
(18 Honorary Doctorates)

Experienced Practitioner (Bridging the gap between theory and practice)

Awarded the Order of Merit by the State's President of the Republic of Macedonia (now North Macedonia). This award was given at the beginning of the 16th Danube-European Conference on Geotechnical Engineering (DECGE) in Skopje, 2018 that was combined with an ITA Conference. At the awarding ceremony not only ISSMGE but also ITA (International Tunneling and Underground Space Association) was represented by their Presidents and all Board Members.

"Do not stick slavishly to codes and standards, but try to be innovative, think creatively, accept challenges with engagement and don't be afraid to take responsibility in your profession."

- Heinz Brandl