Leadership and Legacy

A History of Civil and Environmental Engineering at Illinois

Edited by William J. Hall and Amr S. Elnashai

Department of Civil and Environmental Engineering
College of Engineering
University of Illinois at Urbana-Champaign

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ILLINOIS

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Dedication

This mini-history is dedicated to all those current and past faculty, staff and students of the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign, who through their participation and efforts have made this department into one of the leading civil and environmental engineering departments in the United States and the world. Since its inception in 1867, CEE at Illinois has been at the forefront of advancing knowledge in every facet of civil and environmental engineering, making that knowledge available to students and the profession, and improving quality of life for society.

Photo courtesy of the University of Illinois Archives. (Image 0005374, Civil Engineering Class Scene, circa 1919)

Contents

The early days of the Civil Engineering Building, later Nathan M. Newmark Civil Engineering Laboratory, shown here from the south, circa 1967.

Foreword

William J. Hall
Professor Emeritus

By virtue of many factors, including increasing inquiries as to the history of the department, it was decided it was time to assemble existing documents into one succinct booklet. We begin with a piece on a civil engineering education, a statement by the current department head about the major thrusts that will guide the department's initiatives into the future, and a brief overview of the department, followed by a history of the department. Finally, we end with some miscellaneous information of interest.

Of great major value are the three pieces authored by John D. Haltiwanger (MS 1949, PhD 1957)* with input from professors Narbey Khachaturian (BS 1947, MS 1948, PhD 1952) and William J. Hall (MS 1951, PhD 1954), appearing in the CEE magazine from the Fall/Winter 2003 issue through the Fall/Winter 2004 issue. Professor William Walker (MS 1958, PhD 1963) has assembled information on enrollments, which is included. Other pieces have been prepared by multiple authors. One major source of information on the early years was "A History of the College of Engineering of the University of Illinois 1868-1945" by Ira O. Baker (CE 1874) and Everett E. King.

Although instruction has been essential to the goal of graduating civil engineers from this department—engineers who are prepared to meet the needs of our profession—research too has played a major role from the beginning. This research has been brought into the classroom as appropriate and has served to upgrade practice and meet the changing needs of society. Highlights of the research effort are provided here also.

As one can imagine, there are hundreds of names of individuals mentioned with respect to the pieces to be included; some of those individuals are deceased, but many are still living, and we welcome comments about missing recognitions, errors, etc., which in time can be corrected. We apologize for such matters, but the materials we have reviewed for this piece are voluminous.

* Throughout this book, degree designations and dates for department alumni are shown in parentheses after their names, on first reference.

A Civil and Environmental Engineering Education

Liang Y. Liu
Associate Professor, Associate Head and Director of Undergraduate Studies

Civil and environmental engineers play a critical role in preserving and enhancing the quality of life of our society. They design and construct facilities and infrastructure systems that determine how we live and travel, how efficient our economy is, and how much our environment is impacted. Students studying civil and environmental engineering go through rigorous training in engineering fundamentals and problem-solving skills, which means that they are capable of applying tools of science and mathematics to solve complex engineering problems. Civil engineering projects, such as bridges, buildings, dams, airports, highways, tunnels and water distribution systems, are often grand, intricate, and continuously evolving.

Since 1867, the Department of Civil and Environmental Engineering has educated countless professionals and educators who contribute to the safety and quality of life for millions of people daily, as well as train future generations. As civil and environmental engineers, we thrive on meeting the ever-evolving challenges of our society. Our curriculum must therefore prepare students for long and successful careers, so that they can meet current demands and solve future problems that we cannot even imagine. Through formal lectures, laboratory work, design projects, team collaboration and mentorship, our educational goals are to develop students' skills in critical thinking, problem solving, communication, collaboration, and life-long learning. Civil engineering education at Illinois provides a unique environment to facilitate students in learning, from theories and computational solutions, to laboratory experiments for verification and validation, and then on to real-world design and construction.

The civil and environmental engineering program at Illinois comprises seven sub-disciplines of construction engineering and management, construction materials, environmental engineering and science, geotechnical engineering, environmental hydrology and hydraulic engineering, structural engineering, and transportation en-

gineering. An interdisciplinary program in sustainable and resilient infrastructure systems is a recent addition to our undergraduate program that enhances our students' understanding in systems-based, integrated solutions to societal challenges. Whereas CEE at Illinois is a top-ranked program in the world, we continue to seek enrichment of the learning experience of our students.

CEE at Illinois' success in education forms a tradition of excellence, as evidenced by the professional accomplishments of our graduates. There is still a need for curricular evolution to educate our students beyond rigorous engineering knowledge and problem-solving skills. Societies today are more inter-connected, and civil engineers are faced with challenges that are global, complex and evolving. Many of the challenges faced by society require that civil engineers work collaboratively with other engineering and non-engineering disciplines to provide holistic solutions which none of the disciplines can offer individually. It is imperative that our students develop systems thinking, cultivate a global view, learn how to collaborate with other disciplines, and grow in their awareness of the societal context. There is a conceptual need for change in how we educate civil and environmental engineers in the future. This change should go beyond just courses and curricula. We need to engage faculty and students to change their mindsets, so that a solid foundation is implanted in every student to support a life-long career in a globally connected world that demands innovative solutions from multidisciplinary teams. Looking forward and working closely with practicing alumni and industry leaders, CEE at Illinois is taking a progressive approach to educational innovation, to continue the tradition of leadership that is the hallmark of our department.

Engineering for a Changing World, and for Changing the World

Amr S. Elnashai
William J. and Elaine F. Hall Endowed Professor in Civil and Environmental Engineering and Head

The Civil and Environmental Engineering Department at the University of Illinois at Urbana-Champaign has developed its strategy for the next 10 years and is implementing it in a creative and flexible manner. Below is an outline of our view on education and research for a changing world, and for changing the world.

Our educational programs are adapting to the changing world by providing our students with the unique Illinois educational experience that brands them as not only good engineers with rigorous training and problem-solving skills, but also as thinkers, integrators, communicators, cultural and technical translators, and therefore leaders. Our research thrusts address the most pressing challenges facing the world and seek solutions that underpin the prosperity of humankind.

Wealth creation, through industrial, commercial and residential developments, leads to pressure on our environment and ecology. We at Illinois see ourselves as stewards of balancing wealth creation and environmental protection and recovery. This balance is no more evident than at the nexus of water, energy and the environment, which is one of our emerging research and education thrusts. Underpinning all rural and urban development and wealth creation is an efficient and reliable infrastructure system. After a period of historically-unprecedented infrastructure development in the United States, the very core of our prosperity is threatened by a crumbling infrastructure system that is clearly falling into serious disrepair. Thus, another of our research and education thrusts is providing innovative solutions to infrastructure renewal. While protecting and enhancing the environment and our ecological system, it is imperative that we protect the wealth we are creating. The wealth-protection objective leads naturally to one more of our research and education thrusts, namely management of risk to society. The foundation of accomplishments in the above-highlighted troika of thrusts is a deep under-

standing and mastery of tools for design, construction, simulation and operation of complex civil and environmental systems. We further articulate our three research thrusts below, in addition to the foundation concept of civil and environmental engineering systems.

The Water-Energy-Environment Nexus

The water-energy-environment nexus is the greatest challenge of all, and the world's foremost test of not just prosperity, but survival. Energy and water are at the heart of the economy and way of life, critical for and affecting national defense, food production, human health, manufacturing, recreation, tourism, and the daily functioning of basic societal units. Energy production requires a reliable, abundant and predictable source of water, a resource that is already in short supply around the world. Electricity production from nuclear energy and fossil fuels accounts for about 40 percent of all freshwater withdrawal in the U.S., thus depriving the world of just under half of its water resources, which would otherwise have been available for a hugely enhanced quality of life. On the other hand, energy required for treatment and delivery of water accounts for as much as 80 percent of its cost. An insufficient supply of affordable energy will have a negative impact on the price and availability of water. While the interrelationship of water and energy is a critical aspect of the nexus, there are also potentially devastating environmental impacts at all stages of energy production and water development. Limited water leads to conflicts among energy, agriculture, and the environment and even leads to political instability and ultimately war. Climate change and the shift to renewable energy sources, especially biofuels, lead to new complex issues and further requirements for rationalizing water development and use. None of the three strands of water, energy and environmental impact can be addressed in isolation from the other two. Civil and environmental engineers are ideally suited to lead the world's interdisciplinary response to the above-discussed challenge, in cooperation with the physical and socio-economic sciences.

Renewal of the Infrastructure

Renewal of the infrastructure is critical for a stable and prosperous future. In 2009, the American Society of

Civil Engineers (ASCE) gave the U.S. infrastructure systems a grade of D and estimated that $2.2 trillion is needed to repair, maintain or upgrade the systems that support economic progress and societal safety. Conspicuous by their exceptionally poor state are systems for drinking water, inland waterways, levees, roads and wastewater, all scoring D-. Crumbling infrastructure has a direct impact on our personal and economic health, and the nation's infrastructure crisis is endangering our future prosperity, as stated by ASCE. Transportation systems, utility networks and supporting facilities, wastewater treatment plants, waterways, levees, dams, and energy distribution grids are under severe stress from normal use, and from natural and malicious hazards. Viewing the infrastructure as a live and interacting system-of-systems is not just a more efficient framework for design, construction, operation and maintenance; it is truly the only way to understand the interdependencies of the constituent systems, and their interaction with natural and socio-economic systems. The challenges are colossal. And who is better suited than the CEE community of researchers and practitioners whose training and focus is interdisciplinary, and whose enhanced understanding of the synergy of sciences, technology and the humanities provides the only feasible framework to address the colossal challenges?

Managing Risk to Society

Managing risk to society protects our investment. Natural and malicious disasters and accidents around the world have persistently revealed the lack of a holistic approach toward the four components of disaster management, i.e., assessment, mitigation, response and recovery. Examples abound, amongst which are Hurricane Katrina, Tohoku earthquakes and tsunami, Christchurch earthquakes, Georgia severe weather and many other incidents where lives and livelihoods were in jeopardy. The annual losses in 2010 from natural disasters are about $50 billion-$80 billion, and expected to rise to more than $180 billion by the end of the century, as reported by the World Bank and the United Nations, with approximately 80,000 people killed and millions made homeless on a yearly basis. It is therefore of utmost importance to build aspects of risk management into all investments and to draw com-

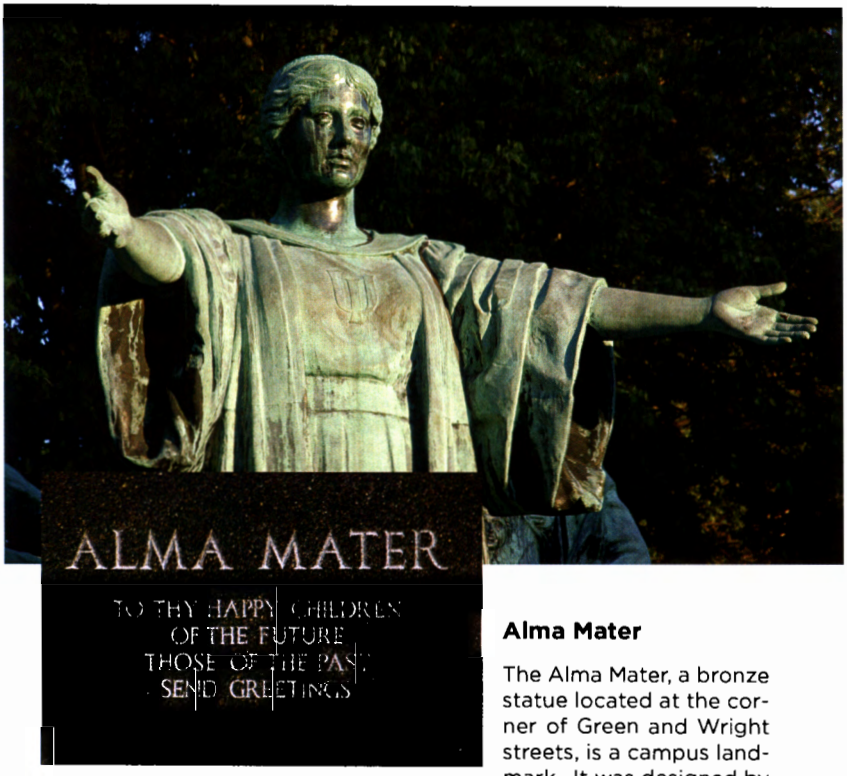
prehensive plans for assessing and mitigating risk, where necessary. It is very important to note that mitigating the anticipated consequences of risk pays back at a ratio of more than 1:5; for every dollar spent, more than $5 are saved, not including human suffering that is alleviated by mitigation. Civil and environmental engineers understand both the quantitative and the qualitative sides and are the community best suited to integrate physical, natural and social sciences towards understanding and managing risk posed to society and our current and future investment.

Civil and Environmental Systems

A systems perspective is essential for the success of all our work in the three thrust areas. Our ever more complex world depends on its civil and environmental systems to function effectively. This systems perspective builds on and extends the traditional view of civil and environmental engineering and integrates it with other engineering sub-disciplines, and the physical, natural and social sciences. The systems approach emphasizes how different components and sub-systems are integrated and monitored as a system-of-systems that serves a community's needs in the context of uncertainty, multiple and competing objectives, interdependencies, and the oft-conflicting requirements of different constituencies. The technical aspects of civil and environmental systems are addressed in the context of long-term social, economic, political, and cultural issues that include design and construction of green civil and environmental infrastructure, construction, monitoring, maintenance, operations, preservation, systems warrantee, performance in extreme events, decommissioning and rebuilding to meet new requirements. The thrust is a toolkit for the three thrusts of water-energy-environment, infrastructure renewal, and societal risk management. It is inherently interdisciplinary and requires detailed conversations with a multitude of other communities to develop new approaches to serve the mission of wealth creation and protection. It is both a foundation and an interface. Its foundation role is explained above; its interface role is exemplified by the required expertise from other engineering sub-disciplines, and from the physical, natural and social sciences.

The above construct provides a clear pathway to-

ward developing research and education objectives as well as implementation, assessment and resource deployment plans. We are already implementing a comprehensive plan for energizing the department along the above lines. Our plans include curricular developments and retuning, hiring across-areas faculty who are acting as intellectual foci around whom we build interdisciplinary teams, providing interdisciplinary management structures, linking expenditure to our education and research goals, providing incentives to accelerate broadening our perspectives, and permeating our approach in all constituencies: alumni, friends, colleagues, national and international organizations, through our networks and communications media. Solid determination to render CEE at Illinois the most rigorous and interdisciplinary academy for learning, discovery and service is our central mission.



Alma Mater

The Alma Mater, a bronze statue located at the corner of Green and Wright streets, is a campus landmark. It was designed by sculptor Lorado Taft, a university graduate, and given to the University by the graduating classes of 1923-1929. Photos: Kalev Leetaru

CEE at Illinois has its headquarters on the north side of the campus of the University of Illinois at Urbana-Champaign, in Newmark Civil Engineering Laboratory (above) and the Hydrosystems Laboratory. The department's Advanced Transportation Research and Engineering Laboratory is located in Rantoul, Ill., just 15 minutes from campus.

An Overview of the Department of Civil and Environmental Engineering at Illinois

The Department of Civil and Envirnmental Engineering (CEE), one of 12 departments within the College of Engineering at the University of Illinois at Urbana-Champaign, has been in existence for more than 140 years, since the year the University was founded. Today the department enjoys a strong reputation for undergraduate and graduate education, for civil engineering research, and for public service. Its graduate and undergraduate programs consistently are ranked among the top civil engineering programs in the country by U.S. News and World Report.

The department consists of about 55 faculty, 800 undergraduate students, and 450 graduate students. It is housed in Newmark Civil Engineering Laboratory and the Hydrosystems Laboratory on the north side of the U of I campus. A facility for transportation research, the Advanced Transportation and Research Laboratory, is located about 15 miles away from campus in Rantoul, Ill. The department is also the headquarters of the Center of Excellence for Airport Technology (CEAT), the Illinois Center for Transportation (ICT), an equipment site for the National Science Foundation's Network for Earthquake Engineering Simulation, and other research and educational programs.

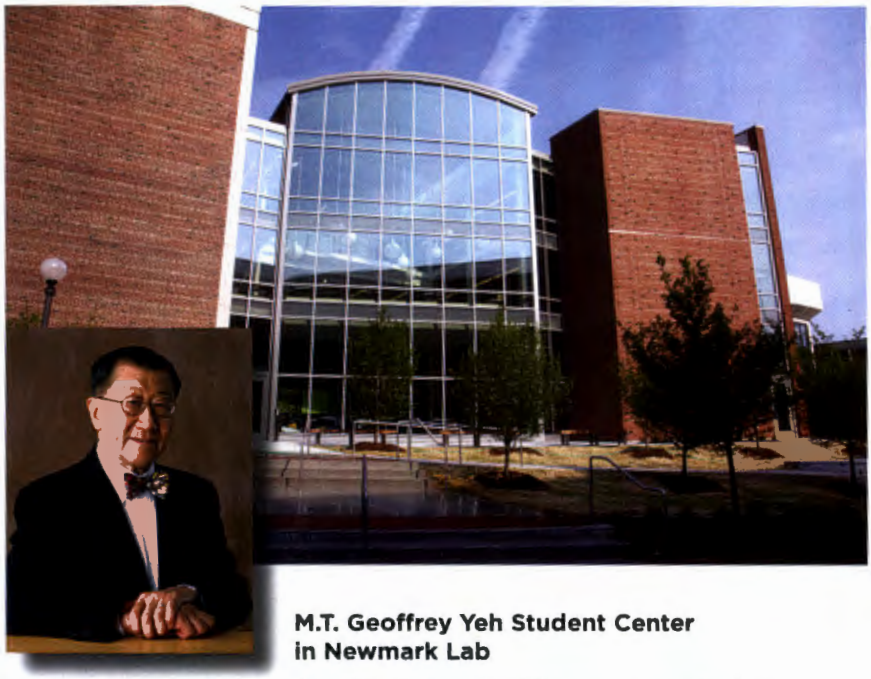
In July 2011, the M.T. Geoffrey Yeh Student Center was completed to provide a 20,500-square-foot addition to Newmark Laboratory at a cost of $7 million. The Yeh Center contains six large classrooms, student study space and meeting areas. The project was funded entirely with the private support of CEE alumni, friends, faculty, students and companies. The facility is named in honor of the lead donor, M.T. Geoffrey Yeh, a 1953 graduate of CEE and longtime real estate developer in Hong Kong.

CEE at Illinois faculty members are engaged in numerous research endeavors, and many of them hold positions of influence and responsibility in national and international engineering organizations and serve on advisory councils and governmental commissions. Through their research and teaching, the faculty members of the department are educating the next generation of civil engineers to be leaders of a profession that will assure a high quality

of life for our civilized world.

Faculty and alumni of our program have contributed to some of the greatest civil engineering achievements in the world. Some examples include the Golden Gate Bridge, the Hoover Dam, the Trans-Alaska pipeline, the Willis (formerly Sears) Tower, the Twin Petronas towers in Kuala Lumpur, and the Burj Khalifa in Dubai.

With 13,000 living alumni, CEE at Illinois boasts one of the largest alumni associations in the world. Illinois civil engineering alumni hold many of the key leadership positions in our profession, and Illinois alumni serve on the faculties of many civil engineering departments throughout the world. CEE at Illinois students graduate with not only an excellent education, but also the reputation, stature, and recognition as "Illinois engineers" that their forebears have worked hard to develop and maintain.



M.T. Geoffrey Yeh Student Center in Newmark Lab

The Yeh Center, completed in July 2011, is a 20,500-square-foot addition to Newmark Civil Engineering Laboratory that features six large classrooms, meeting and conference rooms, and study space for the department's students. The addition features sustainable design, including a green roof. It is named in honor of the lead donor, M.T. Geoffrey Yeh, a 1953 graduate of CEE, longtime real estate developer in Hong Kong, and Chairman of Hsin Chong Construction Group Ltd., Hong Kong. Born in 1931 in Shanghai, China, Yeh is a 2010 Distinguished Alumnus of CEE at Illinois. He established the M.T. Geoffrey Yeh Graduate Research Fellowship in the department in 1994 and the M.T. Geoffrey Yeh Endowed Chair Fund in 1998. He is a member of the President's Council of the University of Illinois Foundation.

Photo courtesy of the University of Illinois Archives. (Image 0005375, Road Materials Lab, circa 1915)

CEE History & Heritage
Part One: 1867–1926

John D. Haltiwanger
Professor Emeritus

The Department of Civil and Environmental Engineering had its birth in 1867 when it was named as one of four branches of the Polytechnic Department of the University. The University catalog for 1868-69 listed a faculty position in "Civil and Rural Engineering," but that position was not filled. However in the 1869-70 catalog, Samuel Walker Shattuck was identified as "Professor of Civil Engineering," and the department appears to have been on its way.

Nevertheless, during the 1870-71 academic year, University records show the department as having been administered by Professor Stillman W. Robinson, head of the Department of Mechanical Science and Engineering, and as having a faculty that consisted of Shattuck as professor of mathematics and Professor Alexander Thompson as teacher of railroad engineering with leadership responsibility for the civil engineering department. Finally, in 1871, John Burkitt Webb was appointed as Professor of Civil Engineering and first head of the department. With that, the department had become a reality.

The department continued to grow under the headships of John B. Webb (1871-78), Ira O. Baker (1878-1915 and interim 1920-22), Frederick H. Newell (1915-20), and Clement C. Williams (1922-26). It was during this period,

1867

The Department of Civil Engineering is established as one of four branches of the Polytechnic Department of the University of Illinois, also founded this year.

1871

John Burkitt Webb is appointed Professor of Civil Engineering and first official head of the department.

1867-1926, that the foundation was laid upon which succeeding department heads were able to build a department of internationally distinguished reputation.

It was clear from the beginning that the department recognized not only its responsibility to instill the knowledge of the profession in the minds of aspiring students, but also to generate new knowledge that could be used to advance the effectiveness of those in the profession, in order to serve better those needs of society that are met by civil engineers. Illustrative of the objectives of the department (frequently referred to as a "school" at that time), even in its very early years, are the following quotations that were taken from University publications of that era:

From an 1870-71 report of the Board of Trustees: "This school is designed to make good practical Engineers, thoroughly prepared for all branches of Engineering work, Railroad surveys, Topographic and Geodetic Surveying, Bridge building, Government surveying, etc."

From an 1872-73 University Catalogue and Circular: "The School is designed to furnish a course of theoretical instruction accompanied and illustrated by a large amount of practice, which will enable students to enter intelligently upon the various and important duties of the Engineer. Those who desire a preparation at once broad and thorough, and who are willing to make persevering effort to obtain it, are cordially invited to connect themselves with this school."

From an 1890-91 University Catalogue and Circular: "While the instruction aims to be practical by giving the student information and practice directly applicable to his future professional work, the prime object is the develop-

1878

Ira Osborn Baker becomes department head, a position he will hold until 1915.

ment of mental faculties. The power to acquire information and the ability to use it is held to be of far greater value than any amount of so-called practical acquirements."

As the program of instruction of the department developed, so did laboratories that were needed not only to support that instruction, but also to provide the space and physical facilities that were needed to foster the research objectives of the department. According to records now available, initial efforts in laboratory equipment development were focused on the acquisition of surveying instruments. Evidence of this interest in the surveying component of the early curriculum is seen in the following statements that were taken from the 1890-91 issue of the University Catalogue and Circular:

"The school is provided with the instruments necessary for the different branches of engineering field practice, including chains, tapes, compasses, plane tables, stadias, transits, levels, barometers, base rods and comparing apparatus, sextants, engineer's transits arranged for astronomical observation, and solar compass attachments for transit.

"A portable altitude and azimuth instrument of the latest and best form from the celebrated makers, Troughton & Simms, of London, is used for instruction in geodesy and practical astronomy. It is read by micrometer microscope to single seconds, both of altitude and of azimuth. The astronomical observatory is provided with an equatorial telescope, and astronomical transit, with attachment for zenith telescope work, a chronometer, and a set of meteorological instruments."

In view of the emphasis then given to surveying in-

The Ira O. Baker Prize honors the top two CEE graduates from each year. Their names are inscribed on a plaque that hangs in Newmark Lab.

Ira O. Baker establishes a Cement and Masonry Laboratory.

struction, this is not unexpected. Interestingly, surveying continued to hold a strong place in the undergraduate curriculum until the early 1950s, requiring at that time 10 semester hours for all students, and an additional six hours of surveying electives for use by some students. How times have changed! As of this writing, the department offers no courses in surveying.

In 1889, Professor Baker established a Cement and Masonry Laboratory, later to be known as the Cement and Concrete Laboratory, and a companion Road Materials Laboratory, which dealt primarily with stone, gravel, brick and bituminous materials, was established in 1906. In 1923, the work of this laboratory was split into two separate units, a Bituminous Materials Laboratory and a Non-Bituminous Materials Laboratory. In a closely related development, a structural research laboratory, the initial focus of which was the experimental study of reinforced concrete, was established in 1923. All three of these laboratories were first located in temporary space, but were moved into the new Materials Testing Laboratory (later to be known as Talbot Laboratory) in 1929.

Even in its earliest days, the department recognized the particular needs of cities to deal effectively with their public water supply and distribution systems, as well as with their sewage collection, treatment, and disposal systems. However, in 1890, it was decided that these subjects could be more effectively dealt with in a separate "Department of Municipal and Sanitary Engineering," which, it was hoped, would attract more students and serve better the needs of society in these areas. Later in 1926, it was decided that this was not a good idea. The new department was

1890

A Department of Municipal and Sanitary Engineering is established with Arthur N. Talbot, the inventor of the septic tank, as its head. This precursor to environmental engineering will exist on its own until 1926, when its responsibilities will be returned to the CE department. (Image 0005378, Arthur N. Talbot, circa 1920, University archives)

then discontinued, and its responsibilities were returned to the Department of Civil Engineering, at which time a Sanitary Engineering laboratory was established. With this action, the foundation of the department as we now know it was firmly established.

But the Department of Municipal and Sanitary Engineering, however brief its life, had a greater impact on the development of our department than may be apparent from this brief notice. The head of that department was Arthur Newell Talbot, who served also as head of the Department of Theoretical and Applied Mechanics (TAM), and whose name is now enshrined on the building that housed that department. Talbot was an extraordinary man in many ways. Even as an undergraduate student in civil engineering, from which he received his degree, he demonstrated clearly not only his innate intellectual abilities (an average grade on all undergraduate work of 98 percent), but also the extraordinary breadth of his interests. While performing with distinction in technical areas, he also took leadership roles in literary society activities on campus, holding several offices in the Philomathean organization, as a delegate to the Interstate Oratorical Association, and as an associate engineering editor for The Illini.

The commonality of interest and the very close relationships that were developed in those early years between the TAM and CE departments contributed enormously to the successes that our department has enjoyed over the years.

Interesting insight into the early development of the department might be gained by looking briefly at the backgrounds and unique qualifications of the men who

1906

Carroll C. Wiley joins the University as the first professor of highway engineering.

1906

A Road Materials Laboratory, which dealt primarily with stone, gravel, brick and bituminous materials, is established.

contributed most significantly to that development. Looking first at the heads of the department, it is noted that, of these early department heads, only one, Professor Ira 0. Baker, held the position for a sustained period of time and left an indelible mark on the department. The others did contribute to the department's growth, but not nearly to the extent that Baker did.

From the available records, it appears that Professor Samuel W. Shattuck, a native of Massachusetts with B.S., A.M. and C.E. degrees from Norwich University in Vermont, who served as the first professor of civil engineering, was a veteran of the Civil War and a man of outstanding managerial and leadership abilities. His appointment in engineering was effective in 1869; however, because of other responsibilities that were given to Shattuck shortly thereafter, direction of the civil engineering program from March 1870 until November 1871 was assigned to Professor Stillman W. Robinson, head of the Department of Mechanical Science and Engineering. Interestingly, Robinson, though not a member of the CE faculty, was well qualified to direct its program, since he had received a civil engineering degree from the University of Michigan in 1863, and had taught mining engineering and geodesy there for several years. Following his service to Civil Engineering, Shattuck was appointed to successively higher positions of leadership within the University, including those of Vice-Regent, Business Agent and Manager, and Comptroller.

John B. Webb, who followed Shattuck and Robinson as a leader of the civil engineering program, the first official head, was born in Philadelphia and received his CE degree from the University of Michigan in 1871. He had a

1913

Harold A. Babbitt joins the department as an instructor to teach sanitary engineering courses. He remained on the faculty until his retirement in 1954.

1914

Wiley establishes the first Highway Engineering Conference in the U.S. It exists today as the Traffic and Highway Engineering Conference, with more than 1,000 attendees annually.

somewhat longer tenure in the position (1871-78), and he is remembered primarily for his insistence that his students perform at very high standards. Indeed, according to available records, he was regarded as a superb teacher, but also as one whose demands upon the students were excessive and unreasonable. However, in later years, many of his former students are reported to have admitted that his teaching style was more effective than they had realized at the time. In 1878, he took a leave of absence from the University to go abroad but resigned before returning.

Ira Osborn Baker, the second head of the department, is the individual who influenced most strongly the early development of the department, having led the department for the periods 1878-1915 and 1920-1922, for a total of 39 years. He received his B.S. and C.E. degrees from the U of I in 1874 and 1878, respectively, and was appointed Assistant Professor in Charge of Civil Engineering in 1879. He was promoted to Professor in Charge of the Department in 1880.

Baker was a man of extraordinary capabilities and energy. During his tenure as department head, he taught courses in engineering drawing, surveying, railroad engineering, bridges, masonry construction, geodesy, descriptive and practical astronomy, tunneling, contracts and specifications, roads and pavements, and analytical mechanics. In the absence of adequate textbooks for his students' use, he prepared such texts for surveying, masonry construction, and roads and pavements, and published them in blueprint form. As noted earlier, he also established cement testing and road materials laboratories to improve both the instructional and research programs

1915

Frederick H. Newell, the third head of the department, came to Illinois from the Massachusetts Institute of Technology (MIT) in1915. He was a native of Pennsylvania with an academic degree in mining engineering from MIT.

of the department. He was also unusually active in professional organizations, having conceived and founded both "The Western Society of Engineers" and "The Society for the Promotion of Engineering Education," the second of which evolved into "The American Society for Engineering Education," which is the primary engineering education organization of today.

In recognition of his outstanding contributions to it, the University of Illinois awarded him the honorary degree of Doctor of Engineering in 1903. Baker retired from the University in 1922 after 48 years of service, 39 of which were as Head of the Department of Civil Engineering.

Frederick H. Newell, the third head of the department, came to Illinois to fill that position in 1915. He, too, was a native of Pennsylvania (Bradford), but his academic degree was in mining engineering from MIT. He had no academic administrative or teaching experience at that time, his prior work having been with the U. S. Geological Survey and the U. S. Reclamation Service, through which he had become highly regarded and admired by his fellow professionals. Indicative of his professional status was his appointment as the first director of the U.S. Bureau of Reclamation. A further indication of his reputation is given in the following statement that was written of him by President Theodore Roosevelt: "He is a public servant of whom it is the bald and literal truth to say, that by his services he has made all good American citizens his debtors."

However, in 1920, Newell observed that he could not get interested in the "educative process," and resigned his position at the U of I to engage in consulting work in Washington, D.C.

1922

Ira O. Baker retires from the University after 48 years of service, 39 of which were as Head of the Department of Civil Engineering.

1922

Clement C. Williams arrives at the University of Illinois and becomes the fourth head of Civil Engineering.

Clement Clarence Williams, the fourth head of the department, was a native Illinoisan with a C.E. degree from the University of Colorado. He came to the University of Illinois in 1922, following service on the faculties of the University of Colorado and the University of Kansas. He resigned from the Illinois faculty in 1926 to assume positions of higher responsibility at other institutions, culminating in the presidency of Lehigh University.

In addition to these department heads, there were many other men who began their careers on our faculty during these early years, but who made their most significant contributions to the growth of the department in later years. This list includes such giants as Harold E. Babbitt, John S. Crandell, Hardy Cross, James J. Doland, Charles A. Ellis, Whitney C. Huntington, William H. Rayner (BS 1909), Thomas C. Shedd, Carroll C. Wiley, Jamison Vawter, Wilbur M. Wilson, and numerous others.

1923–1965

Edward E. Bauer, faculty member from 1923-1965, developed some of the earliest national specifications and testing procedures for soils, asphalt, and concrete, and authored one of the first textbooks on concrete. He also directed the bituminous, concrete, and soil labs.

One of the structural research programs of this era was what came to be known within the department as "The Slab Project." The objective of the 10-year project was to improve our understanding of the behavior of reinforced concrete slabs and improve our ability to design and build them. Much of the theory developed is still in use today. Photo courtesy of the University of Illinois archives. (Image 0005372, Bridge Slab Investigation, circa 1939)

CEE History & Heritage
Part Two: The Whitney C. Huntington Years 1926–1956

John D. Haltiwanger
Professor Emeritus

To set the stage, we should recognize that, except for the first five or six years of this era, circumstances were anything but "normal." The Great Depression, followed by World War II and the economically booming post-war years, all affected the department in varying ways during this most interesting period in history. When Professor Huntington became the fifth head in 1926, the department had an academic faculty of 16 members at ranks of instructor and above, five graduate research assistants, one laboratory technician, and one secretary; and it had an annual operating budget of about $70,000. Faculty salaries ranged from about $2,400 for instructors to an average of about $4,750 per year for full professors. The department secretary was paid $1,200 per year, and graduate research assistants received the princely sum of $600 per year, presumably for half-time appointments. Of course, to put things in perspective, we should realize that, at that time, one could purchase a new car for $500 or less.

The same situation prevailed for much of the next several years; by 1932-33, the department budget had grown to about $77,000, while the faculty and staff, as well as enrollments, had remained essentially unchanged.

1926

The department has 16 faculty and an annual operating budget of $70,000. Faculty salaries range from about $2,400 for an instructor to about $4,750 for a full professor.

1926

Whitney C. Huntington becomes the fifth head of the department, a position he will hold for 30 years.

But in the next academic year, 1933-34, disaster struck the University—in the form of a severe national economic Depression. For that year, the budget suffered a reduction of about 18 percent, shrinking to about $63,000. All faculty members took substantial cuts in salary, and graduate research assistants were eliminated. In the 1933-34 annual report of the department, special note was taken of the severe negative impact that the elimination of research assistants would have on the department's research program and, correspondingly, on its reputation, unless the situation could be corrected in the near future.

Particularly because of the work of Professor Wilbur M. Wilson, who began and was the driving force behind the structural testing laboratory, as well as that of closely associated and collaborating faculty members in the Department of Theoretical and Applied Mechanics (TAM), the department had already acquired a highly regarded reputation for its research. Fortunately, through the leadership provided by Huntington and the cooperation and dedication shown by the faculty and staff, those problems were overcome in the following years, and the department's reputation for excellence continued to grow.

During the 1930s, undergraduate enrollment fluctuated between about 250 and 290, and the graduate enrollment between about 20 and 30, and despite the Depression that engulfed the nation, the department's budget recovered from the reductions of 1933. By 1940 the budget had reached about $80,000, and the academic faculty had grown slightly to 18 members, plus seven graduate research assistants. Perhaps it was the commitment and responsibility that Huntington observed in his faculty in the

1929-30

Charles A. Ellis, a professor in the department from 1914-1921, designs the Golden Gate Bridge. Photo: aimintang/istockphoto.com

early days of the Depression that led him to include in his 1933-34 annual report the following quote by writer Henrietta Ripperger from the April 1934 issue of The Atlantic Monthly: "Among professional men, engineers are the best paid. It has been said that engineers are the happiest of God's creatures. They deal in facts; they see a task, and they do it. Their work, always difficult and challenging, seldom proves impossible. They have a tradition of accomplishment. It is merely in keeping with their whole habit of life and thought that, if they have debts, they try to pay them. It is interesting to note here that the kind of mental training they have had seems directly to produce responsibility in money affairs, a result of education so unusual as to be almost unique."

The evolution of the undergraduate curriculum is also interesting. In the early years, all students followed the same curriculum, but in 1915, the inability of the department curriculum to cover adequately the expanding breadth of the profession within four years led to students being permitted to specialize their programs somewhat by selecting, in their fourth years, among General, Highway, or Structural engineering options. In the years that followed, additional program flexibility was introduced so that, by 1940, a student could specialize in any one of six options: General, Highway, Hydraulic, Railway, Sanitary, or Structural engineering. Numerous similar curriculum changes were made in the following years in order to better satisfy the interests of the students and the needs of the profession. One curriculum change of this era seems worthy of special note. In 1946, the Sanitary Engineering option was replaced by a separate four-year curriculum leading to a

1931-34

Wilbur Wilson conducts fatigue testing of steel plates and joints for the Oakland Bay Bridge and the Golden Gate Bridge.

1946

Nathan M. Newmark is appointed to the faculty after completing his Ph.D. under the guidance of Hardy Cross.

B.S. in Sanitary Engineering. This change was precipitated by a requirement of that era which stipulated that a candidate for a state or federal position in the field of sanitary engineering had to have a degree in that field. The degree was discontinued in the 1960s.

Many of the old-timers will also remember the Summer Surveying Camp that was held at the former Civilian Conservation Corps Camp Rabideau at Blackduck, Minn. Preceded by three weeks of instruction on campus, this five-week surveying camp was authorized in 1945, first implemented in 1946, and discontinued in 1973. The surveying program was administered at that time by William H. Rayner. After he retired in 1952, he was succeeded by Milton O. Schmidt (PhD 1950).

Much of the early reputation of the department was generated through the widespread use of textbooks that were authored by members of this faculty. Before 1945, the faculty had produced more than 50 textbooks, many of which were adopted for use at a large number of schools. Illustrative of these well-known textbooks are the following: Babbitt's "Sewerage and Sewage Treatment," Babbitt and Doland's "Water Supply Engineering," Bauer's "Highway Materials" and "Plain Concrete," Huntington's "Building Construction," Pickels and Wiley's "Route Surveying," Rayner's "Surveying" and "Advanced Surveying," Shedd and Vawter's "Theory of Simple Structures," Shedd's "Structural Design in Steel," and Wiley's "Principles of Highway Engineering." All of these, along with numerous others, were written during the period covered here.

The contributions to the profession through the research efforts of the faculty also served to expand and

1937

Hardy Cross, who made many significant contributions to the profession including the development of the Moment Distribution Method, resigns his position on the department faculty to become head of the civil engineering department at Yale University.

enhance the reputation of the department as a center of graduate study. It is, of course, impractical to list here all of the research activities of all of the members of the faculty that took place during this era, but several of those research accomplishments deserve special note. One such achievement was that of Professor Hardy Cross, who made an enormous contribution to the profession through development of a practical method for the rigorous analysis of highly indeterminate structures that he called "Moment Distribution." Before the introduction of Cross' method, such analyses could be carried out only through the solution of large numbers of simultaneous equations (the so-called "slope-deflection method"), which of course was impractical for many large, complex structures. Moment Distribution, which was essentially an approximate numerical solution of the slope-deflection equations, was used extensively throughout the profession for the analysis and design of complex structures until the digital computer came into widespread use and made the routine solution of large systems of simultaneous equations practical. To further the value of his analytical contribution, Cross also applied it successfully to the analysis of the flow through complex hydraulic pipe systems.

Cross resigned his position in 1937 to become head of the civil engineering department at Yale University. He was succeeded by Professor T. C. Shedd, who had worked closely with Cross at both U of I and earlier at Brown University, and by a young man, Nathan M. Newmark (MS 1932, PhD 1934), who had recently received his Ph.D. here under the guidance of Cross and who had been appointed to the faculty in 1934. Although their efforts were directed

1940

Students can now specialize in any one of six curriculum options: General, Highway, Hydraulic, Railway, Sanitary, or Structural Engineering.

1945

Much of the early reputation of the department was generated through the widespread use of textbooks that were authored by members of this faculty. Before 1945, the faculty had produced more than 50 textbooks, many of which were adopted for use at a large number of schools.

differently, the work of both Shedd and Newmark in the years that followed enhanced enormously the reputation of the department in the area of structural engineering. Shedd's contributions were directed primarily toward the instructional mission of the department, his having been the co-author of two widely used texts, and in what might be called the professionalization of structural engineers; he was extensively involved in the development and implementation of the structural engineering registration requirements in the State of Illinois. Professor Newmark's career development in the department took a different route, the primary thrust of his efforts being in the area of structural engineering research. In his early years here, he worked closely with Professor Wilbur M. Wilson who, at that time, had primary responsibility for the structural research program of the department, as well as with Theoretical and Applied Mechanics professors Frank E. Richart (MS 46, PhD 48), Herbert F. Moore, and other colleagues, who were actively engaged in closely related structural engineering and structural material research.

One of the structural research programs of this era that reflected special credit on the department was what came to be known familiarly within the department as "The Slab Project." Conducted cooperatively with the TAM department, this project was under the general direction of TAM professor Richart, with Newmark having primary responsibility for the analytical studies that were an integral part of it. Professor Chester P. Siess (MS 1939, PhD 1948), who became another of the department's superstars in later years, was also involved in the project's experimental aspects. The objective of the 10-year project was to improve

1945

Karl Terzaghi, known as the father of modern geotechnical engineering, was appointed as a Visiting Research Professor. Two Terzaghi assistantships were established, and Terzaghi was brought to campus for occasional lectures, an arrangment that lasted several decades. Photo: Terzaghi on the U of I campus.

our understanding of the behavior of reinforced concrete slabs under various support and loading conditions, and thereby to improve our ability to design and build such slabs. The results of this study had a profound effect on the American Association of State Highway and Transportation Officials' (AASHTO) specifications for the design and construction of such slabs, as did the pre-stressed concrete research that was begun in the department in the early 1950s. Earlier analytical studies by TAM Professor H. M. S. Westergaard on the behavior of uniformly supported reinforced concrete slabs also influenced strongly the formulation of specifications for the design of rigid concrete pavements. Wilson's other major research during this era included studies of welds and welding procedures, the behavior of reinforced concrete arch and rigid frame bridges, cylindrical shells and thin spheres, and the fatigue strength of riveted connections.

All of these, and many other related studies, had profound effects on the practice of structural engineering. Illustrative of the influence of these studies are the restrictions that, as a consequence of the fatigue-of-riveted-connections studies, were placed on the use of low-alloy steels for members that would be subjected to fatigue loading in the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge.

While the major research emphasis of the department during the early years of this era were in the areas of structural engineering, materials and mechanics, research programs had been developed and were being given increased emphasis in other technical areas as well. The expansion of research activities in other areas was greatly

1946

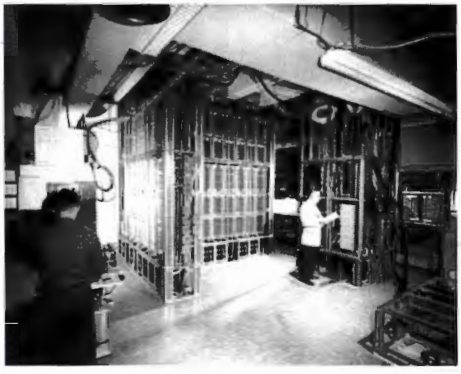
Summer Surveying Camp begins at the former Civilian Conservation Corps Camp Rabideau in Blackduck, Minn. Photo: A teaching assistant named Hugh O'Reilly (MS 54 TAM) is thrown into Lake Benjamin during the summer surveying camp of 1953. Courtesy of Bruce Hannon (BS 56).

enhanced by the corresponding expansion of the physical facilities in which they could be conducted. To this end, a separate Sanitary Engineering Laboratory building was built in 1944 in the area now occupied by the Atmospheric Sciences Building, and a hydraulic engineering laboratory was established in a section of an unused physical plant warehouse nearby. Similarly, during that same period, the highway engineering research program was strengthened by the establishment of a small test track in a Quonset hut located in the same general area. All of these facilities, considered even at the time to be inadequate, were replaced in the following era, which can properly be called the Newmark Era, by greatly improved and expanded facilities. The following research projects, along with many others, were conducted during the 1930s and 1940s:

- Flow of Sludge in Pipes, Diatomite Water Filtration, Hydraulics of Wells and Open Channels, Disposal of Radioactive Wastes (Babbitt)
- Flood Flows of Illinois Streams (Pickels)
- Flow in Prismatic Channels (Lansford of TAM, in close cooperation with CE)
- Foundation Pressure Distribution (Newmark)
- Road Signs, their Size, Design and Placement (Wiley)
- Pressures due to Granular Materials in Storage Bins (Huntington)
- Loads of Culverts through Earth Embankments (Huntington)
- Joints in Concrete Pavements (Crandell, Wiley, Huntington and Richart)
- Hydraulic Model Tests of Spillways (Doland)

1947

Starting in the mid-'40s, the College of Engineering built a series of computers designated as the ILLIAC series. Civil Engineering was one of the two largest users of these machines. Nathan M. Newmark was the first Director of the Computer Laboratory from 1947-1957. Photo courtesy of the University Archives (Image 0002346 ILLIAC, 1956).



- Hydraulic Analysis of Precipitation Data (Doland and Chow). This study provided the basis for the design of the drainage system of Chicago's Congress Street Expressway, now Eisenhower Expressway.
- Study of Dolomites in the Chicago Area to assess their suitability as aggregates (Bauer)
- Soil Particle Size Determination (Bauer)

Even in a short history, note must be taken of the continuity and growth of the department's highway engineering program, established by Professor Carroll C. Wiley and later expanded by Professor Ellis Danner (BS 1930, MS 1949), who joined the faculty in 1946. While the research program in this area was supported in the early years by the Illinois Division of Highways, stronger emphasis was given to it in 1952 with the establishment of the Illinois Cooperative Highway and Transportation Research Program (ICHTRP) which provided continuity of funding, of which the concrete slab studies were a part.

There was widespread interest in the department's work in transportation and highway engineering, as evidenced by the continuous existence of the Highway Engineering Conference, known today as the Transportation and Highway Engineering Conference. This conference, which has been offered continuously since 1914, except for 1945 and 1946 when World War II considerations forced its cancellation, has enjoyed the enthusiastic support of the transportation engineering community throughout the state of Illinois and beyond.

During the late 1940s and early 1950s, as well as in the years to follow, the department's programs were

1948

Ralph Peck publishes "Soil Mechanics in Engineering Practice," co-authored with Karl Terzaghi. Photo: Peck circa 2008

strongly influenced by World War II and its aftermath. Among the more visible of these influences was the presence of significant numbers of U.S. military officers working toward graduate degrees. All of the branches of the military—Army, Navy, Air Force and Coast Guard—sent engineering officers here for advanced study. Paralleling this contribution to our nation's military strength was the department's substantial participation in research programs developed and funded by the U. S. Department of Defense. These programs included not only on-campus theoretical and experimental studies, but also studies conducted at the Nevada and Pacific military test sites concerning the effects of nuclear blast loadings on various types of structures. Interestingly, the military students then enrolled as graduate students were rarely involved in the field tests.

Research and graduate study programs in all areas of the department continued to expand during the postwar years, much of it due to additions to the faculty that were made during the 1940s and early 1950s. Particularly significant among these faculty additions were Ralph B. Peck in geotechnical engineering, Richard S. Engelbrecht in environmental engineering (then called sanitary engineering), and Ven T. Chow (PhD 1950) in hydrology and hydraulic, or hydrosystems, engineering. All of these men, as well as many others such as Chester P. Siess, William J. Hall, William H. Munse (BS 1942, MS 1944), and Clyde E. Kesler (BS 1943, MS 1946) in structural engineering, mechanics and materials, built upon the foundation that had been established by their predecessors and mentors to develop further the well-deserved reputation of the department as one of the world's foremost centers of study and

1948-51

Nathan M. Newmark acts as consulting engineer for the Torre Latinoamericana in Mexico City, designing it to withstand earthquakes, which it successfully did in 1957 and 1985. Department alumnus Leonardo Zeevaert (PhD 1949) designed the tower. Also involved was alumnus Emilio Rosenblueth (MS 1949, PhD 1951).

research in civil and environmental engineering.

During Professor Huntington's tenure as department head, the externally funded research budget of the department increased from about $15,000 to $640,000 per year. In like manner, the undergraduate and graduate enrollments in the department increased from 324 to 593 and from 30 to 154 students, respectively. There are numerous other faculty members of this era whose names have not yet appeared in this narrative but must be included in any summary of the department's programs of that time. Such a list of names, incomplete as it almost certainly is, would include James G. Clark (BS 35, MS 39), Eugene J. Daily (MS 1951), Lawrence E. Goodman (MS 1942), Walter E. Hanson (MS 1947), Frederick H. Reichert, William A. Oliver (MS 28, CE 33) and Anestis S. Veletsos (MS 50, PhD 53) in the structural program; Jess C. Dietz who followed Babbitt as manager of the sanitary engineering program; John C. Guillou (MS 1954) in hydraulics; William W. Hay (MS 1948, PhD 1956) whose primary interest was in railroad engineering; Charles S. Danner (BS 1947, MS 1950) in surveying; and John W. Briscoe (BS 1947, MS 1953), who served not only as a member of the structural engineering faculty but also as unofficial Assistant Head of the department.

While Professor Huntington was an outstanding and highly regarded civil engineer and administrator in his own right, his most significant contribution to the department may well have been his acquisition of a faculty of truly outstanding intellectual and professional leaders. We are the fortunate beneficiaries of the work of these men and their colleagues.

1952

The University of Illinois signs the first official agreement with the Illinois Department of Transportation to collaborate on transportation research. (Previously the university had served as contractor.) Photo: istockphoto.com

A change in the design of license plates to improve their readability in 1938 came as a result of research at Illinois by Professor Carroll C. Wiley, at left. At right is Professor John E. Baerwald, whose work contributed to additional changes to improve legibility, such as the addition of letters. Photo courtesy of the University of Illinois Archives. (Image 0005389 License Plate Study, circa 1962.)

CEE History & Heritage
Part Three: The Newmark Years
1956–1973

John D. Haltiwanger
Professor Emeritus

Nathan M. Newmark was not the unanimous, uncontested candidate to succeed Huntington as department head in 1956. Probably because of his intense focus on and his extraordinary success in the development of the structural research program of the department during the Huntington era, there was concern that Newmark was too one-dimensional to serve effectively as the leader of the entire, multi-dimensional department. Despite these concerns, he was selected as the sixth head of our department.

Newmark very quickly demonstrated that he would expand his focus to include all technical areas of the department and apply to the entire department the same level of effort that he had applied so successfully in prior years to the development of the structural research program. To assist him in this work, he asked Professor John W. "Jack" Briscoe to continue in the capacity of Associate Head that he had held during the later years of the Huntington era. In 1958, Professor William J. Hall joined the department administration with general responsibility for its graduate student and research programs. Following Briscoe's elevation to the position of Associate Provost of the University in 1965 and later of Vice Chancellor for Administration, Professor John D. Haltiwanger also joined the de-

At the end of Whitney C. Huntington's 30-year term as department head, the annual externally funded research budget in the department has increased from about $15,000 to $640,000.

partment's administrative team with primary responsibility for the undergraduate student and instructional programs of the department. Because of its extraordinary growth during this era, it is impractical to try to describe the department's activities chronologically in the space available. Instead of trying to do this, we will address first a few major, department-wide events of this era, and then identify a few of the major personalities and accomplishments of the era in each of the department's technical areas.

The single most significant event of that era was clearly the acquisition of our new building which, following Newmark's death, was named "Nathan M. Newmark Civil Engineering Laboratory." The need for such a facility had long been recognized, and concerted efforts to acquire it were begun shortly after Newmark assumed office. At that time, the programs of the department were conducted in 13 different buildings around campus, including what was then Civil Engineering Hall (now Engineering Hall), Talbot Laboratory, the Civil Engineering Surveying Building (immediately south of the University Library), a Sanitary Engineering Laboratory (south of Springfield Avenue and immediately west of Gregory Street in Urbana), a Hydraulic Engineering Laboratory (located in an unused Physical Plant warehouse near the Sanitary Laboratory), and several smaller structures such as a highway test track in a Quonset hut in the vicinity of the Sanitary Engineering Lab, two old residences across Wright Street from Talbot Lab that were used for research assistant offices, and several others. The first phase of the new building was funded primarily by a state grant of $4,216,000, and construction of it had progressed in 1967 to the point that most of the

1956

Nathan M. Newmark becomes department head.

offices in it could be occupied at that time, while work on the several laboratories continued. The second phase of the building, funded substantially by an NSF grant in the amount of $1,500,000 permitted the expansion of Newmark Civil Engineering Lab within the next few years to become the facility as we know it today. Our current building complex was completed with the construction of the Hydrosystems Laboratory in 1970. Unfortunately, despite continuing efforts, funds were not provided for the construction of a multi-story connecting link between Newmark Lab and the Hydrosystems Lab that would have provided much needed classroom, meeting, and office space. A second major accomplishment that affected the general health of the department was the establishment of the Civil Engineering Alumni Association in 1963. The officers selected to oversee the initial program of this new group included Paul F. Kent (BS 1920), President of General Paving Co. of Champaign, as President; Frank K. Veasman (BS 1939), Vice President of Chicago Malleable Castings Co., as First Vice President; Thomas D. Wofford Jr. (BS 1946), Assistant Chief Engineer, ICRR, as Second Vice President; Professor Edward E. Bauer as Secretary; and Professor Milton O. Schmidt (PhD 50) as Assistant Secretary. As is evident from the nature and extent of its current programs, this organization has grown and prospered, and has evolved as a major force for good in support of the programs of the department. It provides a critical and much-needed link between the department's faculty and students and the world of civil engineering practice.

While not physically or contractually connected with the department, the location of the U. S. Army Construc-

Late 1950s

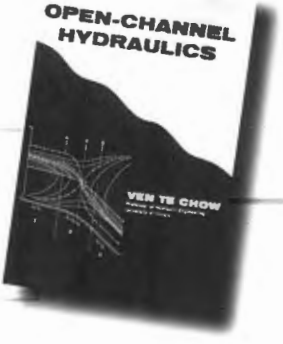
The U of I establishes the Highway Engineering Technician Training Program, the first of its kind in the nation, led by Ellis Danner.

tion Engineering Research Laboratory (CERL) in Champaign represents a third major accomplishment of that era. During the planning phase for the CERL, the Army had indicated that it wanted its new laboratory to be located in close proximity to a highly regarded university civil engineering research program. Such a location would be of obvious benefit to both the new Army laboratory and the nearby academic institution. In response to this interest as expressed by the Army, proposals were submitted by a number of schools, of which the U of I was one. Fortunately for us and, we think, for the Army, our proposal was selected, and CERL in Champaign became a reality in 1969. As a consequence of the many cooperative relationships that have developed over the years between CERL and our department, the effectiveness of both institutions has been greatly enhanced. During this era, the department evolved as one of the premier civil engineering programs in the nation, at both the undergraduate and graduate levels. Evidence of this status is given by the following statement taken from the Engineers' Council for Professional Development accreditation report of 1961: "This department was judged to be one of the finest in the nation with respect to faculty qualifications and scholarly production, curriculum, instruction, and equipment." That report did note, however, that "physical facilities were inadequate," a statement with which the department agreed fully, and which gave support to the department's continuing efforts to acquire a new building.

Among the general observations that help define the growth of the department during this era in both size and stature are the following:

1959

Ven Te Chow publishes "Open Channel Hydraulics."

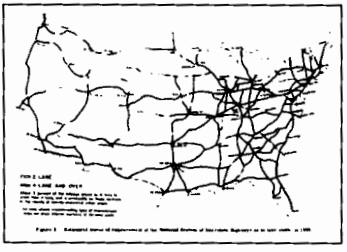


- Of the faculty members that were active during this era, 19 were elected to membership in the National Academy of Engineering.
- Of the faculty members that were active during this era, 14 were elected as Honorary Members of the American Society of Civil Engineers.
- Enrollments varied during this period from 1966 levels of 593 undergraduate and 154 graduate students to maximums of 627 undergraduate and 303 graduate students in 1970 and 1973, respectively.
- The number of full-time-equivalent academic faculty increased to about 70 in 1973.
- The annual research budget for the department grew from about $750,000 in 1956 to more than $2 million in 1973.
- Both Professors Newmark and Peck were awarded the National Medal of Science.

As noted earlier, in the limited space that is available, a comprehensive listing of the activities of the department during this era is impractical, but a highly condensed overview of those activities, as given below, might help portray the character of the department at that time. Under Newmark's leadership, the general focus of the department underwent an interesting change. Up until that time, with a few exceptions, the faculty consisted essentially of two faculties, a "teaching faculty" and a "research" faculty. But within a few years, those two faculties had become one, with all faculty members being involved in both teaching and research, to the benefit of the entire department, especially its students. The structural engineering and me-

The first "Air Force Design Manual" (unclassified) is prepared in the Civil Engineering department by Nathan M. Newmark and John D. Haltiwanger with input from numerous faculty.

chanics programs continued to be the largest and most widely regarded of the department's programs, with general guidance still being given by Newmark. Among the many other faculty leaders in these programs were, in alphabetical order: Robert A. Eubanks, Douglas A. Foutch (BS 1970), William L. Gamble (MS 1961, PhD 1962), Edwin H. Gaylord, German Gurfinkel (MS 1957, PhD 1966), William J. Hall (who subsequently became Department Head), John D. Haltiwanger (author of this article), Narbey Khachaturian, Clyde E. Kesler, Frederick V. Lawrence, Leonard A. Lopez (MS 1963, PhD 1966), Vincent J. McDonald, Robert J. Mosborg (BS 1946, MS 1949), William H. Munse, Stanley L. Paul (BS 1955, MS 1956, PhD 1963), David A.W. Pecknold (MS 1966, PhD 1968), Arthur R. Robinson (MS 1953, PhD 1956), William C. Schnobrich (BS 1953, MS 1955, PhD 1962), Chester P. Siess (who also became department head), George K. Sinnamon (MS 1949), James E. Stallmeyer (BS 1947, MS 1949, PhD 1953), William H. Walker (MS 58, PhD 63), and J. Francis Young, all of whom completed their professional careers on this faculty. Significant contributions to the program were made also by many other young men who spent only parts of their professional careers here. Included in this latter group are, again in alphabetical order, Mohammad Amin (MS 1960, PhD 1966), Alfredo H-S. Ang (MS 1957, PhD 1959), Walter J. Austin (MS 1946, PhD 1949), Steven J. Fenves (BS 1957, MS 1958, PhD 1961), Lawrence Goodman (MS 1942), Hubert H. Hilsdorf, Joshua L. Merritt (MS 1955, PhD 1958), Bijan Mohraz (BS 1961, MS 1962, PhD 1966), Wallace W. Sanders (MS 57, PhD 60), Mete A. Sozen (MS 1952, PhD 1957), Wilson Tang, Yi-Kwei Wen, and Anestis S. Veletsos.



The University's work is reflected in the Eisenhower Interstate System and in many agencies' guidelines for the design and construction of flexible pavement systems.

The well-established research programs in concrete and steel, as structural materials under assorted environmental and loading conditions, and the behavior of reinforced concrete beam and slab structures under varying load and support conditions were continued with expanded breadth, but new areas of structural engineering research were introduced. Among these "new" areas were numerous programs in the area of structural dynamics, with emphasis being placed on both the behavior and design of structures under the effects of both earthquakes and nuclear blast loads. It is fair to say that the research work done here during that era provided the bases upon which much of the design criteria for structures subjected to loadings produced either from earthquake motions or nuclear blasts now rests. Much the same can be said for the areas of prestressed concrete and the probabilistic approach of the determination of the safety of structures.

In addition to its work in the area of the design and behavior of structures to resist nuclear blast forces, a closely related program concerned the design of structures to protect occupants from the radiation as well as the blast effects of nuclear explosions. This program was conducted by Professor Arthur B. Chilton, with the cooperation of numerous other members of the structural engineering faculty, and consisted of courses of instruction as well as a significant number of short courses that were presented to practicing engineers.

But major strides in program growth, in both size and stature, also occurred in the other technical areas of the department. Of particular note in this regard are Geotechnical Engineering, Sanitary (now, Environmental)

1963

The Civil Engineering Alumni Association is established.

Engineering, Hydrology and Hydrosystems, Construction Management and Systems Engineering, Transportation Engineering, and Surveying and Photogrammetry.

Under the guidance of Professor Ralph B. Peck, ably assisted by professors Edward J. Cording (MS 1963, PhD 1967), Melvin T. Davisson (MS 1955, PhD 1960), Don U. Deere (PhD 1955), Alfred J. Hendron (BS 1959, MS 1960), Herbert O. Ireland (MS 1947, PhD 1955), Thomas K. Liu (BS 1955, MS 1956, PhD 1961), Gholamreza Mesri (BS 1965, MS 1966, PhD 1969), Roy E. Olson (PhD 60), and Thomas H. Thornburn, several of whom completed their careers elsewhere, the geotechnical program gained international recognition. As was the case for the structural research program, the work domain in geotechnical engineering was expanded to include soil and rock dynamics in order to deal more confidently with the behavior and design of structures built either on, in or through these materials when subjected to unusual dynamic loadings such as those induced by nuclear blast loadings or earthquake motions.

Directed by Professor Richard S. Engelbrecht, the Sanitary Engineering program made major advances during this era, expanding its scope of interests to the point that its name was changed to "Environmental Engineering and Science" in order to reflect more properly its broader interests. During this era, its areas of research and teaching were expanded to include water quality control, emphasizing both drinking water and wastewater, air pollution control, solid waste management, aquatic biology, and environmental systems analysis. With the development of programs in these areas, it became one of the premier environmental engineering programs in the nation. Par-

1960s

Professors Ven Te Chow (photo) and Ben Chie Yen develop a unique rainfall apparatus in the lab. Designed and built by Terence Harbaugh (PhD 1966) as part of his doctoral dissertation, it receives national attention in Time magazine. Chow is pictured standing under the rain generator with an umbrella.

ticipating closely with Professor Engelbrecht in this program growth and expansion were such highly regarded engineers and scientists as E. Downey Brill, Richard I. Dick (PhD 1965), J. Wayland Eheart, Benjamin B. Ewing, Edwin E. Herricks, Jon C. Liebman (who later became Head of the Department), John T. Pfeffer, Vernon L. Snoeyink, and James J. Stukel (who became President of the U of I).

Similarly, under the direction of Professor Louis R. Shaffer (MS 1957, PhD 1961), who was appointed later as the first Technical Director of the new U. S. Army Construction Engineering Research Laboratory in Champaign, the program in Construction Engineering and Management blossomed. Among the notable additions to that faculty were LeRoy T. Boyer and John W. Melin (MS 1956, PhD 1961). During this period, having been stimulated by a newly enacted "State Technical Services Act," the closely related area of Civil Engineering Systems achieved self-identification, and a significant program of research and instruction in this area was developed. Instrumental in this development were Steven J. Fenves and Leonard A. Lopez. Contributing also to the developments of this era was Professor Judith S. Liebman (later to become Vice Chancellor for Research on this campus) who applied her background in operations research to further expand the scope of the department's interests.

The long and distinguished history of research, service and teaching in the area of Transportation Engineering, which was led in earlier years by Carroll C. Wiley, was continued and expanded under the guidance of Ellis Danner, with the able assistance of John E. Baerwald, Eugene Huang, John Hutchinson (BS 51, MS 54, PhD 61) (all of

1962-63

Professor Steven J. Fenves takes a leave of absence to work with colleagues Locher and Marsh to produce the first comprehensive computer programs for structural design.

whom completed their careers elsewhere), William W. Hay, who had responsibility for the railway engineering aspect of the program, and Moreland Herrin. Upon Danner's retirement, Moreland Herrin assumed the leadership role for this program, and Ernest J. Barenberg (PhD 1965), Samuel H. Carpenter, Michael I. Darter, Barry J. Dempsey (BS 1960, MS 1966, PhD 1969) and Marshall R. Thompson (BS 1960, MS 1962, PhD 1964) joined its faculty. During this era, the Transportation Facilities program grew in size and stature to become a widely regarded centers of transportation engineering study in the nation, a position that it still enjoys.

With the advent of the new Hydraulics and Hydrosystems Laboratory Building in 1970, the department's program in that area of teaching and research also expanded. This era saw a marriage between the well-established hydrology program and the then-emerging laboratory-oriented hydraulic engineering program that had been housed in the old hydraulic engineering laboratory building. This merger fostered the development of a strong and highly regarded program in water resources systems. Until his untimely death in 1981, Professor Ven T. Chow, an internationally known authority in the area of Hydrosystems Engineering, directed the program. Participating with him in this work were fellow faculty members such as William C. Ackermann, John C. Guillou (MS 54), Edward R. Holley, W. Hall C. Maxwell, Murray B. McPherson, Joseph P. Murtha (PhD 61), Harry G. Wenzel, and Ben C. Yen.

Under the guidance of Professor Milton O. Schmidt, Surveying and Photogrammetry continued during this era to be a small but vital area of departmental instruction and research programs. Participating with Schmidt in the con-

1964

Nathan M. Newmark contributes to the founding of the National Academy of Engineering.

duct of this program were Winfield Eldridge, Houssam M. Karara and Kam W. Wong. The department completed this era larger, stronger, more broadly based and more highly regarded, both nationally and internationally, than at any time in its impressive and illustrious history to that time. But this little narrative that attempts to reflect, in a very general way, the nature and extent of that growth, falls short of that goal. Neglected in this piece were the names of countless men and women who participated on the faculty for relatively short periods of time, but who, during those periods, contributed greatly to the ultimate successes of the groups of which they were parts. To these people, many of whom were his personal friends, and all of whom were his highly regarded and respected associates, the author extends his apologies—there simply wasn't enough space to permit the inclusion of all of their names.

Also neglected in this piece are the extraordinary contribution of the nonacademic staff of the department—people like Newmark's secretary, Doyne Proudfit; Vincent J. McDonald who directed the instrumentation of the laboratory tests; and Wyck McKenzie of the staff of the concrete laboratory. It is much to be regretted that we can't give due credit to these folk, for without their committed support, not much of what happened in the department would have happened. Unmentioned also are the untold, but profound, contributions that were made to the profession and to society by the department's alumni. To include this, even reasonably adequately, would require books. Suffice it to say that the reputation of the department is reflected, perhaps most brilliantly and effectively, by and in the works of its graduates.

The new Civil Engineering Building is under construction, left. At right, Nathan M. Newmark, left, and Professor John Haltiwanger examine the plans.

Major CEE Sub-Disciplines

William J. Hall
Professor Emeritus

In order to complete the historical picture presented in the last history article by John D. Haltiwanger, and after reviewing departmental research summaries for the past half-century, it was decided that brief descriptions of the seven major sub-disciplines would depict more fully the research and instructional programs of the last half-century or so, often called "the Golden Era." Over the years the titles of the major sub-disciplines in the department have changed slightly from time to time. Below are brief overviews of significant activities that cut across all or many sub-disciplines, followed by short summaries of the seven major sub-disciplines operating since WWII.

At the end of most of the sub-discipline descriptions is a list in brackets of professors, or staff, identified from study of the Engineering College Research summaries, of key individuals involved with the research; if an individual is identified by name in the descriptive material his name may not be found within the brackets. If we have missed anyone we apologize, and would appreciate learning of such omissions, so as to include them in the next edition of this book.

Computers

Starting in the mid-'40s the College of Engineering built a series of computers designated as the ILLIAC series.

1967

The construction of Newmark Lab, called at this time simply the Civil Engineering Building, has progressed to the point that most of the offices can be occupied, while work on several laboratories continues. Photo (l to r): Professors George K. Sinnamon; Nathan M. Newmark, head; and Robert J. Mosborg, assistant head, examine a model of the building.

Civil Engineering was one of the two largest users of these machines during their development, and also other manufactured units as they became available to the campus, for example IBM and Burroughs, and then later a number of supercomputers. The rapidity of these developments has been breathtaking, and their use in all aspects of our research and instruction grew almost beyond imagination. With the advent of stand-alone desktop machines, and laptops as computational and word-processing tools, along with larger machines, and sophisticated software development, computers have altered the work product and thinking in engineering in a revolutionary manner. Nathan M. Newmark, former Head of CEE was the first Director of the Computer Laboratory from 1947-1957.

Centers

Since WWII, numerous research centers employed for focusing major effort on a given subject have been active in the college and departments. Four brief examples wherein the CEE faculty have/had a major role follow.

Center for Cement Composite Materials, later renamed the Center for Advanced Cement-Based Materials (ACBM)

Although centered at Northwestern University, this center relied heavily on the involvement of CEE at Illinois faculty. Professor Francis Young was the first CEE lead, followed by Professor Leslie J. Struble. This interdisciplinary program was dedicated to exploring the potential for developing new high-performance materials based on cementitious reactions. This center was active for 13 years.

1969

The U.S. Army Corps of Engineers' Construction Engineering Research Laboratory (CERL) is established in Champaign. Photo: Aerial shot taken circa 1969, courtesy of the U.S. Army Corps of Engineers.

Mid-America Earthquake Center (MAE)

Starting in 1997, under NSF sponsorship, the center focused on the infrequent, but high-consequence, seismic events that occur in the Midwestern and eastern states. The initial director was Professor Daniel Abrams (MS 1974, PhD 1979), followed by Professor Amr Elnashai. The center has been instrumental in coordinating the research of more than seven universities in diverse areas ranging from engineering to social science with a common theme of mitigation of seismic risk.

Network for Earthquake Engineering Simulation

As part of the George E. Brown Network for Earthquake Engineering Simulation (NEES), Illinois hosts the Multi-Axial Full-Scale Sub-structured Testing and Simulation (MUST-SIM) site. Under the direction of Professor Amr Elnashai originally, followed by Professor Billie F. Spencer Jr., this facility is one of 15 across the nation that forms a network. Capabilities of this site provide a total testing-analysis-visualization-display environment for testing full-scale structural assemblies under complex loading and boundary conditions.

WaterCAMPwS

An ongoing interdisciplinary center involving work at 10 institutions, the NSF Science and Technology Center for Advanced Materials for the Purification of Water with Systems (WaterCAMPWS) exists to develop revolutionary new materials and systems for safely and economically purifying water for human use, while simultaneously developing the diverse human resources needed to exploit

1970

The Hydrosystems Lab is completed.

the research advances and the knowledge base created. Professor Benito Mariñas of CEE is the Interim Director.

Rankings

Departmental rankings in engineering began in the early '60s, under the American Society of Engineering Education (ASEE), then switched over in 1983 to the magazine U.S. News and World Report. Over those years, CEE at Illinois ranked regularly in the top four, usually among the top three, and in 1986-87 received its first ranking of first for graduate and undergraduate civil engineering programs, a distinction it has held during most of the subsequent years. In recent years, Environmental Engineering has usually ranked in the top four.

Photogrammetric and Geodetic Engineering

Beginning in the '50s and extending into the '90s, this unit was active with research on spatial and aero-triangulation, analytical photogrammetric matters, and especially development of computer programs and applications in this field. As such specialized studies became subsumed especially within governmental laboratories, this area of study was phased out in the late 20th Century. [Affiliated Faculty: Houssam M. Karara, Kam Wong]

1970

Professor Mete Sozen prepares the first American Concrete Institute building code seismic provisions.

Global Leaders in Construction Management

The Global Leaders in Construction Management program, established in 2005, is a five-year program during which students earn both bachelor's and master's degrees. The program's primary focus is to provide the student with a superior balance of practice and theory with a global perspective of the construction industry. In addition to a curriculum guided toward more practice-oriented subjects, students experience three practical components over the graduate year: an international experience visiting construction companies and projects abroad, a summer internship, and a national trip to significant construction projects in the United States.

Photo: Global Leaders students on a trip to Panama in 2009.

Construction Engineering and Management

Liang Y. Liu and William J. Hall

Research efforts in Construction Engineering and Management encompass the application of fundamental principles of mathematics, physical sciences, and engineering concepts so as to obtain an understanding of the factors influencing economics and physical phenomena inherent in the construction processes. Early researchers in the Construction Engineering and Management domain were from the Structures area; they pioneered the development of theories and methodologies in improving the construction processes as an extension of the design.

Since WWII, the Construction Group has been a leader in developing systematic approaches to improving construction processes in buildings, highways, and other infrastructure systems. The group has been a major contributor to POLS (Problem Oriented Languages), in particular Steven J. Fenves and Leonard A. Lopez, specifically for computer applications in the construction industry, along with the uses for Critical Path Methods. The group has been recognized as being highly innovative in making use of the latest computer technology as it relates to construction engineering.

Beginning in 1961 the reorganized program focused on Construction Productivity, Construction Planning, Cost Estimating and Analysis approaches to enhance construction processes. Work by Louis R. Shaffer and his colleagues and graduate students on Critical Path Methods

1971

The first intercollegiate concrete canoe races are held on May 16, 1971, at Kickapoo State Park in Oakwood, Ill., between U of I and Purdue. Concrete canoe racing was invented at Illinois.

and Construction Resource Management in the 1950s to 1970s played a critical role in defining a new field within civil engineering that focused on transforming management issues in the construction industry—so much so that Shaffer is credited in many circles as the "founder" of Construction Engineering Management Systems.

In 1968 the U.S. Army, following WWII, decided to build a major laboratory dedicated to Construction Engineering Management and related systems, denoted the U.S. Army Corps of Engineers Construction Engineering Research Laboratory (CERL) in Champaign. Upon its dedication, Shaffer was appointed the first Technical Director of CERL in 1969 and led CERL until the early 1990s. His vision, leadership, dedication, and contributions in research, education, and practice (both in the civilian and military applications) helped define the current Construction Engineering and Management field.

Built upon a long history of excellence in research, education, and service to the industry, the Construction Group continues to contribute to the construction domain in many fields, as for example field data collection, productivity improvement, construction process simulation, data mining, project planning, multi-objective optimization, and safety. Other relatively recent studies have focused on highway work zone optimization, collaboration, emergency response, public and private partnership, cost analysis, building information models, and with the U.S. Army CERL laboratory in Champaign, sustainable construction methods. Such research efforts help lead to up-to-date instruction in the classroom.

A footnote is in order here. In 1962-63, Professor

1971

The graduate degrees in Sanitary Engineering change to Environmental Engineering in Civil Engineering.

Steven J. Fenves took a leave of absence to work for a year at MIT, and helped R. Locher and S. Marsh with their advanced studies, and out of this effort was born the computer program STRESS, leading thereafter to STRUDL, and thereafter a whole industry of software developed to help with structural design and related systems. This effort constituted a true revolution in technical advancement.

[Affiliated Faculty: John W. Melin, LeRoy T. Boyer, Edward L. Murphree Jr. (PhD 1967), Boyd C. Paulson (BS 1945), R. W. Woodhead, Liang Y. Liu]

1973

Chester P. Siess becomes department head.

Concrete Canoe Racing

The tradition of building and racing concrete canoes has been popular with civil engineering students across the nation for 40 years. This practice got its start at the University of Illinois at Urbana-Champaign when Professor Clyde E. Kesler challenged his concrete design students to build a canoe out of concrete as a class project. The Illinois students raced their first canoe, named Mis-Led, against students from Purdue University on May 16, 1971, at Kickapoo State Park in Oakwood, Ill. After winning three out of five races, the Illinois students declared themselves the world champions. The idea caught on, and in 1987 the American Society of Civil Engineers organized the competition nationally. The Illinois team, the Boneyard Yacht Club, marked its 40th anniversary year in 2011.

Construction Materials

David A. Lange and William J. Hall

In the early years most of the materials work was conducted as part of the structural engineering program, but in the mid-1990s Construction Materials became recognized as an independent sub-unit of the department. Materials are essential to almost every aspect of our civil engineering profession and thereby of major educational interest. As Materials differentiated itself from Structures in the department, several faculty emerged as leaders that brought prominence and recognition. Clyde E. Kesler, a leading faculty member in the structures area who served a term as president of the American Concrete Institute, brought recognition to research of concrete materials. Frederick V. Lawrence, J. Francis Young, Richard L. Berger, Leslie S. Struble, and David A. Lange were among the faculty known for materials research in the 1970s through 1990s. The department has remained strong in concrete materials research in recent years with the addition of John Popovics and Paramita Mondal to the faculty of the Construction Materials group.

The Air Force Center for Cement Composites under the direction of J. Francis Young, established in the mid-1980s, brought an important infusion of resources to equip laboratories for basic materials research of cement and concrete. In 1988, the National Science Foundation (NSF) Center for Advanced Cement-Based Materials (ACBM) was established when Young helped lead a consortium

1973

The structures group conducts a major study on permafrost and its effects on vertical support member creep for the Trans-Alaska Pipeline System.

Excellence for Airport Technology (CEAT) was established in 1995 by Barry F. Dempsey, and David A. Lange succeeded as director starting in 2004. The Center began working with the O'Hare Modernization Program in 2004 on topics of airport pavements and safety. Over its life, CEAT has engaged more than a dozen transportation and materials faculty.

Today, the span of research topics of the materials group ranges from nanostructure to full-scale behavior of concrete pavements and structures. New laboratory techniques are being developed to characterize cement nanostructure, microstructure, and rheology to better understand chemical admixtures, durability mechanisms, and fresh properties. Non-destructive methods and health monitoring are long-term interests. New materials such as self-consolidating concrete, self-healing materials, and geopolymers are being advanced by research in the group.

Testament to the strength of the education CEE at Illinois students receive in materials has been the prominence of CEE alumni in leadership roles in the profession. Through 2011, 20 presidents of the American Concrete Institute have been CEE at Illinois alumni.

1975

The Nathan M. Newmark Medal is established by the American Society of Civil Engineers.

A separate Department of Municipal and Sanitary Engineering was established in 1890 to address emerging issues of water treatment and distribution, and sewage collection, treatment and disposal. This new department was headed by Arthur N. Talbot, inventor of the septic tank. It lasted until 1926, when its responsibilities were returned to the CE department. Photo courtesy of the University of Illinois archives. (Image 0005373 Sanitary Engineering Test Area, circa 1919.)

Environmental Engineering and Science

Vernon L. Snoeyink
Professor Emeritus

The Environmental Engineering and Science Program has its roots in the Department of Municipal and Sanitary Engineering that was headed by Arthur N. Talbot, inventor of the septic tank, until 1926 when the department was merged with Civil Engineering. In 1913, Harold A. Babbitt was hired as an instructor to teach sanitary engineering courses and remained on the faculty until his retirement in 1954. Professor Babbitt ran the Sanitary Engineering Laboratory and brought much recognition to the department by authoring two texts, "Sewerage and Sewage Treatment," and "Water Supply Engineering" (with James J. Doland), that were widely used throughout the civil engineering profession for more than three decades. The sewerage text went through eight editions and the 1958 edition was co-authored by E. Robert Baumann (BS 1945, MS 1947, PhD 1954), a former student of Professor Babbitt and a professor at Iowa State University. The sixth edition of the water supply text in 1962 was co-authored by Professor John Cleasby of Iowa State University.

After receiving his M.S. and Sc.D. degrees from the Massachusetts Institute of Technology, Richard S. Engelbrecht was hired as a member of the faculty in 1954, just as Professor Babbitt was retiring, and he remained on the faculty until his retirement in 1992. He was made the leader of what is now the Environmental Engineering and Science

1978

John C. Liebman becomes department head.

program in 1957 and continued in that position until 1980, when John T. Pfeffer assumed that position. He was the only faculty member in the program near the beginning of his tenure, and with his guidance and the strong support of the department's leadership, it grew rapidly. Today there are approximately 13 faculty covering the areas of water quality, air quality, systems analysis, hazardous waste, sustainability, and groundwater. In addition, there is close collaboration on research and education initiatives with other faculty in the Civil and Environmental Engineering department and throughout the University on topics such as water resources, toxicity of trace contaminants, and the development of new materials for use in environmental quality control systems.

Some of the early faculty members during Engelbrecht's tenure were Ben Ewing, who later directed the University's Water Resources Center and the Institute for Environmental Studies; James J. Stukel, who initiated the air pollution control program and later held the positions of Chancellor at the University of Illinois at Chicago, and President of the University of Illinois; John T. Pfeffer, who initiated our efforts in the solid waste area; Jon C. Liebman, who initiated the systems analysis portion of the program; and Richard I. Dick, Richard Speese, John T. O'Connor, and John Austin, all of whom made strong contributions to the water quality control area. Richard Engelbrecht was best known for his research achievements in the microbiological area of water quality and his extensive public service in positions such as President of the Water Pollution Control Federation (now Water Environment Federation) and President of the International Association on Water Pollu-

1980

Vernon L. Snoeyink and D. Jenkins publish "Water Chemistry."

tion Research and Control (now International Water Association).

The faculty in the Environmental Engineering and Science Program are very proud of its graduates at all degree levels. The number of students in our graduate program has grown steadily through the years to its current number of about 90, with approximately a 50:50 split between M.S and Ph.D. students. These students have made important advances in the state of knowledge in the research laboratory and have continued to achieve after graduation in their positions in industry and educational institutions. Although our undergraduate students are not identified by their area of specialization within civil engineering, many B.S. graduates have also excelled as environmental engineers in the workplace as well.

1981

The Civil Engineering Building is named after Nathan M. Newmark, who died in January of this year.

1982

The Civil Engineering Alumni Association Newsletter reports that engineers' salaries are up 9.9 percent, according to the National Society of Professional Engineers (NSPE). The median annual salary earned by NSPE members in early 1982 was $39,000, compared to $35,000 in 1981.

Hydraulic engineering researchers examine a model of a bridge on Illinois highway 460 that traversed the Wabash River flood plain to New Harmony, Ind. Photo courtesy of the University of Illinois archives (Image 0005376 Men Working on Civil Engineering Bridge Model, circa 1950).

Environmental Hydrology and Hydraulic Engineering

Marcelo H. García
Chester & Helen Siess Endowed Professor in Civil and Environmental Engineering
Praveen Kumar
Colonel Harry F. and Frankie M. Lovell Endowed Professor in Civil and Environmental Engineering
and William Hall

Water resources engineering in the Department of Civil Engineering at the University of Illinois at Urbana-Champaign has a distinguished history in hydraulics, hydrology and water resource management.

The department first made its national mark in 1887-88 when Professor Arthur N. Talbot issued one of the first formulas for determining the waterway area required for the passing of floods under bridges and excess water through culverts. From 1915 until 1920, Frederick H. Newell was Head of the Civil Engineering department and was well known for his work on irrigation and dams. After his tenure as head he became the Director of the U.S. Geological Survey and was known as the "father of stream gauging." In 1921 Hardy Cross joined the faculty in structural engineering but published a seminal paper on flow and head loss in piping networks. The Hardy Cross method is widely used around the world. There followed many other published achievements, for the profession and as part of instruction, as for example the study of magnitude and

1983

The Association of American Railroads names the University of Illinois an Affiliated Laboratory for Railroad Research, under the direction of Professor Ernest J. Barenberg. Photo: istockphoto.com

frequency of Illinois floods by Professor George W. Pickels in 1937. A year later, Pickels published his well-known book, "Drainage and Flood Engineering." In 1926 Professor James J. Doland co-authored with Harold E. Babbitt the first edition of "Water Supply Engineering," a book used as a text nationwide for many years. Professor Babbitt's expertise was on sanitary engineering and he was in charge of the first hydraulics laboratory, which was located by the Boneyard Creek, just north of Engineering Hall. In the 1950s Professor John Guillou was in charge of the Hydraulic Engineering Lab at 1007 Western Avenue, Urbana, conducting numerous hydraulic model studies of highway drainage systems, bridges and hydraulic structures.

In 1950 Ven Te Chow obtained his Ph.D. in engineering under Professor James J. Doland. In the early 1950s Professors Doland and Chow (Chow joining the faculty as a Research Assistant Professor in 1951) worked on the design of storm water drainage for the Congress Expressway in Chicago, which drew significant public attention. In 1959 Chow published the classic textbook "Open Channel Hydraulics," translated into several languages almost immediately. This seminal contribution was followed by the "Handbook of Applied Hydrology," published by McGraw Hill in 1964. The books found use world-wide and are known to be in use now in 2011. Chow was the first President of the International Water Resources Association, after helping to found the association, and with cooperation from Wyndham J. Roberts of the Illinois State Water Survey and Professor William "Hall" Maxwell launched its official journal, Water International.

In the late 1960s professors Chow and Ben Chie Yen

1984

William J. Hall becomes department head.

developed a unique rainfall apparatus, designed and constructed by Terence Harbaugh as part of his doctoral dissertation, which received national attention in Time magazine. By then leadership in the field of urban hydrology, hydraulics and flood management was firmly established at the University of Illinois. In the mid-1960s, professors Hall Maxwell, Edward Holley and Harry Wenzel joined the faculty, bringing new expertise in hydraulic engineering, diffusion and dispersion, and urban hydrology, respectively. Professor Ben Chie Yen joined the faculty in 1967 and gained prominence in open-channel hydraulics, stochastic hydraulics, urban hydrology, and water resources engineering. His book titled "Centennial of Manning's Formula," on open channel resistance became a major reference on the subject. In 1968 with a grant from the National Science Foundation and the State of Illinois, the Hydrosystems Laboratory, designed by Maxwell, was built at the corner of Mathews Avenue and Main Street, Urbana. In the 1970s, Professor George Tauxe was hired to develop the hydrosystems engineering area. He was very computer-oriented and developed a lot of computer applications for his coursework. Professor Joseph Murtha was the first Director of the Illinois Water Resources Center, which started out with an office in Civil Engineering Hall (now Engineering Hall). It was later moved into the Hydrosystems Lab, where it remained for many years. Professor Ben Ewing of the Environmental Engineering group was the Director at the time they moved to the Hydro Lab. He was succeeded by Dr. Glenn Stout from the Illinois State Water Survey. Professor William Ackermann, Chief of the Illinois Water Survey, lectured on water resources planning.

1986-87

The department receives its first ranking of first for graduate and undergraduate civil engineering programs, a distinction it has held during most of the subsequent years.

1988

The National Science Foundation Center for Advanced Cement-Based Materials is established.

It is apparent that the early work described briefly above, and later work in this field, has led to recognition both nationally and internationally of Illinois as a leading institution in water resources engineering and management.

Albert Valocchi joined the Hydrosystems faculty in 1981. This expanded the breadth of research expertise to include groundwater hydrology and contamination. He established research collaborations with faculty in the Environmental Engineering and Science group, leading to a nationally recognized program conducting research on the impact of chemical and biological processes upon contaminant fate. Subsequently in 1990, Professor Marcelo García, followed later by Professor Praveen Kumar in 1995, continued to broaden studies in the water resources areas. García devoted his energy to reinvigorating the experimental activities and the development of new facilities in the Hydrosystems Lab, becoming its first director in 1997. He is known for his work on rivers, sediment transport and water resources engineering, having served as Editor-in-Chief of the American Society of Civil Engineers Manual of Practice No 110 "Sedimentation Engineering," published in 2008. Kumar's research is focused on the complexity in hydrologic systems arising from the interaction of the water cycle with vegetation, climate and human systems. His books "Wavelets in Geophysics" and "Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling" have been actively embraced by the community. Having previously served as the Editor for Geophysical Research Letters, he is currently the Editor-in-Chief for Water Resources Research, both of which are

1990

The CE department's computer network is considered a model within the College of Engineering. As reported in the civil engineering alumni news, "The department has approximately 80 Apollo workstations, including the Series 10000 Visualization System that also acts as a computer server ('it is literally never idle'), and various Series 3000's, 4000's, and 2500's. Much of the work involves finite-element analysis, electronic publishing, visualization, and software development to support the department's large array of research projects."

major scientific journals in the field, published by American Geophysical Union. In 1998, Chris Rehmann joined the faculty, bringing in expertise in the field of environmental transport and mixing, and broke new ground on coupling of fluid mechanics with biological systems.

Ximing Cai joined the faculty in 2003 and has led research in integrated hydrologic-economic analysis and its applications to the various coupled human-natural systems such as reservoirs, watersheds, and regional energy-resource-environment systems. His work has been recognized both nationally and internationally through numerous projects, publications and awards. Also in 2003, Arthur Schmidt (BS 1983, MS 1984, PhD 2002) joined the faculty as a Research Assistant Professor after having worked for the U.S. Geological Survey for more than a decade, bringing expertise in the area of urban hydraulics and hydrologic field measurements. He has worked in collaboration with Professor Marcelo García on a multi-year effort on the development of an integrated hydrologic/hydraulic model for the Tunnel and Reservoir Plan (TARP) in Chicago. In 2005, Gary Parker and Murugesu Sivapalan, two leading experts in their fields, joined the group. Parker, who also has a joint appointment in Geology, specializes in river morphodynamics, river engineering and deep-sea sedimentation processes. His research has led to new insight into river meandering, sediment transport in mountain rivers, delta and fan dynamics and turbidity currents. His research has been applied to dam removal, bridge scour, mine sediment disposal and offshore hydrocarbon exploration. Sivapalan, who has a joint appointment in Geography, has had a long history of research efforts aimed

1991

Neil M. Hawkins becomes department head.

at predictions in ungauged basins and associated issues of heterogeneity and scale. Since coming to Illinois his interest broadened into dealing with the effects of change, and he is spearheading new inter-disciplinary research efforts aimed at hydrologic predictions under change.

The Environmental Hydrology and Hydraulic Engineering group is housed in the Hydrosystems Laboratory, with state-of-the-art equipment, heavily used in research and instruction. The building's central experimental lab is now named for Ven Te Chow. The current faculty are renowned world leaders in such fields as water resources, river and coastal engineering, flood and drought management, groundwater, carbon sequestration, urban storm water management, stochastic analysis of hydraulic systems, flow prediction, mixing flows, urban storm drainage systems, hydrodynamics of watershed flow, hydroclimatology, ecohydrology and geomorphology.

1993

The Advanced Transportation Research and Engineering Laboratory is established in Rantoul, Ill., on the former Chanute Air Force Base.

Grainger Library

Completed in 1994, Grainger Library Information Center is the largest engineering library in the nation. The 92,000-square-foot facility houses a collection of approximately 275,000 volumes and offers seating for up to 1,200 patrons. Photo: Kalev Leetaru

1995

James J. Stukel, former CEE faculty member (pictured circa 1975), becomes president of the University of Illinois, a position he will hold for 10 years.

1995

The Federal Aviation Administration establishes the Center of Excellence for Airport Technology, headed by Professor Barry Dempsey.

Archival photo taken during the construction of the Chicago subway. Chester P. Siess, faculty member and department head from 1973-1978 is second from left. Ralph Peck, who served on the department faculty from 1942-1974, is fifth from left.

Geotechnical Engineering Program

Gholamreza Mesri
Ralph B. Peck Professor

In 1942, Ralph B. Peck was invited to join the department by then-head Whitney C. Huntington. Peck had attended Arthur Casagrande's Soil Mechanics course at Harvard University from 1938-1939 and served as an assistant subway engineer for the City of Chicago from 1939 to 1942, representing Karl Terzaghi, who was a consultant on the Chicago subway construction project. Before 1942, civil engineering professors at the University of Illinois had taught a course in mining engineering (S.W. Robinson), had a degree in mining engineering and had held positions with U.S. Geological Survey and U.S. Reclamation Service (Frederick H. Newell), had taught a course in tunneling (Ira O. Baker), had investigated lateral pressures in grain bins and elevators and loads on culverts through earth embankments (Whitney C. Huntington), and had developed charts for foundation pressure distribution (Nathan M. Newmark, who later undertook research on soil and structure dynamics, and was invited to give the Rankine Lecture of the British Geotechnical Society and the Terzaghi Lecture of the American Society of Civil Engineers). However, the only member of the faculty at Illinois to have had any formal training in soil mechanics was Ed Bauer, who had taken Casagrande's course at Harvard several years before Peck, and had primary interest in soil testing.

After Peck became a faculty member at the Univer-

1995

The Ven Te Chow award is established by the American Society of Civil Engineers in honor of Chow, who died in 1981.

1991

Hydrosystems researchers complete a study to drown-proof the Glen Palmer Dam on the Fox River in Yorkville, Ill., the site of about two dozen previous drownings. The implementation of their recommendations effectively ends drownings there.

sity of Illinois, Karl Terzaghi became a frequent visitor to Urbana, and in April 1945 he was appointed a Visiting Research Professor in the Department of Civil Engineering. The Dean of the Graduate College suggested providing money for two Terzaghi Assistantships and for bringing Terzaghi to Illinois for occasional lectures, an arrangement that was continued for several decades. In fact, Leonardo Zeevaert of Mexico, who had come to Illinois on a Terzaghi Assistantship, later worked together with Nathan M. Newmark on the earthquake design of the Torre Latinoamericana in Mexico City.

At the beginning there were few graduate students, and in a small office Peck set about work on the manuscript of "Soil Mechanics in Engineering Practice," co-authored with Terzaghi, with enthusiastic approval of Huntington. The book was completed in 1948, and together with subsequent editions has remained as the most important textbook in geotechnical engineering (a third edition of this book, with additional co-author Gholamreza Mesri, was published in 1996.)

Peck began building the Soil Mechanics group at Illinois by hiring Thomas H. Thornburn, who had graduate education from the University of Michigan and interest in surficial soils in connection with highways. This was followed with Herbert O. Ireland who had done research on stability of roadbed materials. In Chicago, and through subsequent consulting activities, Ralph Peck had developed an understanding of the needs of engineering practice with regard to earthwork problems and proper place of soil mechanics, rock mechanics and geology in design and construction. Donald U. Deere with graduate training in geology from

1996
David E. Daniel becomes department head.

the University of Colorado was brought in to lead the geological and rock mechanics aspects of the Geotechnical Program. Thus, Peck, Thornburn, Ireland, and Deere—all four hired during the leadership of the department head Whitney C. Huntington (1926-1956)—formed the first Geotechnical group at Illinois. With strong ties to the geology department, structural engineering, and theoretical and applied mechanics, they began the training of geotechnical engineers. Peck, together with Walter E. Hanson and Thornburn, in 1953 published a most widely used textbook, "Foundation Engineering," a book for engineers to use in practice.

The second faculty group of Tom Liu, Tom Davisson, and Roy Olson, and then Skip Hendron, Edward J. Cording, and Mesri, all of whom were educated in the Geotechnical Program at the University of Illinois, were hired during the time that Newmark was department head (1956-1973). The third faculty group included James H. Long, educated at the University of Texas at Austin, Timothy D. Stark, educated at Virginia Polytechnic Institute, Youssef Hashash, educated at Massachusetts Institute of Technology, and Scott Olson (BS 1994, MS 1995, PhD 2001), educated at the University of Illinois at Urbana-Champaign. Peter Lenzini (MS 71) and Gabriel Fernandez (MS 72), both educated at the University of Illinois, made important contributions to teaching activities of the Geotechnical Group.

After Deere, the Engineering Geology courses were taught in the geology department, first by Frank Patton (MS 1961) and then by Al Nieto, both educated at the University of Illinois. A number of faculty members were briefly part of the Geotechnical Program at Illinois. These were

1997

The Mid-America Earthquake Center is established with National Science Foundation sponsorship.

1997

The Hydrosystems Laboratory undergoes a major renovation and its research lab is named for Ven Te Chow.

Ron Heuer (BS 1963, PhD 1971), Philippe Martin and David Daniel.

First-rate instruction at undergraduate and graduate levels has been a primary objective of the Geotechnical group at Illinois. Traditionally a comprehensive set of courses has been offered in Geotechnical Engineering, including on soil and rock mechanics and behavior; foundation engineering including deep foundations; earth pressures and retaining structures including deep excavations and tunnels; slope stability and earth dams; and soil and rock dynamics and earthquakes. Research and consulting experience often has been brought to the classroom, and Peck taught an entire course on Case Histories in Geotechnical Engineering. These courses, together with engineering geology, geomorphology, structural geology and tectonics, hydrogeology, and other courses offered in the Geology Department, as well as courses in structural engineering and theoretical and applied mechanics, have educated students ready to meet the needs of the profession and society.

The research programs of the Geotechnical group at Illinois often have been connected to major civil engineering projects. Through the years, significant research has been carried out on support systems of open excavations and tunnels in soft ground and rock in connection to subway projects in Chicago; San Francisco; Oakland; Washington, D.C.; Baltimore; and Los Angeles. Research with extensive field observations has been carried out on earthfill and rockfill dams, for example, in British Columbia; James Bay, Québec; and Churchill Falls, Labrador. Detailed studies of soil and rock slope stability have been carried out

1997

The fourth-floor environmental labs in Newmark undergo a major, year-long renovation, funded in part by the National Science Foundation and the University of Illinois.

1998

The name of the department is changed from the Department of Civil Engineering to the Department of Civil and Environmental Engineering.

in connection with, for example, highway construction in Seattle, housing development in British Columbia, and the Trans-Alaska Oil Pipeline. Extensive research on ground reclamation and soft ground improvement has been conducted, for example, in connection with Changi, Bangkok, and Kansai Airports. These and other research programs, including projects on rock blasting in urban environment and earthquakes, deep foundations, geosynthetics, and computational geomechanics, all have had a major impact on the practice of geotechnical engineering.

The teaching and research activities of the Geotechnical Program at the University of Illinois through special content have built bridges between university and geotechnical engineering practice. The Geotechnical program has succeeded in fulfilling Karl Terzaghi's hope to educate geotechnical engineers who retain common sense and their sense of proportion.

2001

Faculty help procure the largest moveable full-scale pavement testing facility in the country, the Advanced Transportation Loading ASsembly (ATLAS).

William J. Hall, now professor emeritus, worked with Nathan M. Newmark on the seismic design for the Trans-Alaska Pipeline System. Photo circa 1974

Structural Engineering, Structural Mechanics and Materials

William J. Hall
and Robert H. Dodds Jr.
M.T. Geoffrey Yeh Chair in Civil Engineering

A major portion of the Structural Engineering program immediately following WWII and dominant for three or four decades thereafter, involved individuals engaged in a broad research program spanning civilian and military issues, as well as laboratory, field and analysis programs.

In these earlier years most of the materials instruction and research work was conducted as part of the structural engineering program, but in recent times has become a special, separate sub-unit of the department. It should be self-evident that materials research and development is the foundation of almost every aspect of our civil engineering profession and thereby of major educational importance. The following is a brief summary of some of the most significant work of the structural engineering faculty.

Highway-Bridge Floors

Research on highway bridge floors was carried out at Illinois, largely in Talbot Laboratory, during the period 1936-1954. The object of this research, through analysis and testing, was to develop useable design procedures for highway bridge slabs. Two types of bridges were studied, namely the simple span solid-slab bridge with integral curbs and the I-beam bridge. The findings of this major

Nicholas P. Jones becomes department head.

The WaterCAMPWS is established. Many CEE faculty conduct research through this National Science Foundation-sponsored center.

research program serve even today as a basis for design and construction of short-span bridges [Affiliated Faculty: Nathan M. Newmark, Chester P. Siess, Ivan M. Viest]

Studies of Riveted, Bolted and Welded Steel Connections

The major work on connections grew out of laboratory studies for the Oakland Bay Bridge and the Golden Gate Bridge prior to WWII. At the same time major programs of study on connections in buildings and bridges with high-strength bolts and steels as well as welding took place with the findings appearing in codes and standards in amazingly short time. Numerous detailed studies of the fatigue strength of various steels, of welded connections, as well as, for example, steel power poles and columns were conducted. [Affiliated Faculty: Peter C. Birkemoe (PhD 1966), Douglas A. Foutch, James F. Fuller, Edwin H. Gaylord, Narbey Khachaturian, Frederick V. Lawrence, William H. Munse, James B. Radziminski (MS 1961, PhD 1965) Frederick W. Schutz (MS 1950, PhD 1952), James Stallmeyer, Wilbur Wilson, Richard N. Wright (PhD 1962)]

Reinforced and Prestressed Concrete and Masonry

Since 1867, one of the busiest laboratories of the department has been the concrete laboratory. Out of this laboratory, through the efforts of many nationally famous professors, came research results that had a major influence on structural practice. From the 1950s through the 1970s, major work was undertaken on reinforced and prestressed concrete elements and structures, especially on topics such as bond strength, creep, shrinkage and especially shearing behavior. One of the longest major studies

2003

Hydro researchers, led by Professor Marcelo García and Research Assistant Professor Arthur Schmidt, begin developing hydrologic and hydraulic models to optimize Chicago's Tunnel and Reservoir Plan (TARP), aimed at controlling flooding in the city. Photo: García in a TARP tunnel.

concerned shear in reinforced concrete beams as well as deep beams. Most of this work appeared in building codes and publications almost immediately. [Affiliated Faculty: Daniel P. Abrams (MS 74, PhD 79), Edward Bauer, William L. Gamble, Frank Richart, Chester P. Siess, Mete A. Sozen]

Brittle Fracture in Wide Steel Plates

Brittle fracture, as opposed to ductile fracture, of structural steel had been studied in Europe and the United States during the 1930s and early 1940s. During WWII, fractures in merchant and naval vessels, as well as large steel oil storage tanks, became prevalent. In 1954, through the National Research Council, the U of I undertook investigations that contributed, along with those of other groups in the government and industry, to a solution to this problem [Affiliated Faculty: Furman W. Barton (MS 1959, PhD 1962), William J. Hall, Vincent J. McDonald, Robert J. Mosborg, William H. Munse, Nathan M. Newmark, Stanley T. Rolfe (BS 1956, MS 1958, PhD 1962)]

Military Defense Studies

Beginning in 1949, and up through the present, various faculty in the structural and geotechnical groups have carried out studies of many kinds under the auspices of the Department of Defense and Department of Energy agencies. The studies included the laboratory and field studies of hardened structural elements and tunnel linings, as well as participation in nuclear field tests in Nevada and the Pacific proving grounds. The first so-called "Air Force Design Manual" (unclassified) was prepared in the Civil Engineering department by Nathan M. Newmark and John D.

Robert H. Dodds Jr. becomes department head.

The Network for Earthquake Engineering Simulation is launched in November. The department houses one of the 15 equipment sites nationwide.

Haltiwanger with input from numerous faculty. [Affiliated Faculty: Edward J. Cording, William L. Gamble, William J. Hall, John D. Haltiwanger, Alfred J. Hendron, Joshua L. Merritt, Joseph P. Murtha, Nathan M. Newmark, Stanley L. Paul, George K. Sinnamon]

Seismic Analysis and Design

Following the early work by Newmark and Emilio Rosenblueth, on the seismic design of the Torre Latinoamericana in Mexico City in 1948-51, and as a result of the immense structural dynamics work coming out of the blast and shock studies, it was natural to enter into earthquake research. Interest was driven by the intense need for applications to design and construct nuclear power reactors, as well as large projects like the Trans-Alaska Petroleum pipeline. One of the major national efforts in the field of seismic design took place between 1973 and 1978, which led to a document titled "Tentative Provision for the Development of Seismic Regulations for Buildings, Applied Technology Council Report ATC 3-06." Some 500 pages in length, it introduced modern seismic design procedures and applications of advanced materials, and set the stage for the subsequent modifications of numerous seismic design documents. At the same time, the seismic provisions of the American Concrete Institute code were revised. [Affiliated Faculty: William J. Hall, Alfred J. Hendron, Bijan Mohraz, Nathan M. Newmark Mete A. Sozen, Anestis S. Veletsos]

Systems Reliability and Design

This unit undertook studies in the area of safety and reliability of structures, or more simply research best de-

2005

The Illinois Department of Transportation and the University create the Illinois Center for Transportation.

fined as "extended reliability," which relies on concepts of probability and engineering judgment. This work included theoretical developments and applications thereof to real structural projects. [Affiliated Faculty: Alfredo H.-S. Ang, Wilson Tang, Yi-Kwei Wen]

Computational Mechanics

In the mid-1980s, the cost of computer hardware with tremendously increased capabilities began to plummet dramatically. This development simulated a surge of new research activity in the fields of computational structural and solid mechanics in the department. Much effort focused on the development of modeling and simulation capabilities to predict the nonlinear response of civil engineering structures under severe earthquake loadings.

Key senior faculty during his period included William Schnobrich (nonlinear response of concrete structures), Art Robinson (numerical methods for wave propagation and modal response), David A.W. Pecknold (nonlinear models for steel and concrete structures), Jamshid Ghaboussi (nonlinear constitutive models and artificial neural networks). They were joined by younger faculty including Robert H. Dodds Jr. (MS 1975, PhD 1978) (nonlinear fracture and fatigue in structural metals) and Keith Hjelmstad (nonlinear mechanics of framed structures). Glaucio Paulino joined this group later and focused on boundary element methods and mechanics of emerging functionally graded materials. Recent research by Billie F. Spencer Jr. and his students has led to development and commercialization of wireless structural health monitoring systems, a major research development here in the department.

2008

The fourth-floor environmental laboratories are expanded to allow work on pathogenic viruses, a major threat to drinking water safety.

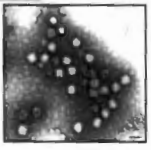


Photo: adenovirus

2008

Marcelo García publishes "Sedimentation Engineering: Processes, Measurements, Modeling and Practice, ASCE Manual and Reports on Engineering Practice No. 110."

An early paving operation. Photo courtesy of Professor Emeritus Marshall Thompson

Transportation (Highways, Traffic and Railroads)

Moreland Herrin, Professor Emeritus
Marshall Thompson, Professor Emeritus
William J. Hall
and Imad Al-Qadi, Founder Professor of Civil and Environmental Engineering

Through lasting contributions to the world's railroads, roadways, and runways, Illinois' transportation engineering program, since its inception in 1867, has established itself as one of the most highly respected educational and research transportation groups in the world.

Early history records indicate that almost all facets of transportation civil engineering began at or shortly after the beginning of the establishment of the department in 1867. One example is the curriculum in Railroad Civil Engineering started under Mechanical Engineering in 1898, with a major Civil Engineering component, and thereafter under various departmental direction, which went forward until 1940. Beginning shortly after engineering instruction commenced was research on railroad track design (Talbot), railway signaling (King), improved rail steels (Moore-TAM), transportation economics, and later, wheel design and braking (Wetenkamp-TAM). An important cross-departmental laboratory, known as the Concrete Laboratory, was established for instruction and research on cement and masonry with applications to all areas of civil engineering. The work there began under Talbot with the study of R/C beams and continued with later work by Ed-

2009

Amr S. Elnashai becomes department head.

2010

Construction begins on the M.T. Geoffrey Yeh Student Center in Newmark Lab.

ward Bauer and Clyde Kesler.

Highway engineering emerged publicly at the University of Illinois in 1906 when Carroll C. Wiley spearheaded numerous facets of highway development, and at the same time the first theoretical basis for the design of concrete pavements was established (Westergaard-TAM). Later as highway engineering evolved, transportation planning and systems programs were established at Illinois (Wiley, Boyce, and Baerwald) including one of the two Highway Traffic Safety Centers in the U.S. The faculty have contributed to such projects as the Hoover Dam, the Panama Canal, the AASHTO Road Test (Herrin), the Eisenhower Interstate Highway System, patented interlayer stress absorbing composite and edge drains (Dempsey), and introduced the widely used Pavement Condition Index (PCI) system and pavement management systems (Darter).

In 1951, following WWII, the Cooperative Highway Research Program between the U of I and the Department of Transportation began with Professor Ellis Danner of the CE department as director, and later with Moreland Herrin in charge. A host of projects were undertaken centering on management, planning, materials and pavements (concrete and asphalt), design, and traffic regulations.

In 2005, the Illinois Department of Transportation (IDOT) and the University created a partnership, the Illinois Center for Transportation (ICT). This center is currently under the direction of Professor Imad Al-Qadi, and located in Rantoul at the site of the old Chanute Air Force Base.

Several of the major efforts attracting national and international attention are described in somewhat more detail in the following sections.

2010

The department's freshman class includes the largest number of women to date—32 percent of the class, or 53 women out of 164 total students.

Pavements

After WWII, development of lime stabilization procedures (lime-flyash and lime pozzolan) for strengthening roadbeds in Illinois were developed in the laboratory and in the field. These procedures have been adopted and employed for rural highway roadways and incorporated into the IDOT specifications and those of many other states.

Other work has involved repeated test-loading on sub-grade soils and methods for enhancing strength and performance over time. A subject of particular attention has been the sub-grade and its drainage. Techniques for extending the cyclic endurance limits for asphalt, or flexible, pavements have been developed and adopted widely. Recent research has centered on techniques of maintenance with the economic goal of "zero maintenance." A continuing research program on reinforced concrete pavements has led to major improvements in that field as well.

In the '60s and '70s a major nationally recognized research effort by our transportation group led to the so-called Mechanistic Design of Flexible Pavements, employing time-tested mechanics procedures for estimating stress, strain and fatigue strength of asphaltic pavements, which has been met with wide adoption in the United States. The same approach has been employed for airport pavements with great success. [Affiliated Faculty: Moreland Herrin, Marshall Thompson, Ernest Barenberg, Samuel Carpenter, Michael Darter, John W. Hutchinson, George W. Hollon (MS 1958), Eugene Y. Huang]

Transportation Centers

In 1993 the legislature and University established

2010

The nation's first university-level course in high-speed rail is taught in the department by professors Chris Barkan and T.C. Kao. Photo courtesy of T.C. Kao

with the department the Advanced Transportation Research and Engineering Laboratory (ATREL) located on a portion of the site of the former Chanute Air Force Base in Rantoul, Ill. The Accelerated Transportation Loading System (ATLaS) was acquired in 2001 and installed at ATREL. The Federal Aviation Administration Center of Excellence for Airport Technology (CEAT) was founded in 1995 to focus on airport pavement improvement and safety issues, including wildlife, anti-icing and lighting. In 2004, the O'Hare Modernization Program initiated a research program through CEAT that targets technical issues related to construction of new and extended runways at O'Hare International Airport. These centers and associated equipment have constituted valuable additions to the department and demonstrated clearly how centers can work. [Affiliated Faculty: Barry Dempsey, William Buttlar, Jeffery Roesler (BS 1992, MS 1994, PhD 1998), Rahim Benekohal]

Traffic

All elements of the growing traffic problems for vehicles of all sizes have received study, and in many cases resulted in changes in practice and procedures by IDOT. For example, in 1997, as a part of ATREL, the Traffic Operations Laboratory (TOL) was formed, which houses equipment for the research and evaluation of traffic signal systems components and provides hands-on instruction for students and professionals. Other examples have centered on such matters as pedestrian movement, traffic movement, land use policies, and new devices to guide and control people and traffic. [Affiliated Faculty: John E. Baerwald, Robert H. Wortman (MS 1963, PhD 1970), Rahim Benekohal]

2011

The department launches its online graduate program, in which students can take graduate-level courses entirely online, combining them to earn certificates or a graduate degree.

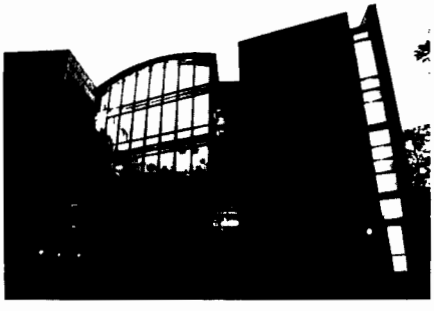
Railroads

With modest laboratory research, but a powerful text (W.W. Hay, "Railroad Engineering," 1953 and 1982), William Hay led railway education from 1947 to 1978, training numerous leaders in the railroad engineering field. Thereafter, management of this area was led by Professor Ernest Barenberg until 1991, when Christopher P.L. Barkan joined the department to advance training of students in railroading, including high-speed rail. In 1982, the Association of American Railroads (AAR) selected the University of Illinois as one of its Affiliated Laboratories. In 2010, the Rail Transportation and Engineering Center (RailTEC) was formed to broaden the scope of rail research and education and establish Illinois as the leading 21st century academic rail program in North America.

Conferences

Several transportation-related conferences and short courses nationally recognized for their contributions to the profession are held at the University of Illinois.

- Established in 1914 by Professor Carroll C. Wiley, the Annual Transportation and Highway Engineering Conference drew more than 1,000 attendees in 2010.
- The Railroad Environmental Conference, held annually since the mid-1990s, draws about 400 participants.
- The annual Traffic Engineering and Safety Conference, established in 1951, currently draws about 300 people.
- The annual Bituminous Paving Conference, established in 1959, currently draws several hundred participants each year.



The M.T. Geoffrey Yeh Student Center in Newmark Lab is complete.

1930 Research Effort Summary

The information that follows is extracted from a pamphlet authored by Whitney C. Huntington, "Research in Civil Engineering at the University of Illinois," Reprinted from the Technograph, p. 18, April 1931.

The efforts described here were accomplished with a research budget for each professor of normally $3,000 per year—except when additional modest industry funding was provided—and generally accommodated several graduate research assistants. Great attention was placed on the quality of publications so as to enhance usefulness by others, including carefully authored and reviewed Engineering College Bulletins.

- Bearing Value of Rollers, Wilbur M. Wilson
- Drainage Investigation, George W. Pickels
- Biaxial Stress, Wilbur M. Wilson
- Sewer Pipe Jointing Materials, Harold E. Babbitt
- Reinforced Concrete Arch Investigation, Wilbur M. Wilson
- Dependability of Theory of Concrete Arches, Hardy Cross
- Joints in Wide Plates, Wilbur M. Wilson
- Aeration of Sewage, Harold E. Babbitt
- Load Distribution by Timber Floors, William A. Oliver
- Moment Distribution, Hardy Cross
- Thin Cylindrical Shells as Columns, Wilbur M. Wilson
- Admixtures in Concrete, Edward E. Bauer
- Bearing Value of Bridge Pins, Wilbur M. Wilson
- The Column Analogy, Hardy Cross
- Bearing Value of Knife Edges, Wilbur M. Wilson
- Laminated Timber Arches, William A. Oliver

Heads of the Department of Civil and Environmental Engineering

Note that during the first 100 years of this top-ranked department, only six heads served in that capacity.

1. John B. Webb, 1871-1878
2. Ira O. Baker, 1878-1915 and (interim) 1920-1922
3. Frederick H. Newell, 1915-1920
4. Clement C. Williams, 1922-1926
5. Whitney C. Huntington, 1926-1956
6. Nathan M. Newmark 1956-1973
7. Chester P. Siess, 1973-1978
8. John C. Liebman, 1978-1984
9. William J. Hall, 1984-1991
10. Neil M. Hawkins, 1991-1996, and (interim) 2001-2002
11. David E. Daniel, 1996-2001
12. Nicholas P. Jones, 2002-2004
13. Robert H. Dodds Jr., 2004-2009
14. Amr S. Elnashai, 2009-

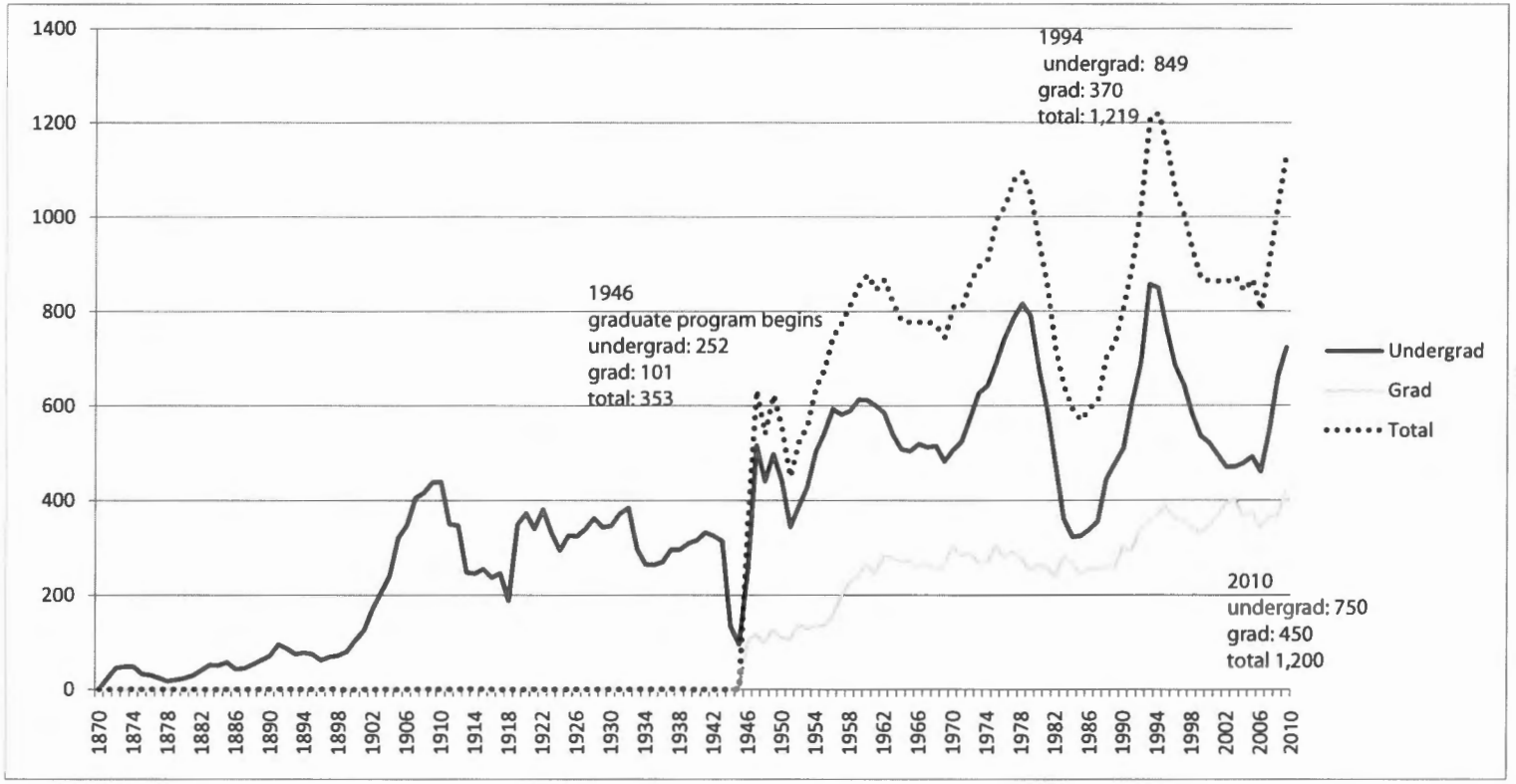
Deans of the College of Engineering

1. Stillman W. Robinson, 1870-1878
2. Nathan C. Ricker, 1878-1905
3. James M. White, 1906-1907
4. William F. M. Goss, 1907-1913, (interim 1915-1917)
5. Charles R. Richards, 1917-1922 (acting 1914)
6. Milo S. Ketchum, 1922-1933
7. Arthur C. Willard, 1933-1934
8. Melvin L. Enger, 1934-1949
9. William L. Everitt, 1949-1968
10. Daniel C. Drucker, 1968-1984
11. Mac E. VanValkenburg, 1985-1987
12. William R. Schowalter, 1988-2001
13. David E. Daniel, 2001-2005
14. Ilesanmi Adesida, 2006-present

Presidents of the University

1. John M. Gregory, 1867-1880
2. Selim H. Peabody, 1880-1891
3. Thomas J. Burrill, 1891-1894
4. Andrew S. Draper, 1894-1904
5. Edmund J. James, 1904-1920
6. David Kinley, 1920-1930
7. Harry W. Chase, 1930-1933
8. Arthur H. Daniels, 1933-1934
9. Arthur C. Willard, 1934-1946
10. George D. Stoddard, 1946-1953
11. Lloyd Morey, 1953-1955
12. David D. Henry, 1955-1971
13. John E. Corbally, 1971-1979
14. Stanley O. Ikenberry, 1979-1995
15. James J. Stukel, 1995-2005
16. B. Joseph White, 2005-2009
17. Stanley O. Ikenberry (Interim) 2010
18. Michael J. Hogan, 2010-

Enrollment Data 1870-2010



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"The Department of Civil and Environmental Engineering had its birth in 1867 when it was named as one of four branches of the Polytechnic Department of the University."

—John D. Haltiwanger

Hall

Haltiwanger

Khachaturian

This is the story of one of the world's most respected civil and environmental engineering departments, CEE at Illinois. In 2003, Professor Emeritus John D. Haltiwanger (1925-2008)—a CEE alumnus who spent his career on the department faculty—completed a three-part history of the department, with input from professors emeritus and fellow alumni William J. Hall and Narbey Khachaturian (1924-2009). Haltiwanger's pieces, plus the work of other distinguished faculty contributors, make up this history, edited by Hall and current department head, Professor Amr S. Elnashai. A timeline of significant events and photographs from the University of Illinois archives enrich the history narrative.

ILLINOIS

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