Interview with

Jacob H. Douma

Childhood

Q: Would you tell me a little bit about your childhood and education in Hanford, California?

A: All right. Let me think a moment. I'll first start by saying my parents were married--they were from Holland-- they were married in Holland. Three days later, they sailed for the United States. They went to the Immigration Office in New York and, checking through there, the Immigration officer asked my father how he pronounced his name, and he said, "Douma [pronounced Dow-ma]." The Immigration Officer told him, "No, in English, it's Douma [pronounced Due-ma]." So I've been Douma [Due-ma] ever since, but it should be Douma [Dow-ma].

Then my mother and father took a long train ride all the way across the United States, arrived in Fresno, California, where they were met by an uncle of mine, who proceeded them by about a year. My father got a job milking cows on a farm, and in about a year and a couple of months I was born on May 30, 1912. Then about a year after that, my father got a job in the Coalinga oilfields, working to raise hogs, chickens, and vegetables for food for the Shell Oil Company field workers.

He bought a buggy and two horses, packed up my mother and myself and our belongings, and headed for the Coalinga oilfields, which are about 50 miles from where we were living near Hanford. We started early one day and got to the Kings River at about dark, and my father decided, "Well, we'd better stop here."

So he built a big bonfire. The coyotes were howling, and my mother got scared. The next day, we got over to Coalinga, and my father worked at that job for a couple of years. Then, after saving some money, we came back to Hanford where my father bought 40 acres of land and started out with a little dairy farm.

Well, we'll skip some time. My father gave me a milk bucket for my eighth birthday, and I had to get up at 5:00 o'clock in the morning to help him milk the cows. He had about 16 cows, and I milked the cows with him before catching a bus and going to school.

Went to Hanford High School. One of my jobs during the summer was to irrigate alfalfa

land. I was the irrigator, and I kept thinking, "Oh, there must be a better way." We had a big, ten-horsepower gasoline motor engine with a belt, and a 5-inch pump down at the well. The engine turned the things that pumped a 5-inch pipe full of cold, clear water, which was enough to irrigate 40 acres. We kept rotating by mowing one cutting of alfalfa every four weeks, and after getting the hay off, irrigating again. But I got the idea then, there must be a better way to irrigate than the way I was irrigating. I had to dig ditches by shovel to get the water to where it needed to be. When I got to my senior year in high school, I'd read enough about the Bureau of Reclamation projects right there in the Central Valley of California to know that they had better ways of irrigating. I decided my first effort would have to be to go to a university and get an engineering education.

Q: So your interests in engineering, civil engineering specifically, came from your irrigation work on your own farm?

A: Right.

Q: Did you have any science or math teachers in high school who were particularly influential on you?

A: Well, I guess another thing that influenced me is that I liked science and math. I could get A's in all of those courses, and I hated English. [Laughs] I did well to get a B- one time.

In fact, before enrolling at the University of California, during my last month in high school, I still had to take a test to determine how well I knew the English language. It was called the "bonehead" English test. If I'd had straight A's in English, I still would have had to take the test. In about two months, the test results came back stating that I didn't pass it and had to take this English course the first semester of my freshman year. I said, "Well, that' s bonehead English."

So when I enrolled at the University of California, I signed up for physics and chemistry and math, and said, "Well, here, this piece of paper says I have to take this English course." I was told I had to take the English course without credit until I passed the "bonehead" English test.

So I took the course, but I hated it. We went through the same stuff I'd gone through about three times before in high school. I must have paid a little better attention to the course because I passed the test after completing the course. English has always been my weakness. I could express my engineering thoughts quite well, but I was seldom satisfied with my English.

My wife was a schoolteacher, and her English was always very good. It got so that I'd say, "This is an important paper. You read it over and suggest what I ought to do about its English. I know that I don't have the commas in the right place." She would help me out a lot. I think I can do a little better job now, but I just don't like to write.

Q: Well, did your parents speak Dutch in the home all the time?

A: Yes.

Q: So did you?

A: That's right. They spoke Dutch all the time, and when their friends came over, they spoke Dutch. In fact, I got so I could speak Dutch pretty well. All of my relatives, except one uncle, were still in Holland, and the first time I met any of them was in 1968. I was in the Chief's office, and I attended the International Association of Hydraulic Research conference, which was held in Holland. After the meetings, I spent some time with my relatives there.

The overseas flight went to London first, and I spent a few days there visiting a hydraulic laboratory. Then I took a flight to Holland and landed in Amsterdam. I'd notified my uncle of that beforehand and, after going through immigration and customs, I saw this man who looked just like my younger brother. I introduced myself, and we shook hands. He didn't know a word of English, and talked to me in Dutch, and I understood a little bit of what he was saying.

We had to take a train ride of about 40 minutes or so to the town of Utrecht where he lived. During that time, he talked in Dutch, and by the time we got through with that train ride, I could understand almost everything that he said.

To get back to your question, I am certain that children who first learn to talk in a foreign language have more problems learning English. Certainly, those kids who grow up in a family that speaks English all the time are much more able to handle the English language than a person like me.

University of California at Berkeley

I decided to go to the University of California at Berkeley. I enrolled in engineering, and was there five years, majoring in civil engineering. I was interested in astronomy and economics, so I took several courses in those subjects as well.

Q: What was the curriculum like in the School of Engineering at the University of California when you enrolled?

A: Well, the first two years I took basic courses in physics, chemistry, and mathematics. After that I concentrated on basic civil engineering courses on surveying, sanitary engineering, bridge design, and hydraulics. I had to go to one two-week summer camp to learn surveying for staking out a railroad. I had one course in sanitary engineering. I learned a little about sewers but never used it.

I should have had a lot more hydraulic engineering courses. One semester before I graduated, I went to the professor who taught me a couple of hydraulic engineering courses, and said, "I'm wondering whether I should come back and get a doctorate in hydraulic engineering and spend more time on the design of dams? I want to learn more about dams. Also, since you don't have any courses on dams, would it be possible for me to do a lot of reading of the literature about dams, and give you some kind of report after the semester?"

He said, "Yes, that's fine. You pick out what you want to read." He suggested a few books. So I read a lot, and wrote a summary report of what I read, and I gave it to the professor. He didn't even give me an examination. He gave me three credits with an A for what I read.

I learned more about dams than I did in any of the courses I took from him. I said to him, "Do you think it would be worth my while to come back and get a doctorate and emphasize the design of dams?" He said, "Get a job where they design dams. You'll learn more there than going back to school." So that's what I did.

Q: So you had really decided when you went to California that you were going to go into civil engineering.

A: Yes.

Q: There were never any alternatives?

A: I had no interest in mechanical or electrical or any other type of engineering, only civil engineering.

Q: And yet Morrough O'Brien, one of the outstanding hydraulic engineers in the whole United States at that time, was then at the University of California, teaching mechanical engineering.

A: Yes, that's right, but he taught hydraulics.

Q: Did you take hydraulics from him?

A: Yes. I took his hydraulics laboratory course, and his basic hydraulics course in fluid dynamics, which mainly covered theoretical hydraulics and very little hydraulic design.

Q: So that's what he taught? He taught the theoretical aspects?

A: Yes, theoretical. That's right.

Q: What was he like?

A: He was a very good man to work with. He did a lot of things. I still remember, after working at the Waterways Experiment Station for a year and then before going back to Denver to work for the Bureau of Reclamation, I went to visit my folks in Hanford. So I thought I'd pay him a courtesy call and tell him how I liked the Waterways Experiment Station, because he was the one who got me there. I went down the hall of the Civil Engineering Building, and knocked on his office door. He said, "Come in," so I opened the door and went in.

He recognized me, but I'm not sure he remembered my name. I said, "Hello. I thought I'd just come and talk to you a little bit.," He said, "Well, you have to go to the other room and come through my secretary's office, and she'll set it up for you." So I went into the secretary's room and told her I wanted to see Professor O'Brien. About two minutes later, she said, "You may go see him."

We had a very good talk. He was interested in what hydraulic research the Corps of

Engineers was doing. I told him about the various hydraulic model tests being conducted at the Waterways Experiment Station. He later served for many years on the Corps' Coastal Engineering Research Board [CERB]. We used to see him down at the Waterways Experiment Station one or more times each year. He always had something constructive to say about the laboratory work there.

He died just a few years ago in Mexico. He did some consulting work in Mexico, and he found a place there in [Baja] along the ocean front that he liked very much. I'll bet that was a very healthful place, so he moved there two or three years before he died.

Q: Was Richard Folsom there when you were there?

A: Yes. Richard Folsom was there when I was there. He's now president of Rutgers University.

Q: He's the hydraulic engineer that worked with O'Brien, and then you worked with him in Los Angeles, didn't you?

A: Folsom?

Q: Because he was with the Los Angeles ....

A: Folsom?

Q: Yes.

A: Oh, he must have been there ahead of me.

Q: About '33, I think.

A: Yes, he was ahead of me. I didn't get to Los Angeles until '39.

Q: And he went to there, I think, after that.

A: Yes. I hadn't seen him since I left the University of California, 1935. Richard Folsom.

I think it's the same Richard Folsom that ...

Q: He's the one that worked down on the Los Angeles Flood Control?

A: Yes. He did. I read someplace where he did that.

Q: Maybe you would have run across him in some of your work down in Los Angeles district.

A: Yes.

Q: What about the hydraulics laboratory that O'Brien had?

A: That was just a small laboratory in one of the university buildings. He had some water running in a flume with a sand bottom that could be tilted. The students measured water surface profiles for various flume slopes. There was a small steel flume for testing other water flow conditions.

He also had a little outdoor laboratory out by the University swimming pool where he model tested bay waterfront developments under contract for the City of Oakland. Before I graduated, I worked with him part-time for about two months on those tests.

Q: That must have been interesting to compare what you did in that laboratory and what you did at WES.

A: Oh, yes. His laboratory was very small compared to WES. He didn't have enough money to do anything large, but it was fine for training students. The Oakland job that I worked on was a good, authentic model study.

Q: But you found that kind of thing interesting, and that's what you led you eventually to get into it?

A: Yes. I was interested in that.

Q: So Morrough O'Brien was critical in your undergraduate education, but you had

mentioned some other professors that were particularly influential?

A: Yes. My favorite professor was Bernard Etchevary , who was very practical. Engineering practice meant a lot to him, and he did a lot of consulting work on practical jobs. He consulted a lot for the Los Angeles County Flood Control District and the Riverside County Flood Control District, and was on their consulting boards. They would send him back to Washington to get some money for their projects, and he'd usually come back with some money. That's why they liked him on their work.

Q: Now, was he a structures person in civil engineering?

A: No, his specialty was hydraulics of irrigation, flood control, and hydropower projects. He knew a lot about dam and channel structures, but little about their structural design, as was the case with bridges and buildings. Of all the professors I had, he came closest to representing what I wanted to follow.

Q: Vem Hagen had a similar comment about the professor that most impressed him, or most influenced him.

A: I didn't know that.

Q: He held the same viewpoint--that of a person who had practical experience and did a lot of consulting.

A: I understand.

Q: So you think it is particularly significant for hydraulic engineers to have such an experience with their professors?

A: I think so. But some professors don't use their experience to their students' best advantage, and these students complained, "We don't see the professor enough. He sends an instructor in to talk to us when he's away on a consulting job." But Etchevary never did that. He was always right there. He never had a substitute. Well, in those days, there wasn't that much consulting to do, I guess.

I had a different experience with Derleth, the Dean of Engineering, who was a structural engineer, bridge designer. The San Francisco-Golden Gate Bridge Authority hired him

as a member of their board of consultants. I took his class on bridge design. About twice a month, he wouldn't show up at the class because he had to go to a board meeting about some problem. The next time he came to the class, he spent the whole class time talking about the bridge and its problems, and how the board functioned. I thought that was valuable information for the students.

It was more valuable, in many ways, than just him going to the blackboard and showing how to calculate the stress in various bridge parts. He said, "Your assignment for today was to calculate these stresses. I assume you've done it. I have given you something else, so you have learned more out of this one lesson than you would have if I were not at the board meeting." Well, that made sense.

Q: In the area of irrigation, California had for years been involved in that and was leading the country. Did you have some good people teaching you about irrigation structures and theories?

A: The California Department of Water had its own engineering staff which designed most of California's early irrigation projects. They had outside boards of consultants whose members were well-known engineers. The Bureau of Reclamation became involved with them in the early '30's, and the Corps of Engineers became involved about 1940. The Corps built a lot of dams and canals for them. The state operates the canals, but I don't think they're building anything new.

Q: How much did they use that experience of the irrigation of the Central Valley or up in the Sacramento River in teaching courses?

A: Not very much. I think Etchevary mentioned it, but to my recollection, he never took one of the projects and outlined and said, "This is what they're doing, and this is how and why they're doing it." He wrote his own textbooks and covered each chapter thoroughly in his class lectures. The lectures concentrated mostly on basic hydraulic theory and design. He would very seldom discuss the practical aspects related to specific project design, construction, and operation. He should have done a lot more in that respect. He could have shown slides and discussed California State dams and Bureau of Reclamation dams with his classes.

Q: How much did they talk about the large civil projects that were underway, such as the Bonneville Dam, or things that were being built by the Public Works Administration?

A: The professors? Not very much. There were about 25 to 30 students in each class, and they weren't all interested in the detailed design of projects. So his course was a little general.

If he had a course with 10 or 12 students who were interested in projects in greater depth, then he could have given lectures on Bonneville, Shasta Dam, and other specific projects. That would have been good for me.

Q: How would you rate the texts you had for your various civil engineering courses? Were they very good or not.

A: Yes, they were good.

Q: You said Etchevary used his own book.

A: Etchevary used his own book. O'Brien used his own book. O'Brien and [George H.] Hickox wrote a book, just a few years before I took their courses. It was very theoretical, fluid dynamics, mainly. In fact, I have most of those books here in my home office.

Q: The last time we talked, we had gotten to your time at the University of California.

A: Yes.

Q: We had talked about some of your professors--Dean Derleth, Etchevary, and Morrough O'Brien

A: Yes.

Q: I was wondering if, at your time there, you had met any of the Engineer officers who were there for advanced study? That was one of the universities to which they sent Engineer officers.

A: Yes. I remember there were some, but I wasn't very close to them. They took different courses, so I don't remember any of their names.

Q: Okay. I just thought I'd ask.

A: Yes.

Q: What was it like studying hydraulics in the early 1930's?

A: What was it like? What I remember the most now is that hydraulics wasn't very advanced at that time. There weren't very many large dams being designed anywhere. The Corps of Engineers and TVA just started designing and constructing dams. The Bureau of Reclamation started designing dams about 1910, and they started constructing dams a few years later, but the hydraulics part wasn't as far advanced. They only made brief hydraulic model tests of dams at that time.

When I was in the Chief's office in the 1950's and '60's, as I recall, there was a lot more knowledge in the field of hydraulics than they had in the university in 1930-35. University textbooks mostly covered theoretical fluid mechanics and very little on hydraulic design of spillways, outlet works, etc., for dams.

As I mentioned before, when I was in my last year at the University of California, I was already interested in dams, and I asked Professor Etchevary, who taught a couple of courses in irrigation, whether I couldn't go to the library and study whatever material was available on dams. So I did that.

Q: Were there very many books on those subjects?

A: Not on dams, no. Not any that covered the hydraulics or design of spillways and outlet works. As I said, the textbooks covered mostly fluid mechanics for the basic equations used to calculate flow of water in a channel or a river, over spillways, and through outlet works, but didn't cover the design of these structures nor problems such as cavitation erosion by high-velocity flow. I didn't know anything about cavitation erosion until I went to work for the Corps of Engineers.

I haven't gone back to the university to see what their courses are like now, but I think there still is a need for a very thorough book on design of hydraulic structures, like dams, high-velocity channels, and so on. Over the years, I've thought of writing such a book. When I got all of my engineering reports, etc., together, I realized it would be excellent reference material for writing the book. If I really went to work, I could write a good hydraulics book, or maybe two or three of them. But it's just too big a job. I can't do it at my age. If I were sixty years old and had ten years to do it, I think I could produce some good hydraulic design books for the universities.

Q: So most of what you learned, you sort of learned on the job, then?

A: That's right. Learned on the job. Just before I graduated from the university, I asked Professor Etchevary, "What do you think I ought to do? Go out and get a job, or come back and get a doctorate degree, study another year or two?" He said, "You'd do a lot better to go get a job, go get the practical knowledge, and you'll learn more than you'd learn getting a doctor's degree." So I did that.

Q: Did you have any exposure to foreign texts or books on hydraulics and hydrology?

A: Not at the university, no.

Q: I was thinking that your background with Dutch, you might have looked at the work that the Dutch have done in that area.

A: Although my parents were Dutch, I didn't know anything about Holland. I'd never been there until the 1960's when I went there several times and got acquainted with the university people. They do have good reports, but not on dams, because they don't build any dams. They've got good reports on tidal hydraulics and estuaries for the problems they have in Holland.

Waterways Experiment Station

Then, at Berkeley, one month before graduation, I was thinking about where I might get a job. I went to one professor, who taught me two classes in irrigation, and asked him about where I could apply for a job. I wanted a job having to do with irrigation, the design of dams, and things like that. He said, "Well, I know the chairman of the Tennessee Valley Authority [TVA]. I'm on their board. You should write him a letter." So I wrote him a letter. They replied, and, of course, they stated how much they were going to pay. They would start me out at $105.00 a month.

A day or two after Professor Etchevary gave me the letter, he asked, "Are you going to take that job?" I said, "Well, I'm going to wait until I hear from the Waterways Experiment Station." Professor Morrough P. O'Brien was on the consulting board for the Waterways Experiment Station [WES], and he said he thought they would have a job there, and for me to write them a letter, which I did. About another week or so, that letter came. They would pay me $110.00 a month. So that was my decision, I go to the Waterways Experiment Station for five dollars more.

After graduation in May 1935, I took a long train ride through the south. When I got to the Mississippi River in New Orleans, the river was in flood. The train was broken up into four-car sections. Each section was towed on a trestle to put the four cars on a barge, and the barge carried the cars across the flooding Mississippi River to land at New Orleans.

I didn't know what the heck I was getting into because one place the water was one foot over the rail where we had to go to get to the barge. Well, we made it on the barge all right, and New Orleans was right straight across the river, but this barge went up river and kept going up river. I said, "Where are we going? This barge doesn't go to Mississippi, Vicksburg, does it?" Vicksburg is about 200 miles upstream. The bargeman said, "No, we've got to do this because the current's so fast, when we start to cross the river, the current will carry us back where we started from, right at New Orleans." And sure enough, that happened.

Then I took the train up to Vicksburg, and I remember Joe Johnson met me there. He had graduated from the University of California a year before I did. He took me to a boarding house where he was staying. I arranged to stay in that boarding house. The next day I got a ride with Joe to the Waterways Experiment Station, located about ten miles south of Vicksburg. He took me into the director's office. The director then was First Lieutenant Falkner. Now the director is colonel, four military grades higher. I introduced myself, and said I received his letter about a job for me here in Vicksburg.

He said, "Well, yes, we have some jobs." He said, "What job did I offer you? How much did I offer you?" I said, "$110.00 a month." He said, "Where did you come from?" I said, "California." He said, "God damn. Anybody who comes to this God-forsaken place deserves a raise. I'm going to raise you to $120.00 right now." He was a native Californian. I found out later that the Federal Government had raised the salary for the job I was offered, with the grade of Gauge Reader Pro-tern, to $120.00 a month since the date of his letter to me.

Q: So when you left the University of California to go to WES in 1935 you were going to do a type of research work with which you already were familiar?

A: Yes, that's right.

Q: Your decision was more a factor of how much money they were going to pay you than what you were going to do?

A: That's right. I was interested in going to either the TVA or WES because I knew what they were doing. The professors told me what kind of work they were doing there, model testing, various kinds of water-oriented projects. I thought those would be good places to learn on the job. WES paid me $5 more than the TVA would, so I decided to go to WES

I found out later that WES was a better place to go than TVA. It had a much bigger laboratory, and it did different kinds of work. TVA only did one kind of model testing, mainly dams, because they were building dams for power. WES had all sorts of model tests for dams, river channels, coastal engineering works, and tidal waterways.

Q: When you first went to WES, you said that you were a gauge reader pro-tern.

A: They had a big outdoor model of the lower Mississippi River. He [Lt. Falkner]] assigned me the task of reading water level gauges on a model of the Mississippi River. The model was about 300 feet long, representing about 600 miles of the lower Mississippi River. They were making studies to determine how high the levees should be to carry a large design flood. The model was constructed to a distorted scale of about one to fifty feet vertically and one foot to one mile horizontally. Water levels were measured along the model for different size floods. By scaling the model measurements up to prototype levels, it was possible to determine the levee heights required along the river to contain the design flood.

My first job at WES was to read water level gauges along the model river. There were about 25 gauges that had to be read about every five minutes. There were about six gauge readers, each sitting at separate point gauges along the model. As the river flow changed we had to read the point gauge and record the water level about every five minutes.

It was just a very simple thing to do, but ... this was in July when the temperature is hot in Mississippi. I thought, "Any grammar school kid could do this. I don't know why a college graduate needs to waste his time doing this." So I went back to Joe Johnson and told him that I would certainly like to get into something that requires a little more effort than sitting there and reading that gauge. So, after a couple of weeks, I got assigned to another job working on model tests of dam spillways and outlet works that was more interesting and challenging. But it was good training, and it didn't last very long.

Q: Wasn't that model one of the first of its kind used in the United States--one that actually tried to scale the lower part of the Mississippi River?

A: Yes. It was the first big model of that kind in the United States. There were other smaller river models, as I mentioned before. Morrough O'Brien had a little outdoor hydraulic laboratory at the University of California, which he operated to study water level problems in Oakland Bay.

Q: From that experience as a gauge reader, you moved on to be a research assistant in hydraulic model studies at WES.

A: Yes. The next job I had was to conduct model studies of Conchas Dam, the first model of a dam that was built at WES. Conchas Dam was a flood control dam in New Mexico. It was a concrete dam, about 250 feet high, with an overflow concrete spillway, a stilling basin, and outlet works.

Since it was the first model of a dam built at WES, we had to learn how to build that kind of a model, which made it more challenging. After it was constructed, it was operated by only one engineer. He made all the model flow measurements and wrote the report. That was really a learning experience.

Q: Do you remember anything that you may have changed in the design of the dam because of these studies?

A: Many times changes were made as a result of model tests. For example, with a chute spillway, high-velocity flow may cause excessive abutment and river bed erosion just downstream of the chute's end. Then a decision must be made whether a stilling basin or a flip bucket should be used. If the rock in the downstream river bed isn't suitable to prevent erosion by the high-velocity flow, then a concrete stilling basin must be used at the downstream end of the chute to produce a hydraulic jump which dissipates the energy before it goes into the river.

However, if the rock isn't excessively erodible and the end of the spillway chute isn't close to the dam, so that the downstream toe of the dam wouldn't be in danger of being eroded, then a flip bucket could be used. The flip bucket flips the water up in the air, so it lands a safe distance downstream of the end of the chute and the toe of the dam. The flip bucket is much less costly than constructing a very expensive stilling basin. That's how changes are made as a result of model testing.

Q: With Conchas, you didn't make any specific changes?