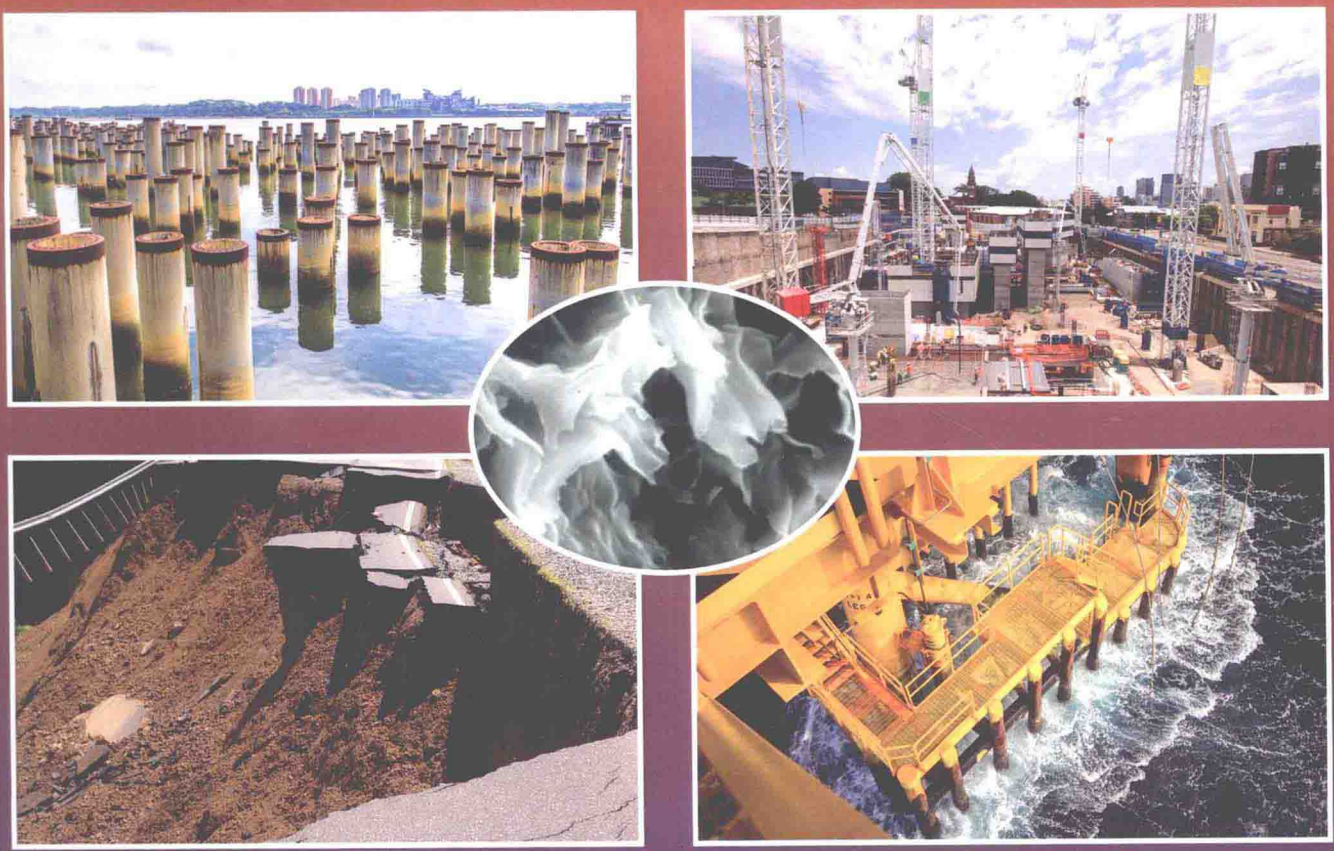
Geotechnical Special Publication No. 233

From Soil Behavior Fundamentals to Innovations in Geotechnical Engineering



Honoring Roy E. Olson

EDITED BY

Magued Iskander, Ph.D., P.E.
John E. Garlanger, Ph.D., P.E.
Mohamad H. Hussein, P.E.

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HONORING ROY E. OLSON

SPONSORED BY

The Geo-Institute of the American Society of Civil Engineers

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Preface

Sponsored by the Geo-Institute of the American Society of Civil Engineers (ASCE), this Special Geotechnical Publication (GSP) honors Professor Roy E. Olson, Ph.D., P.E., NAE, Distinguished Member ASCE, for his distinguished career as a master of the art of teaching the principles and advancing the practices of geotechnical engineering. Through more than 50 years of excellence in the fields of teaching, research and consulting, initially at the University of Illinois at Urbana-Champaign and later at the University of Texas at Austin, Professor Olson has mentored hundreds of young civil engineers who have become leaders in the geotechnical community. His many awards, including the Huber Research Prize, the Croes Medal, the Norman Medal, and the ASTM Hogentogler Award, recognize his many contributions to the understanding of soil behavior and to geotechnical analysis and foundation design. The list of his published papers, which are included herein, give some evidence of the scope of his research and consulting projects.

Professor Olson is a recognized leader within the Geo-Institute and has served as Chair of the Soil Properties Committee, the Research Committee, and the Awards Committee. He also served on the Executive Committee for 10 years, the Board of Trustees of the Deep Foundations Institute, and the UK's Institution of Structural Engineers. He is a unique individual with a wry sense of humor and keen wit. His knowledge and his dedication to the profession has been an inspiration to all who know him.

Professor Olson is proud of the accomplishments and contributions made to the civil engineering profession by many of his former students, many of whom have contributed to this GSP. A list of his Masters and Ph.D. students are included herein.

This Geotechnical Special Publication contains 30 technical papers reflecting the theme of "From Soil Behavior Fundamentals to Innovations in Geotechnical Engineering". The papers contained herein are divided between contributions by invited authors and those accepted following a general call for abstracts. It also includes 21 of Professor Olson's previously published papers selected by the editors for inclusion in this volume. The papers in this GSP cover a wide range of topics including soil properties, geotechnical analysis, risk analysis, foundation design, field measurements, and case histories.

The editors thank the authors for their contributions to the civil engineering technical literature. Following ASCE-GI publishing standards and requirements, the included papers were accepted following a rigorous review process. Each paper was independently and expertly reviewed by at least two anonymous reviewers. Discussions of the papers included in this GSP can be submitted to the ASCE Journal of Geotechnical and Geoenvironmental Engineering. All papers are eligible for ASCE-GI awards.

The editors and the authors thank the reviewers of the submitted manuscripts in acknowledgement of their constructive comments and valuable suggestions. The following are the names of the reviewers who participated in this endeavor by offering their expertise and

volunteering their time, often under demanding deadlines, with apologies to any whose name may have been inadvertently overlooked when compiling the list below:

LIST OF REVIEWERS

The editors are grateful to the following 88 individuals for working tirelessly under a tight schedule to peer review the papers included for publication in this Geotechnical Special Publications.

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This Geotechnical Special Publication is the product of a collective effort of a number of individuals within the Geo-Institute to honor one of its eminent members in appreciation for his role as teacher and mentor, researcher and practitioner.

The editors have been careful in compiling the lists of students who did Masters and Ph.D. dissertations under the direction of Professor Olson. We apologize for any names inadvertently omitted from this list.

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Abridged Autobiography
Roy E. Olson

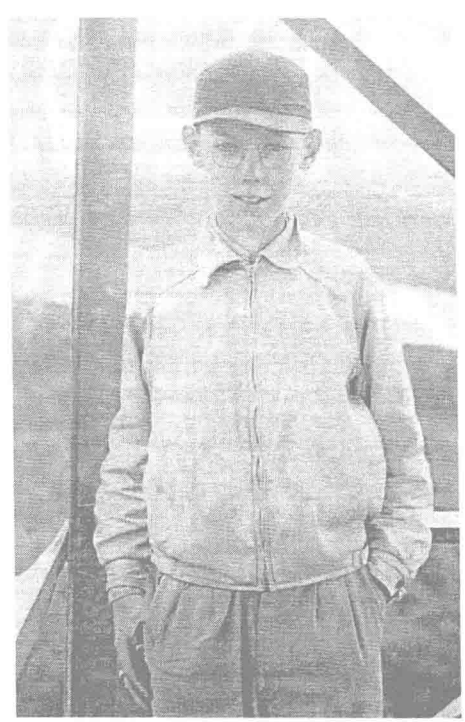
EARLY INFLUENCES

Sir Isaac Newton wrote "if I have seen further, it is by standing on the shoulders of giants". I don't recall standing on the shoulders of giants but, like us all, my path in life was influenced by those who came before me.

My parents grew up poor. My father left high school after his junior year, joined the Navy, and became a medical corpsman with an understanding that the Navy would help him finish high school and then send him through medical school to become a navy doctor. My mother finished nurse's training and then joined the Navy. They married in about 1929 and were immediately discharged from the Navy because my mother was an officer, my father was enlisted, and fraternizing was prohibited. The collapse of the economy in 1929 left them with no assets, few job opportunities, and no government help. They survived by being tough and expecting nothing from anyone. I came along in 1931 and my sister followed in 1933. My mother gave up her job as a nurse and my father started a company that sold construction equipment. A run on the banks in the 1930s caused President Roosevelt to close the banks and my father lost the few assets he had. We endured and the experience taught me that you have to be strong to survive.

EDUCATION

Push to Succeed



I had an undistinguished record in grade school and middle school. After I transferred to a high school in a different neighborhood and started putting forth some effort, my grades improved. I was the star of some classes, like drafting, geometry, business law and English and survived algebra and physics. I remember having an overpowering desire to understand the sciences, especially geology and chemistry. However, I decided to attend the University of Minnesota in the "Institute of Technology" and study civil engineering.

As a freshman, I was required to attend a seminar where a faculty member informed us that only 20% of the incoming freshman would ever get a degree in engineering and, indeed, everyone I knew as a freshman disappeared.

I put forth minimal efforts academically and, instead, went out for the boxing team (lost all of my fights), took piano and ballroom dancing lessons, and started squeezing in a diversity of courses that were not part of a civil engineering curriculum. Grading was considerably tougher then and I didn't get an A in any class until my third year. In one senior class on geometric highway design, with about 35 students, I ranked number one in the class and got a B!

With that particular professor, I decided that the only way to get an A was to learn more about the topic than he did and sit in the front row and correct him when he made errors (I got the only A in the class). I took more than the required number of courses in civil engineering, and substituted other courses to satisfy the accreditation board and inserted numerous courses in other areas.

My advisor assured me that I would never get a degree in civil engineering but I told him that I was interested in an education, not a piece of paper, and I had no intention of ever practicing civil engineering anyway. Nevertheless, after four years, I ranked 3rd in my class with a GPA slightly less than B. A friend, who was 1st in our class, had just barely above a B average. My, how times have changed!

I remained unimpressed with most of the faculty and with the whole curriculum (why would every student in the Institute have to take Semi Micro Qualitative Analysis?). I think it was in my third year that I got so displeased that I tried to lead a student strike in the civil engineering department. The strike fizzled but I noticed that the thing I was most unhappy about was changed before the next year started.

Master's Degree

We had a five-year BS degree in civil engineering with a requirement of 175 credit-hours (most programs are now around 125 credit-hours). Late in my fourth year, my advisor, Prof. Miles Kersten, informed me that the *Minnesota Surveyors and Engineers Society* had just started a scholarship program and he was concerned that if the university didn't come up with outstanding candidates, then there might not be a second year of scholarships. He asked me to apply for a fellowship and pointed out that I could graduate in four years instead of five, receiving a BS degree not designated by department, if I agreed to take the senior courses as a graduate student while also taking graduate courses and qualifying for an accredited M.S. degree in Civil Engineering. I won the graduate fellowship and took 21 semester hours of courses in my first semester (36 hours per week in class), receiving one B and six A's. I continued taking a diversity of courses and loved the relative freedom of being a graduate student and exploring things that seemed interesting. In retrospect, I regret not taking more classes in mathematics and mechanics but it was clear to me that there wasn't much you could do with knowledge in either area at that time, i.e., before digital computers appeared.

Ph.D. Studies

After excelling in the Master's program at the University of Minnesota, I wondered if I was just a "big frog in a little pond" or someone who would accomplish something in life. I decided to seek a Ph.D. degree from the best and most competitive program I could find. I literally wanted a program where the faculty would blow me away with their brilliance and I would have to struggle to survive. After months of reading college catalogs and interviewing people, it was clear that the University of Illinois best fit my interests. It was ranked number one in the U.S. in Civil Engineering but I was more interested in their geology and agronomy departments.

My time as a Ph.D. student at Illinois was a mixture of good and bad. The dichotomy between a sophisticated university faculty and elite student body on the one hand, and a rural local population on the other, meant that there was little to do except study; although perhaps this was an advantage. Besides studying soils courses in the civil engineering department, I minored in agronomy (soil physics and colloid chemistry), geology (finished my 23rd and final course in geology), and chemistry (physical chemistry, radiology, quantum mechanics).

The soils faculty in the civil engineering department at Illinois consisted of a structural engineer (Ralph Peck), a geologist (Don Deere), a forester (Tom Thornburn), and a "general" engineer (Herb Ireland). It was still the early days of what we now call geotechnical engineering and most of the programs around the country had self-taught geotechnical faculty, mostly with no

more than an M.S. degree. Terzaghi taught what he termed "engineering geology" in the spring each year but otherwise was out of town and was not interested in advising a Ph.D. student.

During my first semester at Illinois, I decided to transfer to MIT and study under Donald Taylor because we had used his book on soil mechanics at Minnesota and I thought it was a marvelous text, but he died in December of my first year at Illinois (1955). I couldn't think of any of the other programs I had examined that would have offered the challenging program I was seeking.

To my surprise, the most positive aspect of the graduate program at Illinois was not the faculty but was rather my fellow graduate students. I grew up in a community dominated by descendants of Northern Europeans and, after WW II, the wartime propaganda created the impression that Americans were innately superior to everyone else. I expected to compete with other U.S. students but not with students from other countries. To my surprise, there were many students from around the world who were friendly, very bright, and highly competitive, even though they were struggling with a new culture and usually were not comfortable with the English language. I developed friendships with students from Canada, Philippines, France, Norway, Sweden, Egypt, China, Poland, Russia, and a variety of other countries and developed an enriched understanding and respect for other cultures.

Professor Peck had a wide circle of international friends and consulting clients, and many of them visited regularly. I was introduced to essentially all of them. I had extended conversations (up to a day) with Karl Terzaghi, Alex Skempton, Alan Bishop, David Henkel, Stan Wilson, Laurits Bjerrum, M. Juul Hvorslev, Ken Roscoe, Peter Wroth, and too many others to mention. Those visits gave me a much better appreciation for the world-wide community in geotechnical engineering and I owe Ralph Peck a lot for exposing me to such a varied group of great people.

Summer Jobs

I was the only student I knew at the time who never stayed in town during the summer. One summer I worked in the chemistry lab, the materials testing lab, and did field work for a testing company in St. Paul, Minnesota. I spent another summer working in northern Greenland (Thule) as a civilian scientist attached to the First Engineers Arctic Task Force and working at the edge of 700,000 square miles of ice with a maximum thickness then estimated to be five miles, and stand on top of 2000 feet of permafrost. I also worked summers for the geotechnical engineering firms of Dames & Moore (in Los Angeles, San Francisco, Portland, and Seattle) and Woodward, Clyde, Sherard & Associates (in Denver).

The summer work experiences were incredible. I got to meet a diversified group of important people out in the "real world" and everyday seemed to bring new challenges. Geotechnical problems differed significantly from one region to another and the cultures of different offices of the same firm varied widely. Most of my assignments required a level of technical knowledge that neither I nor anyone else in the office had. I learned that what was important was to have a top notch, and diversified, educational background and the ability to pull out of it the things that could be assembled to produce a useful result. I learned never to pass up an opportunity to learn new things, no matter how alien the topic was. Above all else, I learned to think "out of the box" and be enthusiastic about attacking problems for which I had no previous experience. I had to be self-confident and be able to defend my work. When I did well in dealing with the challenges, I was given more challenges and soon found myself serving as an advisor to senior engineers on even more difficult projects. I was young, enthusiastic, single, and ready to go anywhere and take on any problem whether I was qualified or not, and usually I wasn't. It was, perhaps the greatest period of my life. Beyond technical work, I got to climb mountains from southern California to Washington State, and throughout Colorado.

Most of the engineers I worked with were self-taught. Many lacked understanding of even rudimentary aspects of geotechnical engineering, like the principle of effective stress. The situation was understandable because universities were not turning out a significant number of

qualified geotechnical engineers. In a way these observations were exciting because they meant that life in engineering practice held unlimited opportunities for me and others like me in the new field of geotechnical engineering.

One of my summer employers offered to have me start up a new office for the firm if I stayed with them for another six months. I was sorely tempted. However, during the week when I was made that offer, I received a research grant from the National Science Foundation. The grant would pay me half time for two years and allow me to hire another student to work for me. In addition, the University of Illinois offered me a half-time appointment as an "instructor".

NSF had morphed from the office of Naval Research only a few years before and was just beginning to develop their programs. The result was the overhead rate was only 5% and there were no restrictions whatsoever as to what I could do with the money. It was a marvelous opportunity and I reluctantly returned to academia.

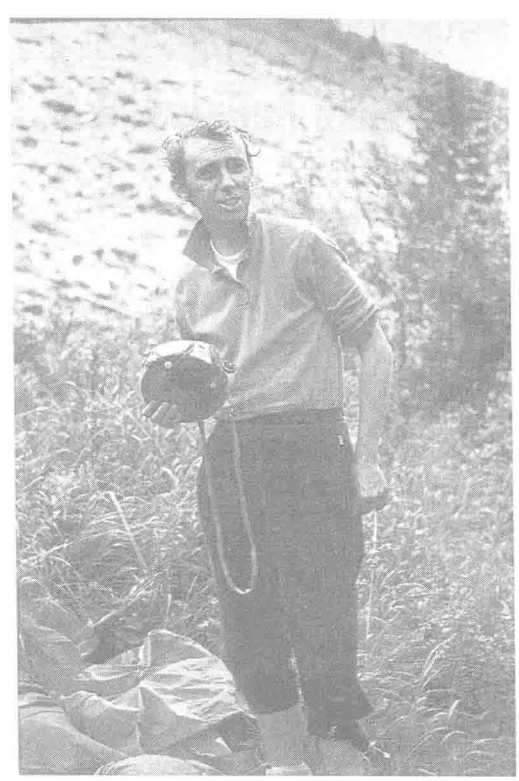
Grammar

In public school I thought spelling was boring and grammar irrelevant. Because the technical content of my reports put me at the top of my classes, I "blew off" the "technical" aspects of the English language. The result was a lot of critical comments on my term papers about mysterious things like *dangling participles*, *gerunds*, and *split infinitives*. My problem with grammar was amplified when I had to pass exams in German and French to finish my Ph.D. degree. I never learned either language properly, although I read much of Terzaghi's first book, *Erdbaumekanic auf bodenphysikalischer Grundlage*, translated his entire third book, *Theorie der Setzung von Tonschichten*, and read numerous papers in German and French. I regretted my decision not to start taking a foreign language in seventh grade - it would have made my life a lot easier.

PERSONAL LIFE

Sports

I engaged in competitive sports activities essentially every day starting in grade school and extending into my early faculty years. There was touch football in the fall; basketball, hockey, skiing, boxing, and bowling in the winter; softball in the spring, and swimming and mountain climbing in the summer. However, some unpleasant experiences in the boxing ring convinced me that my future was likely to be more intellectual than athletic, and certainly less painful.



I did enjoy the challenges of climbing and climbed many trees as a child, roamed the steep roof of our house to my parent's horror, and spent years hiking and climbing mountains. I remember numerous occasions in which I found myself in a place where I could climb up no further and had no apparent way of getting down. I wondered, at least momentarily, how anyone could be so stupid as to get into such a position. I make these comments only because I suspect that there will be readers who have had similar experiences.

First Marriage

The last week that I worked in Denver, I met a girl who was enjoying life on her own but thought it was time for her to get married and settle down. She came from a highly social group in suburban New York and I thought perhaps she could round off some of my rough edges. She, in turn, detested the artificial life in "high society" and wanted someone who would be successful but not so politically correct. We were married a year later. She was a strong-willed person with a personality to match. She decreed that she was in charge of food, clothing, decorating, children, etc., and I was in charge of the structure of any house, the yard, cars, and, most importantly, my job. She stated that job selection was for me alone and she would go anywhere I needed to go (even Champaign-Urbana). After having three children and a pleasant and, doubtless, permanent marriage, she died suddenly as a result of a transfusion with blood containing the hepatitis virus. I had no clue as to how to do anything inside the house and could write a lot about mishaps that were hilarious to neighbors who were trying to help. I wasn't cut out to cook, raise children, or do other domestic things so the loss of my wife was a disaster for me and for my children.

Second Marriage

Several years later, I was introduced to the daughter of a civil engineer. She was a remarkably talented person who played violin in the Denver Symphony orchestra and sang opera in the Boston Opera company. Sadly, I only heard her sing once, at a football game. As a coloratura soprano, she hit the high note in the Star Spangled Banner like no one I ever heard before and drowned out everyone else for substantial distances. We seemed to think that our diverse backgrounds would broaden both of us, so we got married. After sixteen years of conflict, we gave up and divorced. During our marriage, my three children reportedly held a private meeting in which they decided that if ten years of college (mine) meant that you had to work seven days per week and every evening, and if getting B.S. and M.S. degrees in the "arts" meant that you might behave like their current step mother, then they were better off skipping college.

Third Marriage

After being single for a few years, I started taking ballroom dancing lessons again. I allegedly had natural talent in dancing (what else can an instructor say when you are a source of income). I met my third wife in a dancing class and we regularly learned steps faster than anyone else in the class and certainly moved around the floor well. In spite of her being a proud Texan and me a "Yankee" from Minnesota, we get along well (she tolerates my views). Our dancing days are now over as a result of pain in our feet, shoulders, and almost everywhere else as we passed into "old age" but we remember those days fondly.

FACULTY APPOINTMENT AT ILLINOIS

I spent five years in the Ph.D. program at Illinois. In the fall of 1960, I informed my advisor (Ralph Peck) that I was about to start a series of courses in nuclear physics. In turn, he informed me that I would write a dissertation about whatever I was doing at the time and then continue my research as a faculty member. I followed his dictum only to discover that I was quickly buried in work as a faculty member and my days of exploring the unknown were over. I was paid half time for several years out of university academic funds. The rest came from my research projects where I supported up to fourteen research assistants. My teaching load was four courses per semester and as a half time employee I taught "only" two courses per semester. I was an assistant professor for two years and an associate professor for three and became a full Professor in 1965.

My problems with English grammar returned to haunt me as a young faculty member. Eventually I bought the Federal book on technical writing and studied it. I also learned that Dr. Peck was a grammarian and had numerous discussions with him about English grammar. I mention technical writing in case this essay is read by a student who thinks his/her advisor is too

tough on writing style as well as errors in using nouns as adjectives, splitting infinitives, and dangling participles. One study published decades ago surveyed engineering graduates and found that their main weaknesses and need for better education were writing and speaking, not technical design.

I spent ten productive years on the faculty at Illinois. It was an exhilarating, if competitive, even combative, and strenuous time and I learned a lot. However, I had grown up in a city and I disliked life in central Illinois. My second wife had conned me into believing that she liked Champaign-Urbana. However, after we were married, she was soon telling me that she was going to move somewhere else whether I did or not. I was long since ready to move so I started looking for other opportunities.

FACULTY APPOINTMENT AT TEXAS

In the spring of 1970, I went for an interview at the University of Texas and, in spite of a salary offer less than I had at Illinois, I accepted a Professorship and moved to Austin. It was difficult to leave behind a fabulous laboratory that I had equipped using research funds, and which I would never be able to duplicate. The University of Texas was in a period of rapid development that was so substantial that it was written up in Time magazine. However, I found the university to be well behind both of the previous universities in my life and there was little possibility of rebuilding the research program I had at Illinois. Nevertheless, we had some outstanding students and we recruited new and talented faculty throughout the Department.

It was a joy to participate in a period where the civil engineering graduate program at Texas moved up in national rankings from somewhere lower than 10th, to fourth. The probabilities of passing Illinois and Berkeley were not very high because of their long traditions of excellence so we probably did as well as possible.

Moving to Texas also gave me an opportunity to move into more practical aspects of geotechnical engineering and to start living in a more vibrant community. I had hoped to get involved in some of the kinds of design work that I had encountered during my summer jobs. However, local enthusiasm seemed to wane when I became an expert witness in five lawsuits against a local geotechnical engineer in a period of about two years. All of the suits were either won or settled to my client's satisfaction. There were a number of failures of slopes, retaining walls, and foundations, and that led to interesting and educational investigations, but my testimony in jury trials didn't help my popularity with local engineers. The lawsuits did give me the opportunity to work with the nemeses of engineers, *lawyers*, and develop an appreciation for how they work, and how their code of ethics differs from those of engineers, but to find that both engineers and lawyers are ethical in their own ways.

WORK WEEK

I learned to log my time when I worked for geotechnical firms, and that led me to log my time up to this very day. At the end of each year, I wrote a review of the previous year and decided whether I had invested my time wisely or not. For decades, I averaged at least 60 hours per week and one year averaged 68 hours/week. That didn't leave a lot of time for non-technical activities and that was a problem for my family.

AMERICAN SOCIETY OF CIVIL ENGINEERS

During my tenure at Illinois, technical activities in ASCE were carried out in technical divisions, ours being the *Soil Mechanics and Foundations Division* (SMFE). Divisions were administered by so-called executive committees. My interest was in research, teaching, and limited consulting activities, not society activities, and I declined invitations to join committees in ASCE, HRB, and ASTM. I was finally pressed into joining the ASCE *Soil Properties Committee* but at our first committee meeting I discovered I was the only member present and that I was the chair of the committee and, in addition, the committee was responsible for two sessions at the ASCE annual convention in a few months. The first session had been developed and I thought it was unimpressive. I was generously given a week or two to pick a topic for the second session and find speakers. I organized what I thought was a much better second session but then the executive committee cancelled the session I had organized due to lack of a time slot. I ended up chairing a session with speakers who often left me unimpressed. One speaker droned on well past his assigned time, covering trivia of no interest and refusing to leave so I finally got him in a headlock and dragged him from the stage, to cheers from the 200+ members of the audience. My impression was that the division needed some new blood.

Executive Committee

The Executive Committee apparently decided the same thing so within a few months I was moved out of my committee to become the secretary of the Executive Committee. As secretary, I wrote essentially all of the letters going out from the Executive Committee. We fired some chairs who hadn't done anything (I was told) in many years and, as the person who wrote the letters, I was the "hatchet man". In the days of manual typewriters and snail mail, I took on more than I wanted and perhaps got a reputation in some circles that I never lived down.

Division Name

At one of our first meetings, Jim Mitchell stated that the faculty at Berkeley was not pleased with the name of our division. I shared that view and thought the name was too narrow, apparently being a translation of the title of Terzaghi's 1925 book, *Erdbaumechanik auf bodenphysikalischer Grundlage* (loosely translated as *Fundamentals of Earth Construction Mechanics and Soil Physics*). The English name appeared at the time of the first international conference for the *International Society of Soil Mechanics and Foundation Engineering* (ISSMFE). The name seemed to leave out the possibility of including other areas, e.g. engineering geology, rock mechanics, geosynthetics, geo-environmental engineering, and soil dynamics. Jim and I worked as a subcommittee of two and came up with two names, *Geotechnic* and *Geotechnical Engineering*. The names did not exist in the unabridged Oxford Dictionary of the English Language so we had the right to define the names as we pleased. After two votes, ASCE members agreed on the name *Geotechnical Engineering*. We defined it to mean everything that geotechnical engineers did, and ignored the circular definition. Some friends have chosen to simply say they practice *Geotechnic*.

Management Group

In those days, members of the *Technical Activities Committee* (TAC) of the ASCE *Board of Direction*, served as liaisons with the technical divisions and that required individual members of TAC to attend a number of executive committee meetings in the divisions they monitored. That task was onerous so the decision was made to collect divisions into groups called *Management Groups* and the TAC member then met with the management group. I had served six years on our Executive Committee and retired but was elected to be our Manager so I served another four years as manager. The resulting ten years that I spent as secretary, member, and manager of our division were certainly the most interesting years of my involvement in societal activities. I met large numbers of wonderful people and developed many friendships.

As a member of a Management Group, I also met with TAC and served on their committees on *Technical Sessions* and on *Publications*. It was illuminating to find out that nine of the top ten best-setting ASCE publications were in geotechnical engineering and the only "outsider" was a pamphlet costing $0.25. We surveyed attendance at our technical sessions at several ASCE annual meetings where all divisions participated, and discovered that about 90% of the total ASCE attendance was in our sessions. In the first technical session that I chaired, we had more than 200 people in our session and the next session in that room had six people, all of them speakers.

At one meeting of the committee on technical sessions, there were some rather bitter complaints from divisions which were assigned sessions at times like Monday morning and Friday afternoon. The staff person who arranged the times was surprisingly blunt. He announced that he gave Geotech whatever we wanted and then fit other divisions in where there was space, and informed them that when they had attendance like we had, they would get better times.

EVOLUTION

I first became interested in geotechnical engineering because it was a link between geology and engineering. However, both faculty and fellow students assured me that the field had no future and geotechnical work would continue to be performed by structural engineers or general civil engineers.

When I became a faculty member, my major interest was research. At that time, it seemed like you could choose to work in any area of geotechnical engineering and do something worthwhile. I was wildly enthusiastic and energetic so I wrote multiple proposals, all of which were funded. The result was that I had more money than I could spend, but not nearly enough time to supervise the work properly and thus some of research was not as fruitful as it could have been. As a result, I cut back on research to try to balance it with the availability of qualified students.

During my time as a student, I was highly critical of almost every faculty member I encountered, and was perhaps even more critical of the degree programs. I wanted students to have lots of options as to what they studied. The result was that I served (usually chaired) curriculum committees for decades and constantly had conflicts with faculty who thought that civil engineering was really just their area and they protected their required courses strongly. At Illinois, I pushed through a curriculum in civil engineering that was objected to by most of the faculty and students. The faculty were protecting their "turf" (my view), and the students wanted the faculty to tell them what courses to take.

I also chaired a new committee at Illinois that had the students evaluating the faculty. That was an educational experience for me. I discovered, and have since verified, that student evaluations are really about whether or not they like the professor, not whether or not they got a good education. A faculty member who regularly missed more than 50% of his classes and never (my experience) came to class prepared, got perfect scores in both of his classes on every question. In the next semester, when his students came to me to complain about him, I asked why

they rated him so highly in the previous semester. The universal answer was "he was such a nice guy that we didn't have the heart to tell him the truth". Experiences of that kind led me to spend more time trying to figure out students and less time doing research.

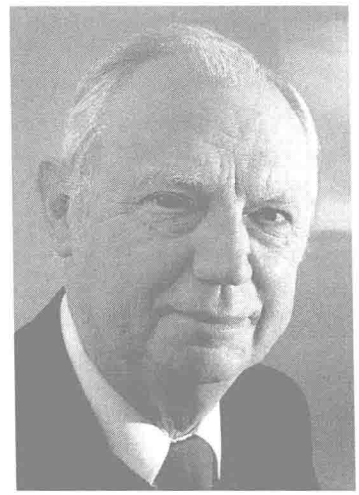
When I started teaching, we used only lectures and the blackboard to communicate. In my first class, first exam, most of the class did fine but there was a significant group of students who did miserably. I gave them a hard time in our next class but, at the end of the class, suddenly had an epiphany and told everyone to hand in all of their notes. To my surprise, the "poor" students had studied their notes but their notes were wrong. Accordingly, I typed up and reproduced notes on the primitive equipment we had then. Now, almost all of the students did fine but there would be a few who had major problems. I asked some of the students who had low scores, to come to my office so I could find out what the problem was. One student complained bitterly that he had studied my notes and gave correct answers but I still graded him down. He found my specific statements that were the problem and I had to admit that his interpretation of the notes was acceptable, even if he was the only one in class who had that problem. That meant that the problem was more mine than his, and that led to a lot of time spent trying to figure out how to communicate, and how students learned. That time also took me away from research but my class evaluations improved greatly.

I look back on my career in education as an evolutionary process that was constantly a challenge.

FINI

I think I am fortunate in that geotechnical engineering grew from a very young group when I was young (say 1950's) to a mature group now that I'm old. It was a marvelous run with many fascinating and productive people and I've always taken great pride in calling myself a *geotechnical engineer*.

CURRICULUM VITAE



Current Position

Professor (*Emeritus)*
University of Texas at Austin

Education

B.S., University of Minnesota, Engineering, 1953
M.S., University of Minnesota, Civil Engineering, 1955
Ph.D., University of Illinois, Civil Engineering, 1960

Honors & Awards

- First Minnesota Surveyors and Engineers Society Scholarship, University of Minnesota, Academic Year 1953-54
- First American Society for Testing and Materials Graduate Fellowship, January 1, 1960 to October 1, 1960
- Walter L. Huber Research Prize, American Society of Civil Engineers, October 1971
- C. A. Hogentogler Award, American Society for Testing and Materials, June 1973
- Norman Medal, American Society of Civil Engineers, November 1975 (with D. E. Daniel and T. K. Liu)
- Croes Medal, American Society of Civil Engineers, October 1984 (with D. E. Daniel)
- L. P. Gilvin Professorship, University of Texas, September 1984
- C. A. Hogentogler Award, American Society for Testing and Materials, 1987
- Terzaghi Lecture, ASCE, San Diego, October 24, 1995
- Distinguished Alumnus Award, Department of Civil Engineering, University of Illinois, April 1997
- National Academy of Engineering (2003)

Theses and Dissertations Supervised

DOCTORAL STUDENTS

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Langfelder, L.J. (1964)
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Mesri, G. (1969)
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Painter, W.T. (1970)
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Garlanger, J.E. (1970)
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"Pore Pressures and Volume Changes in Unsaturated Soils," University of Illinois, 104 pages, with R. B. Peck

Daniel, David Edwin (1980)
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