The second in a series of articles on the history of the Department of Civil and Environmental Engineering

Part Two, The Whitney C. Huntington Years: 1926-1956

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Part I of this story, The Early Years: 1867-1926, was published in the fall/winter 2003 issue of the CEE newsletter. These articles are not intended to be a detailed history, but rather a highly condensed overview of where we came from, who some of the primary contributors to our growth over the years have been, and what some of their major contributions were. This piece, Part II of the narrative, is being identified as The Huntington Years because Whitney C. Huntington served as head of the department during the entire period.

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 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. But in the next academic year, 1933-34, disaster—in the form of a severe national economic depression—struck the University. 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 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 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 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 W. H. Rayner. After he retired in 1952, he was succeeded by M. O. Schmidt.

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 by this article.

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

Whitney Clark Huntington

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, 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 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, 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 TAM professors F. E. Richart, H. 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, 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 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 1950's. 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.

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—Henrietta Ripperger, 1934

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 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)
- 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 C. C. Wiley and later expanded by Professor Ellis Danner, 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. This conference, which has been offered continuously since 1914, except for l945 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 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 post-war 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 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, and Clyde E. Kesler 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 research in civil and environmental engineering. During Prof. 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 J. G. Dark, E. J. Daily, G. H. Dell, L. E. Goodman, W. E. Hanson, F. H. Reichert, W. A. Oliver, and A. S. Veletsos in the structural program, J. C. Dietz who followed Babbitt as manager of the sanitary engineering program, John C. Guillou in hydraulics, W. W. Hay whose primary interest was in railroad engineering, C.S. Danner in surveying, and J. W. Briscoe 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.

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