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Reminiscences
Monsieur Michel (Mike) Gambin

Interviewer: Prof. Roger Frank, Ecole des Ponts ParisTech (ENPC), VP of ISSMGE for Europe (2005-2009)
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Place: M. Gambin's flat on St-Louis Island, Paris

Roger: Dear Mike, we thought that as your education was completed more than 50 years ago in several countries, France, UK and USA, and that you have worked all over the world, you could bring an unusual perspective to the Geotechnical community. This interview will be a stone in the arch of your Golden Jubilee.

Mike: Yes, I did receive my education from some famous Engineers. Jean Kerisel who was President of the ISSMFE from 1973-1977 was my teacher at Ecole Nationale des Ponts et Chaussées in Paris (1952-1953). Secondly I studied with Arthur Casagrande and Karl Terzaghi at the Graduate School of Arts and Sciences Harvard University where I was the recipient of the Augustus Clifford Tower Fellowship for the year 1954-1955. I was also granted a partial enrollment at MIT where I received additional lectures from two distinguished teachers, namely Prof. D. W. Taylor in Soil Mechanics and T. W. Lamb on clay mineralogy. I was also trained in the UK with the contracting firm *McAlpine* in 1953 working on the foundations of Broms Hall II Power Station near Birmingham and, at Easter 1954, I visited Egypt, landing at Alexandria from a Lloyd-Triestino regular steamer to visit Aswan Dam III under construction some years before the High Dam started. Nowadays young students get scholarships to foreign countries very easily, and fly everywhere. In September 1954, I reached New York City on SS Ile-de-France and the return trip back to my home

country in 1955 was on the brand new MS United-States, friendly called the "Floating Cafeteria".
Casagrande and Terzaghi I still remember them well, both were great men. Casagrande was a marvellous teacher: every student easily understood his courses and his English was good. He would often refer to the experiences gained by himself and from his German colleagues before WWII and to the theories of Prandtl, Hvorslev and others. His course on pore pressures and sand liquefaction was unforgettable.
Karl Terzaghi was teaching Engineering Geology which included site investigation. He was presenting his own expertise from dam sites all across the world. He also talked about SPT and CPT and explained how the cone penetration test results could be improved by various unusual techniques, such as slurry flushed upward above the tip to reduce friction on the rod.
His English was awful and I had to give my notes to my classmates for them to get a better understanding. What surprised me most was the following advice: "Do not buy my book on Theoretical Soil Mechanics; what you really need to know is in my second book written with Prof. Peck". He would also say " These days, I spend more time and effort preventing design engineers using my theories wrongly, especially that one on the consolidation of thin normally consolidated clay layers, than I do on new research work". I never asked Harry Seed (class of 1947-1948) or Jim Mitchell (class of 1952-1953) if they remembered he had said so in years before. These statements, however, are supported by a personal communication from Prof. Peck to the authors of a Technical Note in Volume XXXII of "*Géotechnique*" (December 1982): "[Terzaghi] was not, as he was the first to admit, a theorist beyond the extent that seemed necessary to understand the behaviour of earth material. (…) It might well be that, in Vienna, when Frölich and Terzaghi were cooperating on their book, Terzaghi was more than happy to let Frölich elaborate on and manipulate the theory as much as he desired".

Roger: You then spent 30 months in the French Army for your National Service, being, during the last year, a Lieutenant in the Corps of Engineers, partially acting as an instructor at the French Army School of Engineers in Angers. What then?

Mike: I had been contacted by Prof. Kerisel to work with him at his newly opened Consulting Firm *Simecsol* in Paris, but the shareholders of the recently incorporated company *Les Pressiomètres Louis Ménard* convinced me to join my younger ENPC classmate Louis Ménard who had yet to perform his military service. In this way my professional life started and I am still in the same business, more than 50 years later.
After his initial military training period, Louis got a good position with my help at the Army Fortification and Building Design Office in Paris for the rest of his 24 months obligations and we could meet every day to run the company.
I knew about the patent that Louis had been granted for a new instrument to test the soil by borehole expansion, his pressuremeter, but I had never seen the equipment. As a man of vision, in the first draft of the patent, he had said: "the equipment is used to characterize the ground by a bearing factor" (see the facsimile of the handwritten draft in ISP5, Volume 2, p.55, lines 5 & 6 of the introduction). This is what he demonstrated as early as 1962.
I found him drilling holes – 60 mm in diameter - with a hand auger up to 10 metres depth to insert his rubber clad pressuremeter probe, and that by hand too. We soon started developing a drilling technique involving mud circulation to create a non-caving cavity to perform pressuremeter tests (PMT) in loose sandy soils below water table. We tested the technique at various locations using portable hand pumps as for plant treatment in gardens. We also tested larger probes in larger holes but we then got too many bursts. After that, we started using conventional drill rigs with solid drag bits and also compressed air drifters since our aim was not to retrieve core samples before testing but to get a borehole wall as intact as possible in all

types of ground. I had to educate young farmers to become drillers and pressuremeter operators. The fact that I had enlisted as a private in the Army helped me a lot. I had learnt how to control men and equipment. We had more and more clients for site investigations with PMTs, mostly brought by the same shareholders, since they had good contacts with the Paris Ministry of Public Works, with architects and with contractors.
At the same time as we improved the testing techniques, we had to develop the derivation of the parameters, the E-modulus, derived from a G-modulus and now called E_M and the limit pressure p_{LM}. Then the theory behind these parameters had to be refined, and the method of using these results in foundation design to be worked out. Louis Ménard's main concern was to develop a foundation design based on allowable differential settlement between footings by following the advice of Prof. Terzaghi (as in Article 54 of his book with Prof. Peck) and using the results of our own tests.
For this reason the first papers were written on "the E-modulus as a function of the stress or strain level" (Paris 5th ICSMFE, 1961) and "Settlements, New Trends" (*Sols-Soils*, various papers in 1962 and 1963). They incorporated the decline (the American Geotechnical Engineers would say: degradation) of E_M as a function of strain level (with the first diagram of that sort in the geotechnical literature) and the importance of the shear effect on the settlement of footings on relatively homogeneous soils. Unfortunately, these papers were written in French (with summary and figures headings in English and German) and were barely noticed in the Anglo-Saxon world. Still, it was the start of a new vision of soil "elasticity".
We undertook a large number of full scale vertical bearing capacity and settlement tests on shallow footings and piles in the basement of our newly built office building at our *Centre d'Etudes Géotechniques* near Paris, using its huge specially designed beams to provide the required reaction (see fig 1 in paper of *Sols-Soils* No.6, 1963). The whole building would hiss each time the ultimate load was reached. Then papers on "bearing capacity at failure from PMT" were published (Montreal 6th ICSMFE, 1965) where the replacement was proposed of the Terzaghi bearing capacity equation by one involving (1) the soil reaction to borehole expansion as defined by p_{LM} and (2) a "relative depth" concept. A paper on the "Settlement of piles" (*Sols-Soils* No.7) followed based on a totally new concept far from that of Gorbunov-Posadov.
Geotechnical Engineering was greatly changed. Not only were clients flocking into our offices but Engineers from all over the world came to listen to us. Prof. J. Schmertmann probably wrote his paper on settlement prediction from CPT results after his meeting with Louis in the late 1960s. Nevertheless, old habits remained and only a few adopted our views, which were too early.
At this time we submitted geotechnical reports based on the results of PMTs to design most of the underpasses and overpasses of the well-known *Boulevard Périphérique of Paris*, the riverside *Voie Express Georges Pompidou*, and the A1, A7, A10, A11, A13 motorways radiating from Paris. Our partners did the same in the other regions of France. Among them, the network of the LPC (our FHWA), was very active. They undertook research work, either on theoretical points or on more load tests on prototype foundations. You will remember, Roger, your PhD work at that time on modelling pile settlements and its further developments.

Roger: Your team was one of the first to undertake full scale horizontal loading tests on piles and on sheet piles?

Mike: Yes we were. After a first series of lateral loading tests on piles performed in the quicksand of Mont St. Michel Bay by Louis Ménard, a second series was undertaken at the

Centre d'Etudes, and completed by tests in Japan by Dr. H. Mori. That was only a few years after Ken Roscoe had said "[at that time] Soil Mechanics theories did not contain any mention of displacement, except for vertical settlement. Presumably the designer was meant to assume that the foundation did not move until the soil failed and then the movements were catastrophic". The research work on the application of the results of PMTs to the design of laterally loaded structures lasted until the late 1960s with several papers, among them "Lateral loading of short piers" and "Lateral loading of flexible piles". The "Design of Sheet Pile Walls" followed involving new computer programs developed by our team.

Roger: In the same time you became busy at sea?

Mike: Yes, in the mid-1960s Insurance experts started to ask us to check the security of exploratory jack-up drilling barges at sea for the oil industry. The soil response to a pressuremeter test was very similar to the soil response under each jack-up barge spud leg when the whole barge is ballasted so long as each leg is forced down in turn to refusal. I remember that once we predicted a spud depth penetration below mud line, not knowing the platform was of a new design where the 4 legs are pushed together. Further, the barge was tugged to its location as the monsoon was starting. The soil liquefied simultaneously under all the spuds due to the effect of the ocean swell and the oil company had to return the barge to port, and wait for the next dry season.
For that sort of soil investigation, we developed a hydraulic vibro-hammer which could drive the PMT probe deep enough below the spud depth penetration and could easily work from any ship. We also used the pressuremeter for many other types of off-shore jobs: not only for oil production platforms in the Mediterranean Sea, the Arabian Gulf, or the South-East Asian Seas, but also for floating-storage-and-offloading buoy anchors. The vertical forces on these piles and the tractive efforts on the anchors is up to ten times that which we find on land. Dimensions are accordingly, i.e. piles of 2 metres and more in diameter. Soil liquefaction could occasionally occur. Off-shore Tunisia a pile designed for an embedment of 45 m sank in seconds to 100 m below mud line. In the Macassar Strait the owner followed our recommendation already given in Tunisia. He stopped driving piles at the recommended depth and without observing any refusal. Next month, none of the piles would move when re-driven.
In 1969 I was also involved in the design of one of the first submarine off-shore oil reservoir in the Trucial States – now the United Arab Emirates. Not a single private automobile on land but one traffic light. To cross the creek, you had to whistle the ferryman. Then, we slept on the floating pontoon in portacabins. One night, a strong gale arose, the anchors and the electric generator failed and then no radio. We finished stranded along the Sir Bu Nu'air Island, a territory claimed by Iran… Next afternoon, a search boat found us finally.
Piers for bridges crossing straits can also raise problems. I remember arriving at the Messina Strait in 1969: "- Where is the platform?", "– Oh, my gosh, it has disappeared!". It was a monopod platform resting in 100 m of water and tied by 12 anchors. One failed and the monopod crashed to the sea bottom. We returned a few months later for PMTs up to 160 m depth under a 4 leg platform. The bridge is not yet constructed, but it is now designed for piers on land.
I must say, each off-shore site investigation was a real adventure.

Roger: Coming back to land, what about Dynamic Compaction?

Mike: This is another series of patents of Louis Ménard's, which might have been based on two Soviet processes, one to treat loess where you tamp the soil with a heavy pounder and the other one to densify thick layers of granular fills below water level – as sea dikes – by using

explosives. The second method had been tried during the construction of Franklin Dam in the USA in the 1930s but with no follow up. The secret was to have discrete tamping points on the ground surface and to tamp a defined number of blows at each spot. Prints can be more than 2 metres deep. On the photograph, the car gives the scale of the prints. Densification is not just obtained by compression, but more by the shear effect, a point which is not always understood. Success came immediately because Louis checked the resulting improvement by using his pressuremeter. Had he not be able to, it would have taken years before international recognition. Dynamic compaction is mostly aimed at increasing the E_M yielded by PMTs. Bearing capacity at failure can also be increased but generally at a lesser rate. CPT is not a suitable tool for that sort of quality control, since it only yields a failure parameter q_c. Further, when the soil went through a liquefaction phase, liquefaction may re-appear and q_c dramatically decreases during acceptance tests.
I designed many big jobs in France and around the world: the new air-strip at Nice on French Riviera, on crushed rock, the first phase of the new Changi Airport at Singapore on sand fill over marine clay, new ship-building yards in Sweden, Nigeria, Iran, etc. Also the soil treatment for large factories or warehouses in Sweden again, in Bangladesh, Indonesia, Korea, mainland China, etc. I was involved in the design and construction of the Chek Lap Kok airport of Hong-Kong, and various dams foundation in Mexico, Thailand, etc. I remember having to design a soil improvement scheme in South-East Asia based on a soil report submitted by a Western firm. Identification parameters were fine, except everyone forgot about quoting bulk density. The first time I visited the site I was horrified for it was pumice and we never could have achieved the expected E_M. However, the owner was so satisfied that I worked for him as a consulting engineer on many other big projects.

Roger: What about your experience as a Managing Director overseas?

Mike: In the mid-seventies I was in charge of *Ménard Techniques Ltd*, in Aylesbury, North-West of London and I designed several dynamic compaction jobs over old fills for new roads projects around London. I was helped by Malcolm Puller and Turlough Bamber. We had Joint Venture agreements with *Cementation Piling and GKN* who later bought up *Keller*. In the late seventies, especially after the untimely death of Louis Ménard, I managed *Ménard Inc.* in

Pittsburgh, at that time the heart of soil improvement, with the head offices of *Vibroflotation Inc.* and *Hayward-Baker Inc.*, which later was also bought by *GKN-Keller*. There, *Techniques Louis Ménard Company* had a joint venture with *Elio D'Appolonia Inc.* and we got much support from his son David. I undertook 3 jobs then, one in Santa Cruz south of San Francisco for the State of California, one east of Chicago along Lake Erie for a large tank farm and one in Baltimore, all based on the experience of a first job in Jacksonville, Florida. American Engineers did not waste time and started imitating us, initially for densification of old fills on FHWA projects. Now, several big American firms offer this method which has become public property.

Roger: Mike, I think that during all these years you always had extra-curricular activities?

Mike: You are right, Roger. Already, at high school, I was editing a weekly newspaper *Le Lycéen* on mimeographed sheets and which included an editorial, detective stories, games, a movie chronicle, etc. Some years later I was involved in many student associations. This is how I was in the French delegation invited by *Frei Universität Berlin* in 1951 to counterbalance the gigantic World Peace Youth Meeting organized by the USSR in Berlin. There I was really impressed by the power of the USSR and decided to learn more about it. This is why I learned Russian during my military service, which helped me much later to win a court case for patent infringement as a defendant, since the patent method on which the plaintiff based his action was partially described in the Soviet Geotechnical Magazine the year before his patent application.
I was an active member of the UGE, the French Engineering Students Association, and I represented the UGE at the first meeting of the European Federation of Engineering Students in 1953 in Ghent. I rapidly became Vice-President of the Paris Division of the *Mutuelle Nationale des Etudiants de France* (MNEF) which was running the social security for students and later I became Secretary General at the national level of the MNEF.
I don't know whether my involvement in the editing and publication of *Sols-Soils* magazine from 1962 to 1980 can be considered as extra-curricular or not. The 35 issues not only contained prominent papers either in French or in English on Geotechnical Engineering but also included abridged translations of papers published in German, Russian or even Japanese.
The same question occurs with my introducing an additional Working Group (No.5) to CEN-TC341 to write the EN-ISO Standards on Expansion Tests in Boreholes, which naturally includes the Ménard pressuremeter test.
During all my years of demanding professional activity from 1958 to 1992, I could not commit myself to participate in associations on a voluntary basis. We could simply entertain friends and clients in our flat overlooking the River Seine on the Isle Saint-Louis. Among many others, delegates of Japan, USSR and China would often visit me.

Roger: Now, what about your involvement within ISSMGE?

Mike: As I said, my activities would not permit any large commitment to any type of Association or Learned Society. However, as early as 1987 I initiated a European Regional Technical Committee No.4 of ISSMGE on Pressuremeters which produced a report for the European Conference held in Florence in 1991. This Committee became ISSMGE Technical Committee No. 27 (see the photo of the closure banquet of one of these meetings) which produced another report for the first International Conference on Site Characterisation in Atlanta (1998). TC 27 was merged with TC 16 which thus became devoted to all types of in situ testing. I was a member of TC 16 until 2001, and I remain a friend.

From 1998 to 2002, I was Vice President of CFMS, the French Geotechnical Society and from 2001 to 2005 I was an appointed member of the ISSMGE Board.
Being a francophone Engineer, I thought it my duty to transfer our Geotechnical knowledge to our friends in Africa and to some other more isolated places. I am thinking of Haïti for instance. So, with the help of the newly formed CFMS Committee for a Francophone Cooperation, which included academics and engineers from Belgium, Switzerland and Canada, we collected the addresses of francophone higher education establishments overseas. The first Francophone Geotechnical Libraries partially funded by ISSMGE were distributed during a first meeting held in Marrakech, Morocco, in September 1996. In the meantime I had started to translate the "ISSMFE News" in French and mail it. Then from December 1995 on, I edited, with the financial help of ISSMGE, a quarterly *Lettre de la Géotechnique* which is still in existence and now posted on the ISSMGE website. After that, I thought it necessary to set up an ISSMGE Member Society representing the French speaking African Geotechnical Engineers and Academics: the CTGA or Trans-national African Geotechnical Society which gathers those dwelling in the 20 African francophone countries - excluding the 3 North African ones who have their own Society. Finally, in 1998, with the help of my former ENPC colleagues, and with you, Roger, I set up a yearly 3-week program of Continuing Education for African Engineers, held in Paris. Along the same line, I tried to bring francophone lecturers to the Annual General Meetings of the CTGA to help the development of sound geotechnical engineering in Africa.

From left to right: Prof A. Gomez Correia (Un. Guimaraes, Portugal), Prof. J. Nuyens (ULB, Belgium), Mr. das Neves (Min. Roads, Portugal), M. Gambin, Prof. J. Biarez (Ecole Centrale Paris), Dr. A. Coutinho (LNEC, Lisboa).

Roger: And in conclusion?

Mike: My task, I think, will last as long as my life. It is difficult for me to see that the message from Louis Ménard dating back to the early 1960s has not yet been accepted by the whole Geotechnical Community, although the number of instruments sold has now passed the 1000 mark. Sometimes, I hear "what is new with foundation design using PMT?". The answer is "The whole basis was set up in the 1960s and only refinements can be worked on". A few

books were devoted to the pressuremeter and its use in design, but none of them really stressed the basis on which Louis Ménard developed his 2 simple equations on soil displacement and soil failure under load and based on PMT results. Even now, teachers and students are still much too happy to work on mathematical theories they enjoyed so much during their college years and forget about the reality of soil. Use of more and more effective computer software makes them think that soil behaviour is in the memory of their electronic devices. I was very puzzled when I saw the cover of an ASCE magazine on student theses showing a young student in front of a computer key-board!

Last year I wrote a paper on the fallacy of the Terzaghi (or Frölich?) equation for footing bearing capacity (ISC'3). This was already implied in the Terzaghi and Peck book, page.420-422 (1948 edition). Since 1994, J.-L. Briaud has worked on this subject and has reached the same conclusion. This year or next year, health permitting, I shall write a paper on "Settlement and shear". For the first International Conference on Education in Geotechnical Engineering, in 2000, I have written a paper on the history of defunct Soil Mechanics theories. I would like the theories of the first half of the 20th Century to be at least limited to their own region of application and, better, superseded by newer concepts in these days of sustainable development.

Personal history of Michel (Mike) Philippe Gambin: Civil Engineer (ENPC, 1954) MA (Harvard, 1955), Fellow ASCE

Born 2 Dec.1930.

EDUCATION: Lycée Janson de Sailly, Paris (1936 – 1951), ENPC (1951-1954), Harvard and MIT (1954-1955).

CAREER: Director *Les Pressiomètres Ménard* (1958 – 1962), Director *Techniques Louis Ménard* (1962 – 1978), Division Head *Solétanche* (1982 – 1992), Adviser *Apagéo* (1992 to 2010).

PUBLICATIONS: more than 200 papers on in situ testing, PMT, Dynamic Compaction, vibrations in soils, soil liquefaction, etc.