



FREDERICK J. CONVERSE
(1891-1987)

INTERVIEWED BY
HARRIETT LYLE

November 16, 20 & 21, 1978

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Pasadena, California



Subject area

Civil engineering, soil mechanics

Abstract

Interview in 1978 with Frederick Converse, professor of soil mechanics emeritus, covers his family background in upper New York State, his undergraduate education in engineering at the University of Rochester, and his professional life at Caltech. At Rochester, his mentor was Frederic W. Hinrichs, who later became dean of students at Caltech in its early years. Converse was hired as an instructor in Caltech's engineering division in 1920, by the division's first chairman, Franklin Thomas. A pioneer in civil engineering and an adviser to builders, architects, and contractors, Converse taught one of the earliest courses in the country on soil mechanics and conducted research on the vibration compaction of sands and cohesive soils. He was a leader in professional organizations in his field and consulted for various firms and government agencies, including the United States Navy, the California Division of Architecture, the Kaiser Steel Mill, and Permanente Metals Corp.

Administrative information

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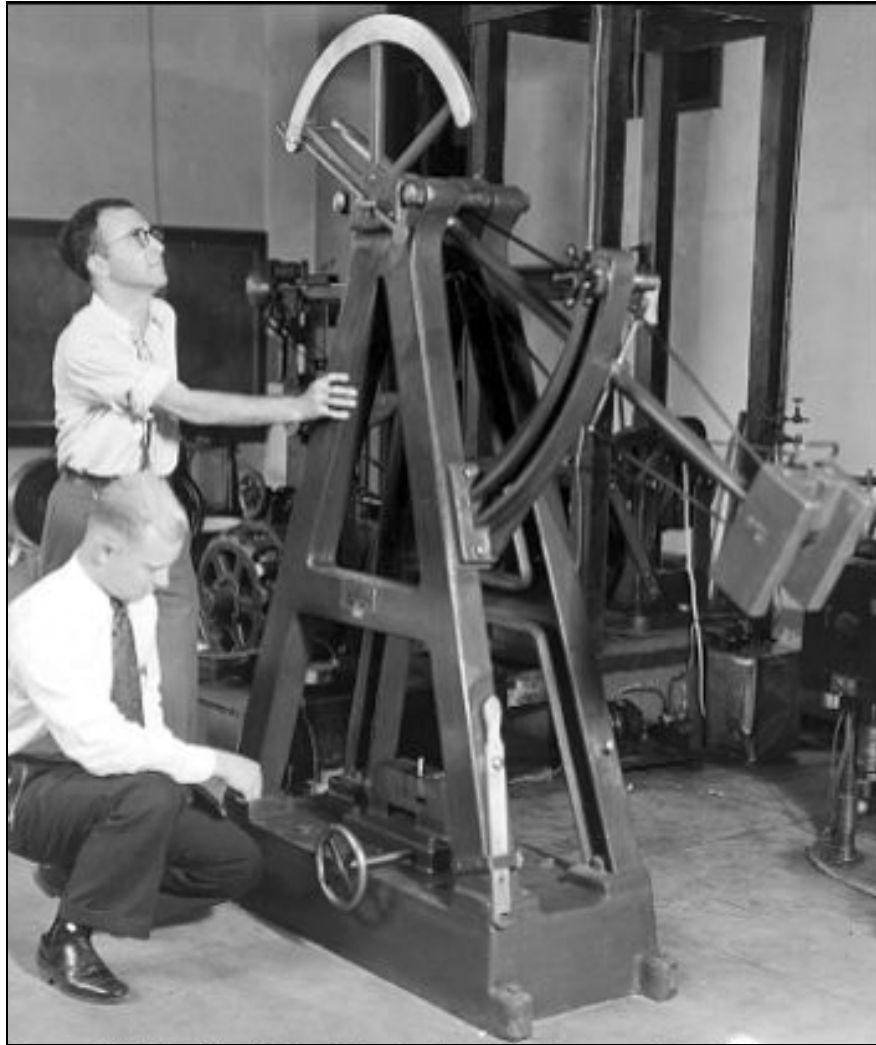
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Under the supervision of Frederick J. Converse (not pictured), students in the Testing Materials Laboratory at Caltech use an impact machine to determine the shock resistant properties of such materials as steel and wood. Caltech Department of Civil Engineering, 1934.

California Institute of Technology
Oral History Project

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Errata:

p. 8: “Camp A. A. Humpheries”—Correct spelling is Humphries.

p. 12: “Professor Sorenson”—Correct spelling is Professor [Royal W.] Sorensen.

CALIFORNIA INSTITUTE OF TECHNOLOGY
ORAL HISTORY PROJECT

Interview with Frederick J. Converse
Pasadena, California

by Harriett Lyle

Session 1	November 16, 1978
Session 2	November 20, 1978
Session 3	November 21, 1978

Begin Tape 1, Side 1

Lyle: Can you tell me a little about your background--where you grew up, and a little about your parents, and your early education?

Converse: Yes, I was born on October 15, 1891 in the village of Palmyra, New York. My father, Frederick Elliot Converse, was a lawyer, and my mother's maiden name was Florence Vail. The population of the village was about 2300 people, mainly middle class. The village was located in the midst of a farming area, with low hills on each side of it, and a broad valley extending north of it for about one half mile. A small creek meandered down the center of the valley, while along the north side ran the New York Central and the West Shore railroads. The Erie Canal followed the south side of the valley close against the lower street of the village.

I attended the Palmyra Classical Union School, a two-story brick building housing both the elementary and the high schools. We lived close enough to the school so that I could walk to classes. The curriculum required each high school student to have two years of either Greek or Latin, and two years of either French or German. I had Latin and German. Physics was taught but no chemistry. My father was secretary of the board of education for many years and hired the teachers.

I was president of the senior class in high school--which is nothing to boast of, since there were only about a dozen students in the class. I also belonged to a club which put on Shakespeare plays. But the extra-

curricular activities in which I was most interested were baseball and basketball. I was the pitcher, and captain of both teams, in my senior year when we won the county championships in both baseball and basketball.

Lyle: Was this the standard education for everyone in that community, or was this a particularly advanced school?

Converse: No, no. This was the standard education for everybody. The total school population while I was there was around 400. Most of the elementary schoolchildren came from the village, but there were a number of farm children in the high school. Small one-room schoolhouses provided the education for the elementary schoolchildren from the farms. The schools were located at convenient places two to three miles from town. Our home was a comfortable nine-room, two-story house situated on a three-acre plot of land on Main Street, about a quarter of a mile from town--that is, from the business district, which was two blocks long. We had a horse, a cow, chickens, a pig, bees, a dog, and a cat. There was a large front lawn, a garden, and a field in back where we raised corn or other products for feeding the stock. There were apple trees, cherry trees, pear trees, and plum trees on the property. I had an older brother and a younger sister. We boys helped my father with the work outside of the house, and my sister helped mother. As we grew older, we were given more responsibilities in taking care of the animals, the yard, and the carriages. They were very happy growing-up years. We worked as a family and most of our recreation was as a family, especially on the long winter nights when we were gathered in the library to read or play games like checkers, or sang together. I played the violin. Of course there was no television and no radio. For many years our lighting was by kerosene lamps, then came gas lights, and finally electric lights. There was no indoor plumbing up to the time I went to college.

We were taught the habit of thrift in those days. For instance, every birthday I would get a big silver dollar and take it to the bank with great ceremony to be deposited in my account. All of the work that we did at home was done for the family without thought of pay. But in the summer, from the time I was twelve years old, I would go out to the surrounding farms and pick berries or peas, and bring the money home and put it in the

bank. My favorite cousin Winifred, who had lived with us while she went to high school, and then came home from Cornell University with a Phi Beta Kappa key, gave me an incentive to save money so I too could go to college when I grew up.

When I was about sixteen and brother Ray was eighteen, we decided to go into the chicken business to raise some money. I imagine the idea came from my father, because he furnished us with the eggs and a brooder to start with. For quite a while things went along very well, and we were beginning to earn a little money. Then one night in the fall the weather turned very cold, and it was necessary to bring the brooder into the cellar of the house to keep the eggs from getting too cold. The heat for the brooder was a kerosene lamp. Along about midnight father smelled smoke and ran down to the cellar to find the brooder in flames. The house did not catch fire, but the chicks in the brooder were all dead, and father said there would be no more brooders in the cellar; and that was the end of the chicken business.

In the summer of 1909 my father said that I could have the back two acres to raise whatever I wanted to, and sell the produce for money to help out for college. So I raised beans and hired the little children of the neighborhood to pick them for me. At the end of the day, I would sort and sack the beans and take them to the railroad station for shipment to the canning factory. That was a good experience and made a little money. However, another windfall came along that summer which really made it a busy and profitable summer. There was an opening in the post office for a substitute postal deliveryman to take the place of vacationing mail carriers. I got jobs substituting on three rural routes and one village route. Each vacation period was fifteen days, at \$2.50 per day. The rural routes required me to furnish a horse and buggy to drive twenty-five miles a day. My father furnished the equipment. I would get to the post office and sort the mail and get home again about one o'clock. In the meantime, the picking went on and I hired my friend Oliver Guthrie to oversee the work.

Lyle: That must have been exciting, too.

Converse: It was very interesting. I became acquainted with farmers for miles around the village, as well as most of the people in the village.

The next summer I became even better acquainted with the villagers by taking the census.

I graduated from high school in 1909, but did not go to college that fall because I was offered a job as office boy at the Garlock Packing Company office, and it seemed like a good chance to get some more money for college, and get some good experience also. I learned about the business of an office, and about the manufacture of steam packing for engines.

For some time I had been planning on going to Cornell University to major in agriculture, but during the summer of 1910, pressure began to build up to become an engineer. It happened because the resident engineer for the state engineers came to Palmyra. He was a member of our church and became a good friend of my father. He frequently came out to our house and told about what engineers did. His job in Palmyra was to organize an engineering office to handle the work on a six-mile section of barge canal which was being planned for replacement of the Erie Canal running from Albany to Buffalo. It also happened that a new engineering college was to open that fall at the University of Rochester. My brother was going to the university and wanted me to go there. Also it was only twenty-five miles from Palmyra and there was good trolley car service to Rochester, so the folks were in favor of it. In the end, I went to Rochester. I didn't think that I would be accepted, because I lacked two requirements for entrance into the engineering course--advanced algebra and chemistry. However, my brother Ray said that he would get me in all right. Sure enough, he talked them into letting me try, but I had to take a special course in chemistry at the same time I was taking the regular college chemistry, and also had to tutor in advanced algebra and pass an exam.

The regular engineering course was twenty-one units of solids, no easy courses. Seventeen men started the engineering course that fall, but I was the only one who came back for the second term. However, there were two other men who had been at Rochester the previous year, and had taken all of the courses available at that time, such as chemistry, physics, math, and French. The three of us went through the rest of the engineering course together. That first year turned out to be more or less of a nightmare. The head of the engineering department told me several years

later that he was trying to see just how much of a load he could put on a student, and after that first year the course was lighter.

Lyle: They didn't know either.

Converse: No, there had never been an engineering course at Rochester before that year. By the end of that first year, I was pretty well beaten down from lack of sleep and little physical exercise. I always regretted that there was no time to work out for the varsity baseball and basketball teams. I did play on the intramural teams, both the fraternity team and the class team. And I played on the varsity second team when they went out of town, but I never had time to practice. Our class basketball team was the champion in each of the four years.

I belonged to a national fraternity, Theta Delta Chi, and to an inter-fraternity group consisting of one or two men from each of the nationals and a non-fraternity man or two. We met once a month throughout the four years. These fraternities were very enlightening, because I was the only engineer among a group of arts and science majors, and I gathered that life was considerably less arduous for them.

One of the professors whom I liked best, and who was to cross my path several times in later years, was Frederic W. Hinrichs. In later life, he was professor and dean of students at Caltech. He was Captain Hinrichs then, retired from the army ordnance department because of a bad case of tuberculosis. He was one of the finest men one could want to meet. He was an excellent teacher, and we had much of our engineering with him and the rest of it with the head of the department, Ernsberger, who was a very brilliant engineer. So we had very fine individual attention all through the rest of the engineering course and graduated in 1914. The three years after the first one were very pleasant. I enjoyed them very much, because we were learning lots of things and had engineering laboratories, and I had time enough to absorb it and to know what I was doing.

Lyle: Did you go back and work on the Erie Canal at all then?

Converse: Well, yes. That is, I worked on the construction of the barge canal which was replacing the old Erie Canal. Between each of the college

academic years--1911, 1912, and 1913--I worked for the state engineer's office at Palmyra on barge canal construction. I was given the title of boatman, which paid \$3.00 per day, although most of my work was surveying, inspecting and working up final estimates. I did get a chance to live up to my title once, when I brought a twenty-five foot work power boat from Albany to Palmyra along the old Erie Canal.

Lyle: The barge canal ran parallel to the old Erie Canal?

Converse: More or less. The old canal followed the contours of the hills, while the new canal was straighter, with large sweeping curves. The barge canal was wider and deeper than the old Erie Canal, and had no tow paths. There were five bridges, a lock, a power plant, and an aqueduct and spillway in the six-mile section.

Lyle: So did you have those Erie Canal mules going through the town?

Converse: The canal was to the north of the town. There was one short street in the business section that ran parallel to the canal and only a few feet above it, but the rest of the town was on higher ground, possibly fifty or one hundred feet above the canal and off to the south of it. A broad valley extended to the north of the village for about half a mile. This valley had once been the bed of a river which was the outlet of the Great Lakes during the retreat of the last glacier when the ice still covered the St. Lawrence River. It was this river bed which made the canals feasible. The railroads were on the north side of the valley. There were some low hills to the east and west of the village--known as drumlins-- which were composed of rock and earth scraped up by the glacier from far to the north in Canada and deposited as the ice retreated.

Lyle: Sounds beautiful. So in 1914 the First World War was . . .

Converse: Well, it was starting in Germany but not in our country.

Lyle: Were you very much aware of this?

Converse: Only mildly aware of it. Of course there were no radios or television to play it up--only the newspapers were reporting it. It was far away and I was too busy graduating and looking for a job to pay much attention to it. The fact was there was a mild depression in Rochester and I didn't find a job there. But one of us three who had gone through college together had an uncle in Cleveland, Ohio who was hiring help, and all three of us went there to work. He worked for the city in the appraisal of all of the equipment of the Cleveland Electrical Illuminating Company, which was being purchased by the city. Our job was to enumerate all of the equipment in the power plant and substations, including all of the wires, cables, and instruments. Our data were then priced by others in the office. We worked there for nine months, and then, just as the job was completed, I received a letter from the president of the University of Rochester informing me that the General Electric Company was taking student engineers and suggesting that I apply. I applied and was accepted for the two-year course at Lynn, Massachusetts. One of the other men went to Westinghouse, and the other found a job in Rochester. My base pay was \$10.80 per week of forty-four hours. We sometimes worked overtime, and this time was applied to the reduction in the length of the course. I worked Saturday afternoons checking and repairing test apparatus and sometimes worked fourteen-hour shifts for a week or two. So I completed the course in eighteen months. I completed the course in early October 1916, and was immediately hired as a regular employee as mechanical-electrical engineer. A few days after I was hired by General Electric, I received a telegram from Professor Ernsberger, head of the engineering department at the University of Rochester, telling me that Professor Hinrichs had become seriously ill. The TB had gotten the better of him, and they were sending him down to the South Carolina mountains where they didn't expect him to live. He wanted to know if I would help him out by coming to Rochester and taking his teaching load for a year. The subjects taught by Hinrichs were very basic for any engineering--applied mechanics and strength of materials--and I thought it might be worthwhile for both me and the General Electric Company to spend a year teaching those subjects. I talked it over with my boss, and he agreed to give me a leave of absence, so three days later I held my first teaching class. In the spring of 1917 America was in the war, and the draft was being prepared. Word came to Professor Ernsberger that

engineering teachers would be exempt from the draft and urged me to stay and teach in the fall. I agreed to come back, and in the meantime I went to Erie, Pennsylvania where I had relatives, and worked in the shops of the Erie Steamshovel Company. I taught at Rochester during the fall term, but during that time it became apparent that the policy regarding exemption of young engineering teachers had been changed and some were being drafted. I put in applications for officer training to both the army and navy, hoping that one of them would take me. Before they responded, I had an offer from the newly organized Bureau of Aircraft Production to help establish a testing laboratory for airplanes in France. I immediately wired my acceptance, and the next day both the army and the navy accepted me for officer training, too late. After waiting a month or more for orders to go to France--I spent the time at the Bureau of Standards in Washington, D.C.--I was ordered to Pittsburg! It appears that those in charge had decided that the problems could be best solved by the laboratory being close to the place where the streamlined wire wingbracing was being manufactured. Also, since we would have to deal with high ranking officers, we remained civilians. There were three of us sent to organize the laboratory--another engineer and a chemist. We took over an existing testing laboratory and collected a staff of machinists, test men, and helpers. We designed and manufactured testing equipment and worked with the manufacturers on the problem of failures in the wires which held the Flying Jennies together. Failed wheels and other parts were sent from France for testing. As the summer wore on, I began to feel restless, and a little bit guilty. Here I was a perfectly healthy young man enjoying life while men were so badly needed in Europe. The laboratory was well staffed with some very good 4F men, and I was not really needed anymore. Then one day I received a letter from President Rhees of Rochester University saying that he had recommended me for officer training with a special group of men who had been out of college from three to five years. This was my chance, and within a very short time I was in Washington barracks training for basic army life with the first replacement regiment. About ten weeks later the regiment moved out, and those in the officer training group were planning to go to Camp A. A. Humpheries for final training, when the war ended. We were given the choice of staying three more months and receiving a commission as a second lieutenant, or being discharged immediately as private first

class. I was home for Thanksgiving.

Lyle: Did you go back to the university then? What did you do?

Converse: I went back to the university and paid my respects to Professor Ernsberger, but of course my place had been filled. I worked for the Gleason Gear Works for the next nine months. Before taking the job with the Gleason Gear Works, I was offered a job with the General Electric Company in Buffalo, but preferred Rochester.

Lyle: Had you heard anything about Caltech at this time?

Converse: No. It was only by a series of coincidences that I came to Caltech. I was not doing very well at the gear works and did not think that it was the type of work I wanted to continue with. At about this time, the United States Government advertised a type of railway ticket that would be good for six months on any railroad in the United States, with unlimited stopovers. It seemed like a wonderful chance for a young man who had never been west of Cleveland, Ohio, to see what our country looked like. I started out to take the northern route to the West Coast, but in Chicago there was a blizzard blowing and it was very cold, so I switched plans and took the Santa Fe route south. The first stop was Denver, where I stayed for two weeks, and part of the time I picked apples to earn expenses. Next I explored the Grand Canyon and went down the Bright Angel Trail to the river. I landed in Los Angeles on a dark drizzly day in October, and after a few days I took a temporary job as machinist and strike breaker at the San Pedro Shipbuilding Company yards. I worked on a night shift and had a good chance to enjoy the sights of the area for about two weeks.

Begin Tape 1, Side 2

Converse: One day I saw an ad in the paper saying that the Los Angeles City Bureau of Power and Light was planning on building a hydroelectric plant in San Francisquito Canyon, and they were hiring mechanical-electrical draftsmen. I had been interested in hydroelectric plants, and had read about them

in the engineering literature, and this seemed like a good chance to get some experience in that line. I was hired and was still there in the summer of 1920. The power plant was finished, but I was still working on other projects and had advanced considerably in pay and standing with the department. Nevertheless, my thoughts were sometimes lingering on the possibilities of returning to Rochester. Then one day as I was walking down Broadway at lunchtime, I met Captain Hinrichs--now Colonel Hinrichs--the man whose place I had taken at the University of Rochester. He had been sent to Texas during the war and had regained his health. Now he was again retired and was going to Throop College to see if he could get a job there as a teacher. He could not go back to Rochester because of the climate. That evening he called me up on the telephone and said that he had been hired, and that there was a place for another man in the engineering department, and suggested that I apply for the job.

Frederick J. Converse

Session 2

November 20, 1978

Converse: So I came out to talk to Professor [Franklin] Thomas, and he said that the position which Colonel Hinrichs had mentioned was no longer open because Professor Michael, who had gone back east for the summer and had indicated that he might not return, had just sent a telegram that he was coming back to his old position. However, Professor Thomas told me that they were expecting to have a new president and an expansion in the engineering department, and while all he could offer me was an instructorship, the chances were good for advancement. I think the only reason I took the job was because of Colonel Hinrichs and my sincere regard for the man.

I liked Professor Thomas very much, and I got to talk with Professor [Robert] Daugherty, and he was very friendly and nice to me and told me all about the Institute and its past history. So I very soon became well acquainted with the engineers. Also, I soon got to know people in chemistry and physics and mathematics, and some from Mount Wilson, astronomers who were closely tied to Caltech. There were relatively few faculty members at that time and I soon met most of them. The first party was one at Professor Thomas's home for the engineers. This was followed by a party for all of the faculty and their wives and children. It was held in the small auditorium which once stood near the corner of Wilson and California streets. The faculty parties were very informal and lots of fun.

Lyle: Did you meet your wife here in Pasadena?

Converse: Yes, I met my wife at a meeting of the young people at the First Methodist Church during the first weeks of my arrival in Pasadena. She was the daughter of Stanton D. and Mrs. Mead of Pasadena. She was taking graduate work at U.S.C. in Romance languages. We were married in March, 1921. While in school she was president of Delta Delta Delta sorority, active in student affairs and Phi Beta Kappa. She was a very

wonderful woman.

Lyle: She was from Pasadena? She grew up here?

Converse: She was born on a farm near Marengo, Ohio, but spent most of her growing-up years in Pasadena.

Lyle: What about the funding for research? Did you have time to do any research?

Converse: There was very little research done by members of the engineering faculty except that done in connection with consulting projects, and that was paid for by the client directly to the professor. There were two major exceptions that I knew about in the early days. One was a research project on transmission lines for the Southern California Edison Company. The high voltage laboratory was built for that project by the Edison Company, and Professor Sorenson designed a million volt transformer and carried on research in that field for some time. The other large project was research to improve the design of the large pumps for the Metropolitan Colorado River Project, in the 1930s. This involved the design and construction of expensive testing equipment which became Institute property. The earliest project that I personally was involved in was done entirely without compensation and merely to try to find out why the Santa Monica concrete pier failed only a year or so after construction. The concrete piles simply disintegrated as though they had rotted. I made up a lot of three-inch by six-inch cylinders of concrete of various mixtures of sand, cement, and rock, and at various densities, and submerged them to one-half of their height in simulated sea water. They stood in a tank north of Throop Hall all through the hot summer, and one after another they disintegrated above the water line. Finally only a few did not disintegrate. The cause of the disintegration was clear--salty water migrated upward by capillary action, but then the moisture evaporates and the salt crystallizes. The salt expands upon crystallization, so the internal pressure caused the concrete to fail. The cure was to make dense concrete. This work was all done in my spare time from personal interest only.

Lyle: The city of Santa Monica didn't pay you?

Converse: No. I had written the results in the form of a paper for publication in the Engineering News, but then I discovered that the army engineers in Montana had been working on the same problem and had published an account of their work just a week or so before my report was sent to the publisher. Their problem had been the failure of the piles of a bridge.

On another occasion, I became interested in a statement in the strength of materials text which I was using in class. The statement was that short simple beams which were liable to fail in horizontal shear could be strengthened by letting the beams extend beyond the supports. This did not seem to agree with theory, so I procured a number of wooden beams and tested them to failure in horizontal shear. There was no advantage gained by letting the beams hang beyond the supports. I sent the results to the author of the book. The data was very good and he was glad to have it.

Lyle: Now, you mean if you have a beam on a house and it goes out really far, it won't support any more weight than if it is a short beam?

Converse: No, not exactly. A long beam usually fails in bending--compression or tension in the outer fibers of the beam--but as the beam becomes shorter there is a certain length at which it will fail by horizontal splitting along the center line of the beam. It was at this span or shorter that the overhang was supposed to help strengthen the beam. I also did a long series of tests on timber beams for the army engineers, for which I was paid.

Lyle: Was this before the war?

Converse: Yes, in the late twenties. From the mid-twenties on, industry came to Caltech more and more frequently for help in their problems. Many of the problems were turned over to me, and some of them involved long series of tests. An example is the behavior of brick masonry walls under earthquake stresses. Another was the behavior of floors and roofs under

earthquake conditions, and another intriguing one was the determination of how Coca Cola bottles break and how to tell after they have broken. During the depression of the thirties, there were a number of efforts made to develop cheaper ways to construct houses, especially concrete wall panels of various types. I worked on several of these projects. All of these projects were handled directly by the professor and the client, without going through the Institute administrative channels.

Lyle: It sounds as though you were very involved in the community outside in terms of doing all of this outside work.

Converse: Yes, I found it all very interesting, especially since it led to my being active on committees of the American Society of Civil Engineers and the Structural Engineers, studying building code revisions and working on a code for structures to resist earthquakes.

Lyle: Why don't we go back a little bit more, because I want to ask you about the depression--what effect it had on you and on Caltech.

Converse: As for me, the depression caused my meager salary to be cut by 10 percent. But that was more than made up by the outside work I was involved in. As for Caltech, the times were pretty grim. As I remember the gossip of that period, a large proportion of the Institute's income came from stock in Mr. Arthur Fleming's lumber business, and that was very markedly reduced during the depression. All departments were put on strict orders to conserve expenses, and it was very difficult to get new equipment. Dr. Millikan became a supersalesman and organized the Institute Associates--a group of people who agreed to donate \$1000 a year for general Institute expenses. He also obtained other funds and was able to keep us from foundering.

There was some interesting research in progress in the aeronautics department. Many early models of commercial aeroplanes were tested in the wind tunnel--funded of course by the various aeroplane companies. The Metropolitan Aqueduct Project was under construction, and three pump companies had joined together to do basic research on pump models, because the aqueduct pumps were the largest then in use in the United

States and a small increase of one percent in efficiency was worth \$50,000 a year to the Metropolitan Aqueduct Association. The pump companies funded the project and paid for some expensive equipment designed by Dr. Knapp in order to measure values to a very high degree of accuracy. The equipment became the property of the Institute when the project was finished.

Begin Tape 2, Side 1

Converse: Early in 1930, a man named Robert V. Labarre came to the Institute to try to induce someone to work with him on some foundation research. He was referred to me, and I was immediately interested. Labarre was a retired building superintendent who had spent most of his life working in the Detroit area and the south, and had a large fund of experience, but was not a college graduate. He had come to Los Angeles to retire, but found retirement too dull, so he decided to start as a foundation engineer. He had built equipment for testing the bearing capacity of building foundations and had tried to sell his services to architects, engineers, and contractors. There was little interest in his proposals but he made enough to keep an office open. What he really wanted was someone to keep him company. I had read the literature on soil mechanics and foundation engineering since 1925, and this research seemed like a good chance to learn more of the practical side. We worked together for three years and published some papers. Then he asked me to join him and form a firm of Labarre and Converse. I told him that I did not want to leave Caltech, but he induced me to join him on a part-time basis. We formed the firm in January 1933 and had an occasional job, so it was not too much work. In March 1933, the Long Beach earthquake occurred. There was an immediate demand by the State Division of Architecture for tests on the foundations of school buildings. At that time we were the only ones prepared to do the work, so we were immediately swamped with work, and from then on we were very busy. By the end of three years I had had enough of two full-time jobs, and the partnership was dissolved, but I still continued with some consulting work in that field.

Lyle: Were you able to involve your students in this work at all?

Converse: No, not in the Labarre and Converse work. We had full-time men to do all of the fieldwork. I did not start a soil mechanics course until 1934, and then it was for graduate students only. On my other test work, I frequently used graduate students and found them to be excellent helpers.

At the time I started teaching soil mechanics at Caltech, there were only three other schools in the United States that had soil mechanics. European schools had been interested in the subject for several years. The first time that soil mechanics came into being as a science was in 1925 when Dr. Karl Terzaghi published the results of his extensive research into the fundamentals of soil behavior under stress at the American College in Constantinople.

Lyle: What about at Caltech? Were people in civil engineering interested in soil mechanics?

Converse: Yes, Professor Thomas approved the course in 1934 for graduate students, and later wanted all civil engineers to have the course. After the 1936 International Convention on Soil Mechanics and Foundation Engineering at Harvard in 1936, Dr. Millikan became interested, and Dr. Lindvall was interested when he became head of the engineering division.

Lyle: Did you ever get to talk to Dr. Millikan about it?

Converse: Very little, but every time I asked for financial assistance in going back east to conventions he approved the request. After each trip I would write to him in detail about the trip, and finally he became quite interested.

Lyle: Was there any pressure on you to get a Ph.D.?

Converse: No. When I first came to Caltech I suggested to Professor Thomas

that I might work for a doctor's degree, but he discouraged me, saying that none of the engineering professors had Ph.D's and that experience in the field counted more than extra academic work. However, at a later date, when Dr. Millikan was asked what the important things were for advancement, he is said to have answered, "A Ph.D., publications, and the man's wife." By that time I was too busy to think about getting a Ph.D.

Late in 1940, the Navy began letting contracts for the construction of shipyards and for a fleet base on Terminal Island, California. One of my friends, Donald R. Warren, a structural engineer, had organized a group of architects and engineers to try and get some of this work. The contracts were being let by the Navy's office in San Diego. One day I received a telephone call from Warren from the naval office there. He said that he could get the fleet base job if I would handle the foundation investigations for him. I said okay, and we formed a separate firm of Warren and Converse to handle the soil work. This was a real big job, with not only the docks, quay walls, and buildings, but also a huge graving dock 1100 feet long and seventy-five feet wide to handle some of the Navy's largest ships. From that time on, I was deeply involved on work for the Navy and other war work, until the war was over.

Lyle: Did you teach during the war?

Converse: Yes. I went to Dr. Millikan at the start of this outside work and told him what I proposed to do. He said that if I could carry my full load at the Institute, I was free to work at the other work in my free time. I kept daily time records during the war in order to be sure that Caltech was getting full time, and found that I averaged seventy hours a week during the next six years. In addition to my regular Caltech work, I taught a special group at Lockheed Aircraft Company in applied mechanics for a year or two. In addition to the fleet base, I worked on the soil problems for five shipyards, two dry docks, the Kaiser Steel Mill, Permanente aluminum works, various docks, a rubber plant, a power plant and many miscellaneous structures. All of the experience was exceedingly valuable to me, for I was completely on my own in making decisions and

and designing structures. The theories of soil mechanics and my equipment and procedures for sampling and testing the soil were thoroughly tested and proved to be very practical. In some cases, the results were so dramatic that at least two of the largest engineering contractors--Raymond Concrete Pile Company and Bechtel Brothers--were convinced of the value of soil mechanics in the construction business. Since soil mechanics was relatively new in the United States, and was looked upon with suspicion by some of the old-timers, the service seemed worthwhile. As an example of the things that happened, consider the Marin Shipyard on Thompson Bay off San Francisco Bay. The site for the shipyard had been purchased, and we were asked to investigate it and make recommendations for the foundations. A small strip of the site was on land, and the rest on a mud flat that consisted of very soft mud extending--in its outer perimeter--to a hundred feet or more. We recommended that they abandon the site and find a better one. But their contract had a deadline for completion, and there was no time to find and purchase a new one, so it was necessary to do the best we could with what we had. The first thing that was needed was a twelve-foot fill over the mud flat extending out several hundred feet from the shore. The problem was to place the fill over that soft mud. Soil mechanics calculations indicated that a three-foot fill would be possible without causing failure of the mud. So a blanket of soil three feet thick was worked out over the mud to the full distance required, then a second three-foot layer was added, and so forth, until the entire area was filled to a thickness of twelve feet. It was recognized that there would be settlements--as much as two feet in some cases--so the buildings were placed on piles, and the contractor knew that he would have to keep filling the areas outside of the buildings as settlement progressed. Then, far out beyond the end of the fill, a dike had to be built so that the water within the dike could be drawn down about twelve feet. Raymond presented a design for the dike consisting of two parallel lines of timber sheet piles tied together with steel rods and filled with mud. My calculations indicated that some of the rods would break and I suggested larger rods. Raymond bought the rods, but did not use them at first, until the smaller rods began to break; then they substituted the larger rods. The ways on which the ships were to be built were supported by timber piles driven to firm rock. Some of these

piles would have to be cut off below the water level so that the ship could be launched. In order to perform this operation, a trench had been dredged to a depth of twelve feet, along the seaward side of the ends of the ways, leaving a mud bank opposite the ends of the ways. My calculations indicated that the mud bank would fail if they drew the water down twelve feet, but it would be just stable if the water held at ten feet. There would be no factor of safety, so it was suggested that a line of sheeting be driven along the toe of the slope for safety's sake. The contractor elected to take a chance and hold the water at ten feet, but he had the sheeting on hand just in case. The superintendent kept a careful watch on the pumps, and for some time they worked along with the water at a depth of ten feet. Then one day he was called away for several hours and when he came back there was a crack along the top of the mud bank, and a slide was imminent. The pump man had let the water draw down to twelve feet. So they got busy and drove the sheeting and completed the job. The next problem that had to be proved was a matter of batter piles. Batter piles are piles that extend into the mud at an angle. They were to be used as a safety measure just in case there was a lateral wobbling during launching. The mud was one hundred feet deep at the point where they were to be used, but calculations indicated that piles only half that length would carry the required load. They had driven one pile and it had gone out of sight with only a few blows, so we decided to run a test load to see where the error was. We watched the pile sink to half its length under its own weight, then the hammer was put on and it went down most of the rest of the way, so that just a tap set it at the required depth. Then the load test was made, and there was no movement of the pile until just at the required load, then a slow creep developed. This one example will, I hope, let you see why the war work was so exciting and satisfying to me, in spite of the long hours and sometimes sleepless nights.

Lyle: What was Caltech like during the war? You were very busy, I know.

Converse: Everybody was very busy. Many of the engineers and scientists were engaged in a project which, I believe, was proposed and guided by Dr. von Kármán. I knew very little about the project, but one day there

was a terrific fire in the basement of the Kellogg Radiation Laboratory and a man was burned to death. He had been working with solid fuel for the rockets, turning portions to proper size on a lathe. Suddenly the material caught fire and set fire to the stored fuel, and the whole mass erupted in a mass of flame. The man ran out like a blazing torch, but he was so badly burned that he did not live. After that, the rocket project was moved to the base of the mountains, and became the Jet Propulsion Laboratory.

Lyle: Who funded that kind of work?

Converse: I don't know, but since the government had practically taken over Caltech with V-12 students, they were probably financing the research. It is my understanding that as the research progressed, Dr. von Kármán organized a private company, [Aerojet Corporation], to manufacture the rockets for the government, and that the rockets were a great contribution to the war effort.

Lyle: Pauling was here during that time, right?

Converse: Yes, but I do not know what part he played in the war effort.

Lyle: Did you know George Ellery Hale at all?

Converse: No, only at a distance. I never talked with him. I did not travel in that circle.

Lyle: Who would be in that circle?

Converse: That would be Dr. Millikan, Dr. Noyes and other leading scientists and astronomers.

Lyle: What about the students that you had? What kind of relationship did you have with them?

Converse: I think you might call it a friendly relationship, although it

was mostly a classroom relationship. In my first year at Caltech, I taught freshman drawing, and got to know the men quite well. In the spring, a group of them came to me and asked me to help them form a fraternity. I was a member of a national fraternity and was glad to help them establish the Pi Alpha Tau local fraternity. The fraternity continued until Dr. Millikan decreed that there should be no fraternities at Caltech. This occurred about the time the student houses were constructed. However, the Pi Alpha Tau men continued to meet once a year on April first, and those that are left still assemble at the Athenaeum once a year. My wife and I were also invited to be chaperones at student dances in the early years.

Lyle: Millikan stopped the fraternities. I didn't know that. What did you think of that?

Converse: Oh, of course I did not agree with it. The Millikans were not fraternity people and they could not know how much a fraternity means to a man during and after college. One of the oldest Caltech fraternities, the Gnomes, still continued to exist as an off-campus fraternity, and I understand that they still initiate Caltech students. I think that the fraternities are a definite asset to a university. I believe that the alumni are definitely more interested in the university than they would otherwise be. I have had a great deal of admiration for Caltech boys; they have, in general, been intelligent, responsible men, eager to learn.

Lyle: Did the boys choose who lived in and belonged to the fraternity houses in those early years?

Converse: Yes.

Lyle: Is that also true of the student houses that Caltech built?

Converse: At first they were mostly assigned by the registrar, who tried to get a reasonable mixture of upper and lower classmen in each house. Later on, the students themselves had some choice as long as the group was properly integrated. I do not know what the system is now.

Lyle: Did you find graduate students equally interesting to work with?

Converse: Yes, the graduate students were the cream of the crop. While there were only a few in the early days of my years at Caltech, they gradually increased in numbers as time went on. I do not remember that I ever knew a graduate student that I did not like and enjoy. I worked with quite a few of them, both in soil mechanics classes and in research, and I also hired them as helpers on various testing jobs. There was one unusual group of army officers who were sent to Caltech for master's degrees at the close of the war in Europe. There were eighteen of them, all of whom had rated in the upper 3 percent of their class in West Point, and all of whom had been in active duty during the war. There was one colonel, one major and the rest were lieutenant colonels. One had been in charge of repairs of the Remagen Bridge over the Rhine River when it was hit by a shell and the bridge and the man were dropped into the river. Another had been in the Salerno campaign in Italy; another was in charge of maintaining roads in the invasion of France; and still another was in charge of work on air strips during the war in the Pacific. I probably enjoyed this class as much as any other that I was privileged to teach, for they had a lot of practical knowledge and asked interesting questions and took part in discussions.

Lyle: So how many classes did you have like that? Was it just the one class?

Converse: Yes, that was the only time the army sent a group like that to Caltech. I taught them in two subjects, soil mechanics and concrete mix design. Of course the regular number of Caltech students were attending the Institute at the same time that this special group was there. During the war, we had other special students who were in the V-12 Navy group. These were boys who were being given college training by the Navy with the assumption that they would become Navy officers upon graduation. Many of them were transferred here from Stanford University, and others came after having already been in the Navy. They caused some problems because they did not adhere to the Caltech honor system. Their cheating was so flagrant that they had to be separated from the regular Caltech

students, and were proctored in all exams.

Lyle: Did they ever change their attitude?

Converse: Not that I know of. I had them in applied mechanics, which came early in their course. They did not take soil mechanics.

Lyle: After the war, a lot of veterans went to a lot of different schools. Did you have veterans coming into Caltech?

Converse: Yes, after the war, teaching was never the same in some of the courses that I taught, but in the soil mechanics course, which was made up of civil engineers only, the attitude was still fine. Probably most of the boys were as good as ever, but it seemed as though there were always some who dared you to teach them something and were very critical of most everything.

Frederick J. Converse

Session 2

November 21, 1978

Begin Tape 2, Side 2

Lyle: Could you tell me a little bit about the administration change from when Dr. Millikan was there to whenever Professor DuBridge came?

Converse: Dr. Millikan's regime was a very difficult one for Caltech. There were the first years when money was scarce, then the depression when it was scarcer, and finally the war. In spite of it all, Dr. Millikan succeeded in building Caltech from a relatively unknown engineering school into a school known throughout the world for its scientific achievements. For the faculty, those years were years of austerity. Also, the civil and mechanical engineering departments, at least, were left to languish. There were no additions in the permanent staff of the civil engineering department from the time I was hired until after the war. To Dr. Millikan, engineers were second-class citizens, except for aeronautical engineers, some of whom were highly theoretical experts, like Clark Millikan and Dr. von Kármán and Dr. Bateman. When Dr. DuBridge came, there was immediately more money for faculty salaries, and the engineering department was drastically revamped. New faculty members were brought into the department, and faculty were supposed to engage in more sophisticated engineering research with a more scientific approach. This, of course, was hard on some of the old-time professors who were not consulted about the changes and who felt demoted. The surveying and most of the engineering laboratories were discontinued. As far as I was concerned it was a very good change. My salary was doubled, and when the new civil engineering building was built, I had excellent soil mechanics laboratories and these were not discarded. Moreover, I now had time for government-sponsored research and some free time for consulting work.

Lyle: What kinds of research did the government sponsor?

Converse: A research project on the vibration compaction of sand was sponsored by the army engineers for one year. The program was then expanded to include both sand and cohesive material, and the cost was transferred to the navy, and we worked with the Naval Research Laboratory at Port Hueneme, California. The navy was particularly interested because of the difficulties they had experienced in landing troops and equipment on sandy beaches during the war. The research resulted in the design of a compaction device in the form of a sled about thirty inches wide by five feet long which could be dragged along over a beach at a speed of about thirty feet a minute and consolidated the sand to a depth of six feet. Graduate students were employed on the project, and the data were used by one in preparing his doctor's thesis.

Lyle: Did you now have time to write a book?

Converse: Well, I didn't write a book, but I wrote a chapter in a book with fourteen other foundation engineers. The book was entitled Foundation Engineering and was edited by G. A. Leonards of Purdue. Each author was supposed to be an expert in a particular portion of the field. My chapter was entitled "Foundations Subjected to Dynamic Forces." The book was intended as a reference book. Nineteen years later it is still selling a few copies each year.

Lyle: Had you wanted to write a book while you were teaching?

Converse: No. McGraw-Hill had suggested that I write a book on soil mechanics several times, but I was always too busy.

Lyle: Were the type of students who came to engineering after the changes in the engineering policy by Dr. DuBridge different than those before?

Converse: I don't think that I can give a good answer to that, for by the time the policies were in effect I was only teaching classes in soil mechanics and foundation engineering. In those classes, the men were all responsive and bright students. How good they would be as practical engineers, I would very much like to know myself.

Lyle: Professor Lindvall became chairman of the department--was it about this time when the reorganization took place or was it later?

Converse: It was at the time of the reorganization. The choice of Dr. Lindvall was approved by everyone in the engineering department, because he was very competent and very well liked.

Lyle: Were the businesses that you had very exciting to you?

Converse: Oh yes. I had always enjoyed solving practical problems, and the problems brought in by my clients were always intriguing. In this type of consulting work there was a chance to use my knowledge of soil mechanics, but also just about as much depended on judgment and an analysis of the practical situation. As time went on and I had to delegate more of the work to other engineers and technicians, it was not quite as much fun as when I could follow every move and every decision myself. I think my consulting work was of value to my students also, because there were frequent opportunities to bring current problems into the classroom, and sometimes the class could visit a job under investigation and see how it was done.

Lyle: Another question I had was--I just wondered if you could tell me what periods in your life you remember as being the most exciting and really special.

Converse: Well, there is one period in my life that my thoughts have often turned to as one of happiness and excitement. That was during my high school years in Palmyra, New York. During those years, I worked hard, played hard, and had a wonderful family life. I had a wonderful kindly understanding father and mother, an older brother and a younger sister. During the long winter evenings we read books in the library, or played games together or sang, and I had my violin and a fine horse to care for and ride. Then at the high school there was that beautiful young girl I could talk to and take for moonlight rides in an open sleigh when the world was covered with a blanket of snow. And for excitement, what could beat being hoisted on the shoulders of your teammates after fanning out the last

three men of the opposing team, and winning the championship game?

Then there was another time that was a time to remember. It was after the war and for the first time in years there was a relaxation from work and strain, and my wife and I drove up through Idaho and the Yellowstone National Park and down to the lodge in the Jackson Hole country where we stayed for two weeks. It was the perfect place for relaxation and being together on hikes and rides about the valley and watching the boats on Coulter Lake, and even visiting an Indian teepee. Then of course, I will never forget the thrills of the war years, which I have described to you.

Lyle: I wondered if there were maybe just one or two people in your life that were really important to you.

Converse: It would be hard for me to name only one or two people who were really important to me, for there were many, and they include my wife and family and my parents and brother and sister, all of whom were the most important to me in my life. But if you mean one or two men who were important in my developing an interesting and satisfying career, I can think of one or two who were very important. There was Captain Frederic W. Hinrichs, Jr., who was my first teacher at the University of Rochester and who became my friend, and who, by becoming seriously ill, caused me to become a teacher. And it was Captain Hinrichs--then Colonel Hinrichs--who was responsible for my coming to Caltech. Another man, Captain Robert V. Labarre, was undoubtedly the most important person in causing me to enter the field of soil mechanics and foundation engineering, which became my specialty for forty years and which caused me to have an interesting and sometimes thrilling career.