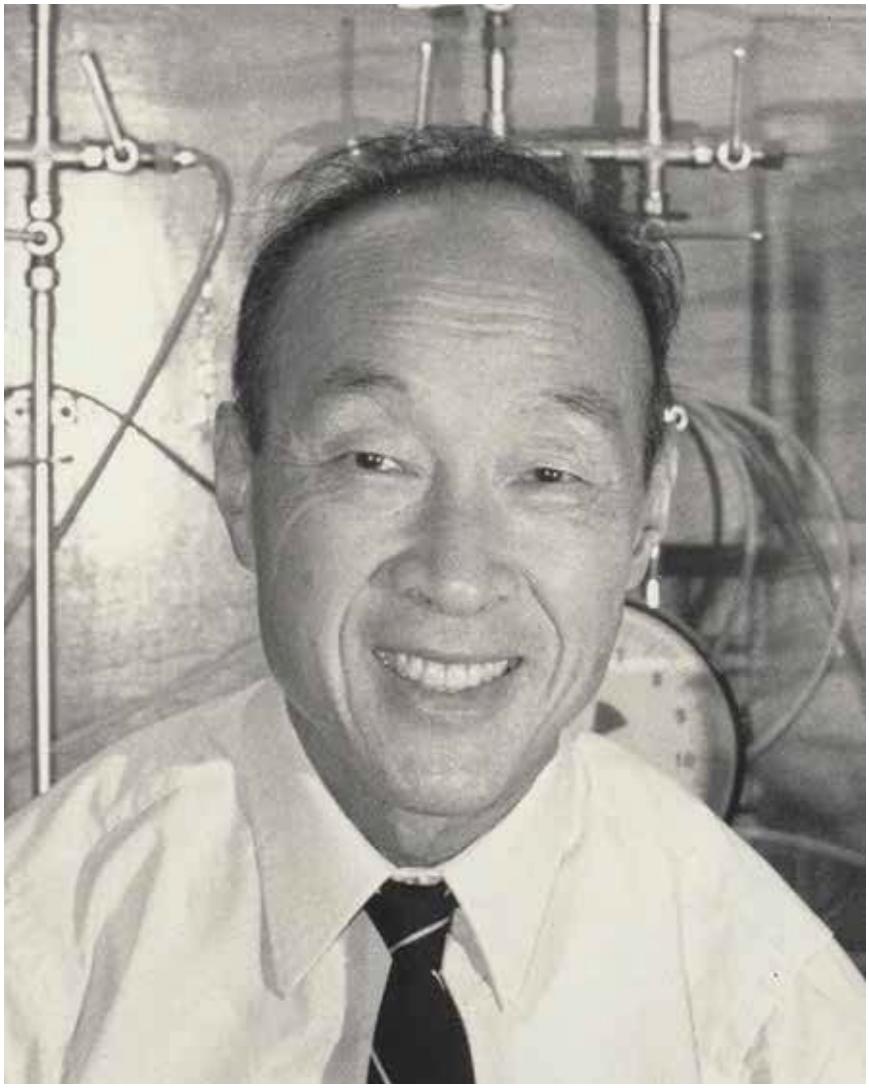
Tien Wu, PhD, Hon.M.ASCE

By Tugce Baser, Yewei Zheng, S.M.ASCE, and Mohammed Zayed



Professor Wu at Ohio State University's Soil Mechanics Laboratory (circa 1980).

Over the past 50 years, Professor Tien Wu has been devoted to imparting his experience, knowledge, and wisdom to generations of students using case histories to guide and teach. He received his Bachelor of Science degree in civil engineering from St. John's University in Shanghai, China, in 1947. Both his master's and PhD degrees in civil engineering were earned from the University of Illinois, where he was one of Professor Ralph Peck's first PhD students.

Wu spent 12 years as a professor of civil engineering at Michigan State University. In 1965, he left Michigan State for The Ohio State University, where he holds the title of professor emeritus. In addition to his exceptional teaching career, he has held positions as a visiting professor at institutions worldwide, including the Norwegian Geotechnical Institute, the Royal Institute of Technology in Stockholm, the National University of Mexico, Tongji University in China, and the Forest Research Institute in New Zealand. He has served as a United Nations consultant to the Punjab Agricultural University in India and to the Southwest Jiaotong University in China.

Professor Wu was awarded the ASCE State-of-the-Art Award for his paper "Reliability of Offshore Foundations" and the Ralph B. Peck Award in

Wu melts ice taken from the Meserve Glacier (1967).

Professor Wu (r) receiving the 2008 Ralph B. Peck Award from G-I President Art Hoffmann.

2008. In 2003, he was elected as an honorary member of ASCE, a status that is reserved for only those who have achieved acknowledged eminence in their field. Most interestingly, Professor Wu has been awarded the United States Antarctica Service Medal as a member of a U.S. expedition to Antarctica, where he participated in a study of the movements of a cold-based glacier.

He has worked in many areas over his long career and has performed research on the strength properties of soil and rock, stability of embankments and natural slopes, soil reinforcement, and, perhaps most notably, risk and reliability assessments for foundations and slopes. A pioneer in the development and application of probabilistic methods in geotechnical engineering, he has studied geotechnical reliability, providing leadership and insight into the probability of foundation safety, safety and hazard analysis of slopes, and uncertainty and decision-making in geotechnical engineering.

It was a great pleasure for our Geo-Institute GSO interview group to chat with

I once heard a lecture by Drucker, the great guru in mechanics. He said that if you work on the same subject, you have to change the method. If you use the same method, you have to change the subject. This is very true. You always have to look at the possibility of looking toward a new method and theory.

Wu, at left with colleagues, observing deforested slopes on Prince Edward Island in Alaska.

Professor Wu about his career. During our interview, he won our hearts with his great sense of humor and modesty. His modesty was amply demonstrated when he told us that he doesn't consider himself a "GeoLegend."

Q: How did you first discover your interest in civil engineering, and soil mechanics in particular? What was your motivation?

It's probably the most interesting part of my story. In 1948, I went to the University of Illinois Urbana-Champaign (UIUC) as a graduate student. I had already graduated from Saint Johns University in China, which no longer exists because it was a missionary university. During my college time, I was most interested in structural engineering because in those days that was the only branch in civil engineering that had a rational basis. So, shortly after my arrival at UIUC, I went to see Professor Huntington, the department head, who served as an advisor to all incoming foreign graduate students. I presented him with a list of courses that included mostly structures courses. He looked at it, gently smiled, and said I should add a soil mechanics course. I mildly protested because I had taken soil mechanics in China and was not impressed by it. Again he smiled at me and said, "This is very different, I assure you." Then I said, "Yes, yes."

That decision turned out to be a very decisive moment in my life. I went to the class taught by Ralph Peck. The first part of the class was soil classification. As you know, Atterberg limits and such are not particularly appealing. After a few weeks, Karl Terzaghi, who was a professor at Harvard University, arrived as a visiting professor. He would come to our university every semester for two weeks to work with Peck on their consulting jobs. He also gave lectures to Peck's soil mechanics class. The topics included permafrost in Siberia, loess deposits in the steppes, and

other consulting jobs that included a dam in British Columbia. These projects were real eye openers. I didn't know the world was that big! After that, I immediately decided to pursue a PhD in soil mechanics, and have never regretted that decision.

Q: Throughout your entire career, which project did you find most challenging?

The most challenging project was the one I did in Alaska on Prince of Wales Island. I wanted to establish the relation between deforestation and slope stability. It was a new topic for me, and I was fortunate to get a National Science Foundation grant to do it. But when I first visited the site, I was sort of scared. I didn't know what to look for because I had little experience with landslides in forests. I ended up spending four summers there. For the first summer, we were scouting around, looking for whatever clues we could find. Then, in an uncut section of the forest, we saw a small slide. Beneath the piece that slipped, I could see that the roots were pulled out or broken. That observation demonstrated the mechanics of roots as a tensile reinforcement. It was a very exciting moment.

Q: What do you consider to be your best career achievement?

I would say it's the relation between plants and slope stability that I just mentioned. I started with the deforestation problem and was later able to apply the principles to soil-bio engineering for highway slopes in Ohio, where I used willow poles and oak seedlings to stabilize shallow slides on embankments and cut slopes.

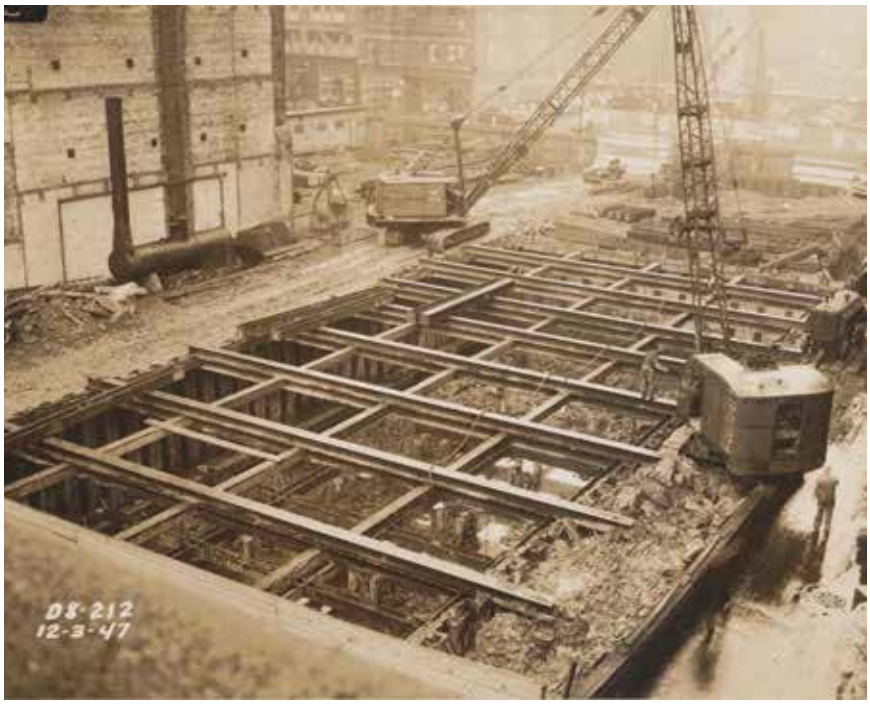
Q: What did you learn from Dr. Peck as his student?

The most meaningful thing was his description of consulting projects. They were similar to Terzaghi's lectures. Besides the case history, he would ask questions like what are the unknowns, how do you deal with the unknowns, and what would you do? He would ask students to summarize the problem on one page. I didn't realize at the time that these would be such important lessons. They would help me significantly years later.

Q: As a pioneer in reliability analysis in geotechnical engineering, what stimulated your ideas of applying probabilistic methods in geotechnical engineering?

I actually don't remember. [big laugh] Uncertainty about soil properties has

always been a concern, and it still is. I remember I started reading statistics books. They didn't make much of an impression on me because many examples were about grabbing black or white balls out of a bag. Then I read a paper titled "Safety of Structures" by Freudenthal, which made great sense and sort of gave me the start. Also Taylor's classic text, *Fundamentals of Soil Mechanics* (1948), has a section in which he said that different safety factors may be applied to cohesion and internal friction because of the different uncertainties in the measured values. To my knowledge, that was the first mention of partial safety factors in soil mechanics texts.



Measurements from instrumented excavations during subway construction in Chicago formed the basis for Wu's PhD thesis "An Analytical Study of Earth Pressure Measurements on Open Cuts," under the supervision of Ralph Peck.

Q: You have also worked on a variety of topics in geotechnical engineering. Although the topics are related, was it difficult to switch from one to another?

Not really. Starting on any new topic is always challenging, and changing the topic is not more difficult than studying a subject continuously. Well, I'm not sure. You know I once heard a lecture by Drucker, the great guru in mechanics. He said that if you work on the same subject, you have to change the method. If you use the same method, you have to change the subject. This is very true. You always have to look at the possibility of looking toward a new method and theory.

Q: What's the most significant accomplishment geotechnical engineers have made in the last 40 years?

That's a big question, and I've thought about that. If we go back several decades, I can think of several. Certainly I would name unsaturated soils, including swelling clays, and advances in in-situ measurements.

Q: In your opinion, what are the top three research needs for geotechnical engineering practice in the U.S.?

Well, I'm not sure I'm qualified to answer that. You really need to ask this to practitioners who have a lot of

L to R: The authors, Tugce Baser, Mohammed Zayed, and Yewei Zheng.

experience. But if I must answer your question, I would say application of new technologies for in-situ testing and site investigation because there is always uncertainty about what is underground. I think the other area is well-documented case histories that can be used to compare predictions with actual performance.

Q: Do you believe that today's universities place enough emphasis on fundamentals?

Again, I don't think I'm qualified to answer this question because I have been retired for some time, and thus I am not quite sure about the preparation of current students. But back when I was teaching, many students were weak in basic statics and mechanics.

Q: What do you see for the future of geotechnical engineering? And what advice would you give to a young engineer in this field?

This is a difficult question. [big laugh] I would say pursue whatever you think is interesting and challenging. The other advice would be to work on projects that benefit human welfare, society, and environment. On a different level, I advise that they read Taylor's 1948 book because it's very clear on the fundamentals. I have also advised graduating seniors to read Terzaghi and Peck's *Soil Mechanics in Engineering Practice*, Part C, before practicing geotechnical engineering.

Q: Recently, a professor published his CV that included a list of his career failures. Do you have anything like this list?

Well I haven't done much design, but I've certainly made more mistakes than I like to admit. A recent failure was a project where we tried to use plant material to stabilize a slope. We did the proper site exploration and consulted with a colleague in horticulture. We also read the literature and proposed using willows, which had been used before and which our horticulture colleague said could survive in a wide

range of conditions. What we forgot to do was to take our colleague to see the site. I think Peck once said that the failure mode that you didn't consider during design will be the one that gets you. And the willows didn't do well. When I took our horticulture friend to the site, he said he had never seen such a dry site like this before. We should have taken him to the site before construction instead of afterward.

Q: What do you think about overall development in geotechnical engineering? Terzaghi, Casagrande, Peck, Mesri, you, and the others started the fire. Do you think today's generation of professors' efforts will be enough to advance what you started?

I don't think I should be listed with the giants you named. My contributions are very small in comparison to theirs. Geotechnical engineering has really changed. Now we have many new geo-environmental engineering problems. They have intrigued me for some years, but I lack the knowledge in the sciences to make the transition. I think the new generation of professors is doing very well. They have really advanced our knowledge in this direction, but I must admit I have difficulty understanding many of the papers in the journals. GS

TUGCE BASER is a graduate research assistant in the Department of Structural Engineering at the University of California, San Diego. She is researching soil borehole thermal energy storage from renewable energy sources in the shallow subsurface. She can be reached at *tbaser@ucsd.edu*.

YEWEI ZHENG, S.M.ASCE, is a graduate research assistant in the Department of Structural Engineering at the University of California, San Diego. He is working on numerical simulations and reduced-scale shake table tests of geosynthetic-reinforced soil bridge abutments. He can be reached at *y7zheng@ucsd.edu*.

MOHAMMED ZAYED is a graduate research assistant in the Department of Structural Engineering at the University of California, San Diego, where he works on shake table testing and numerical simulation of suction bucket foundations used for offshore turbines. He can be reached at *mzayed@ucsd.edu*.