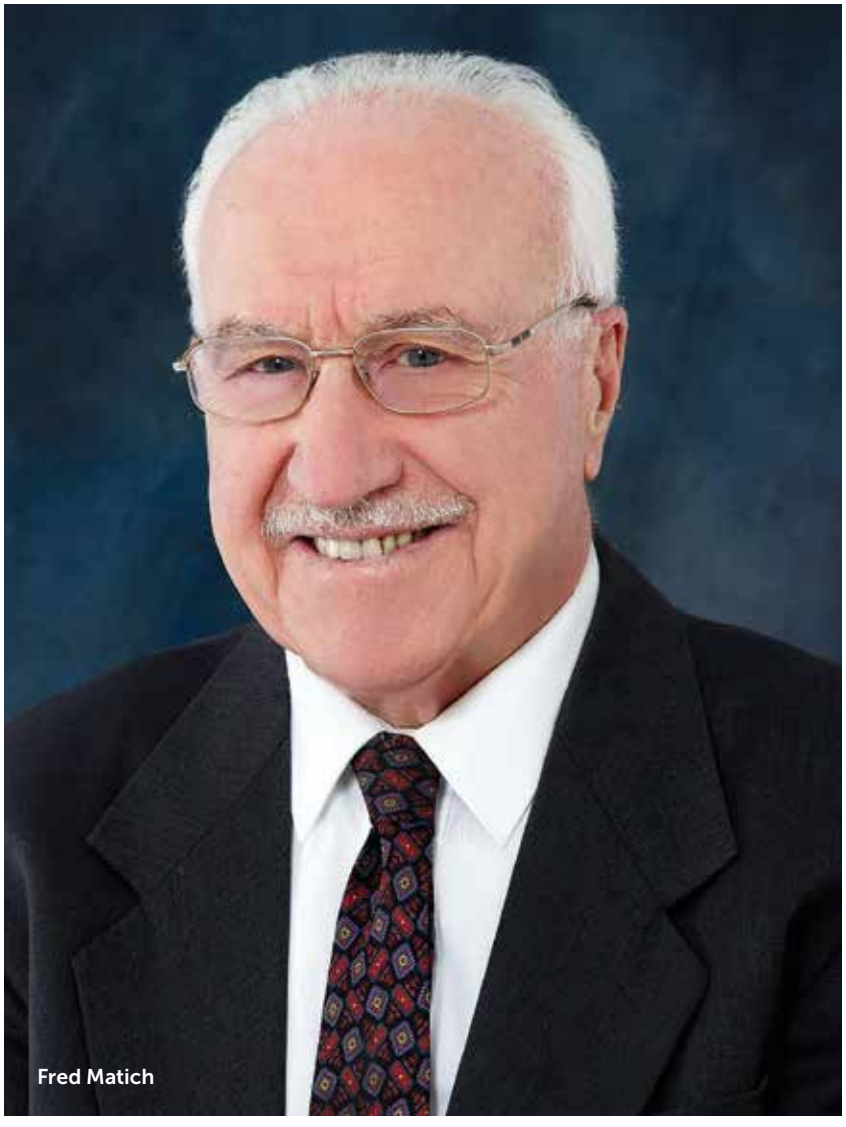
M.A.J. (Fred) Matich, P.Eng, SM, FEIC, FCAE

By Markus Jesswein, Andries Kirstein, EIT, and Sartaj Gill



Fred Matich

With more than 60 years of consulting experience, Fred Matich has made significant contributions toward geotechnical engineering in Canada. He's worked on several thousand projects across Canada and in more than 25 other countries, including heavy construction and environmentally challenging mining developments and subdisciplines of marine and cold regions engineering. Over his career, he has worked closely with many prominent members of the geotechnical profession in Canada, including pioneers Robert Hardy and Norman Lea, and well-known professionals such as G.G. Meyerhof, Norbert Morgenstern, and Victor Milligan. Matich's achievements have been recognized through several awards, including the Julian C. Smith Medal for achievements in the development of Canada, the Engineering Institute of Canada's (EIC) K.Y. Lo Medal for significant engineering contributions at the international level, and the R.F. Legget Medal, the highest award from the Canadian Geotechnical Society (CGS).

Born and raised in New Zealand, Matich got involved in geotechnical engineering in 1950 with research toward a civil engineering degree (with Honours) sponsored by the New Zealand Army. His research

investigated the trafficability of military vehicles on beaches, part of a project on amphibious landings. The work included development of portable manual equipment to measure soil strengths in the field, and experimentation with bullet penetration into soft ground. In 1952, Matich was awarded a scholarship to Harvard University, where he studied as a master's student under Professors Karl Terzaghi and Arthur Casagrande.

Matich considers himself fortunate to have been active professionally during a period of significant growth in geotechnical engineering, with its opportunities to gain diverse experience. He came to Canada after finishing a master's degree in 1953. He originally worked for Geocon Ltd., which offered geotechnical engineering as a consulting service. In 1954, the company became a division of The Foundation Company of Canada Ltd., a major Canadian general contracting and engineering organization. This gave Matich an opportunity to work closely with many other well-qualified geotechnical engineers experienced in civil engineering design and construction. He was involved in the engineering development of the oil sands in northern Alberta, Canada. Over the years, he has participated in an impressive list of independent peer-review boards, including the Geotechnical Review Boards (GRB) established by Syncrude Canada Ltd. in the 1970s. Matich has been in the consulting field throughout his career, and currently continues to offer his services through his firm, MAJM Corporation, Ltd.

Matich (left in photo) at U.S. Air Force Base at Lajes, Terceira Island, Azores, Portugal, where he directed offshore geotechnical exploration for a marine terminal in 1958.

Q: As one of the last remaining and still active students of Terzaghi and Casagrande, how did they influence your outlook on geotechnical engineering?

These two eminent professors influenced me by adding enormously to my previous geotechnical studies. Both were excellent lecturers. Casagrande's presentations were the finest I've seen — most of the material was written on a chalkboard in those days. Terzaghi's presentations were also excellent. He provided great graphical illustrations and explanations, particularly in engineering geology. His accounts of consulting assignments were most interesting and very valuable for a young student. I still have my notes and refer to them periodically. I was at Harvard from 1952-1953, the last year that Terzaghi lectured full time. When he wasn't available, his wife, Ruth Terzaghi, lectured in his place. She was an accomplished engineering geologist in her own right. I often quote one of Terzaghi's parting comments to our class: "When you get into practice, and when all else fails, use common sense."

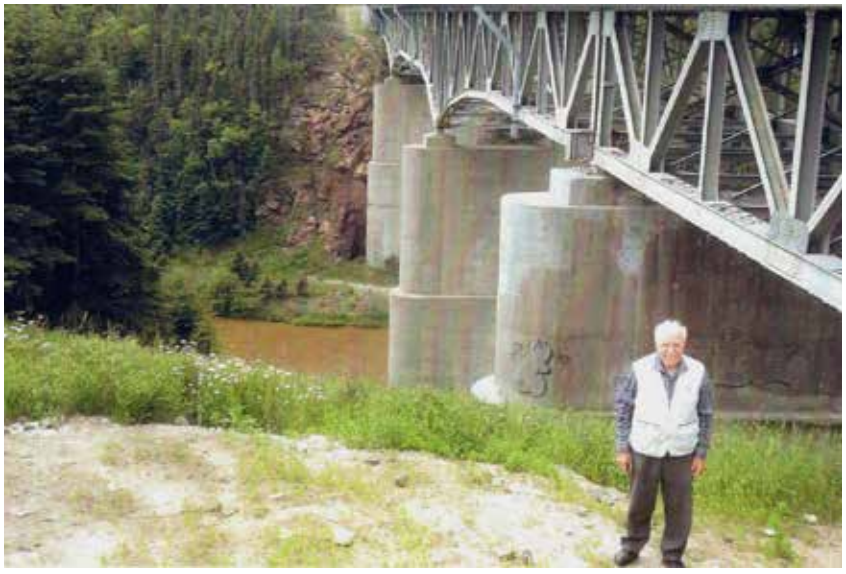
Q: You've seen the profession evolve from heavy reliance on "experience" to one that's becoming quite codified. What are your thoughts about the way the profession is moving?

Terzaghi and Casagrande stressed the value of practical experience. Terzaghi noted, in particular, that participation in field work involving drilling and other geotechnical site investigation techniques has the added benefit of assisting in the understanding of the geological aspects of a project. That type of participation is still important today.

When I joined Geocon Ltd., it was managed by Norman Lea, a Harvard graduate. He employed other graduates in geotechnical engineering from Harvard and other universities, but required all of us to work on field investigations for the first few years. We had to plan the field investigations, particularly the drilling and sampling operations. In the process, we learned much from the drillers. The drillers came from the diamond drilling activities used in the mining industry, and knew geology from their experience in investigations for minerals, such as gold or copper. It took time to develop the skills to go into the field, assess the site, plan the investigation, and importantly, defend your choices.

It's very important to have geotechnical work checked and reviewed by senior people so you can learn from the experience of others. In my early years, I was fortunate to talk and work

In March 2000, Matich received the Engineering Institute of Canada's K.Y. Lo Medal for his significant engineering contributions at the international level.



Matich in a recent photo at Little Pic River Bridge near Marathon, Ontario. At this site in 1956, he investigated a slope failure during abutment construction, including slope stabilization using electro-osmosis directed by Dr. Leo Casagrande.

with experienced senior people in Geocon's parent organization about the design and construction aspects of projects to which geotechnical data was being applied. In fact, the company had a policy to have work reviewed by senior representatives. Today, reviews are also conducted for many special projects by independent geotechnical review boards.

Today we also have new tools and much more codification. Excellent codes, publications, and archives are available. Examples include the *Canadian Foundation Engineering Manual* and guidelines from the Canadian Dam Association. Codes are becoming more comprehensive and stricter. It's still necessary, of course, to obtain the appropriate fundamental data needed for design. A thorough site investigation is important, as is attention to geological details, as demonstrated from the analyses of case histories of some dam failures, for example.

Great advances in site investigations and analytical tools have developed over the years. These are vitally important, and it's clearly desirable to keep abreast of them. We have many more tools to assist in better understanding the geotechnical, geological, hydrogeological, environmental, and geochemical aspects of a site. Special programs, such as FLAC and developments in computers, have improved analytical capabilities enormously. Notwithstanding, the application of geotechnical data to the design, construction, and operation of projects still requires some degree of engineering judgment. It's important to appreciate this.

Q: Of the projects you've worked on, which ones make you the most proud?

I've been privileged to work on many important projects in Canada and internationally, and find it difficult to single out one as a special mention. Therefore, I'll discuss two major projects with which I had the longest association.

First, I was involved for more than 30 years with Syncrude Canada Ltd.'s oil sands project. It's one of the largest mining operations of its kind in the world, with very challenging geotechnical problems for which there was no precedent at the time. My first assignment was in 1962. Drs. Bob Quigley and John Brown (colleagues at Geocon at the time) and I visited the site to take part in an initial mining feasibility study. This led to involvement on other geotechnical studies, including large-scale trial mines and participation on the Geotechnical Review Board (GRB) for the project. The GRB, as initially convened in 1972 to decide on the basic mining method, had 13 members, including professors Arthur Casagrande, his brother Leo

Casagrande, Robert Hardy, and Norbert Morgenstern. The oil sands could not be economically mined and processed until the energy crisis in 1973. I saw mining on a large scale come to fruition over the years while serving on the GRB. It's now a major project for the Canadian economy. A personally significant aspect of this project was the opportunity to work with the many people and geotechnical experts involved from the owner's side, research groups, and consultants' organizations, who collectively made the project successful.

The second project is the major tailings management facility at Inco Ltd.'s (now Vale Canada Ltd.) nickel mine in Sudbury, Ontario, one of the largest hard-rock mines in the world. I've been privileged to serve this client for about 60 years, since 1956. At that time, there was little precedent for the application of geotechnical engineering to dams built with mine tailings that could liquefy under vibratory loads, such as those associated with earthquakes. Over the years, Inco (and Vale), like Syncrude, have kept abreast of advances in technology applicable to the design, construction, and operation of its tailings dams. In addition to the engagement of consultants, Inco (and Vale) have maintained an independent tailings review board of senior engineers for at least 25 years. It's been my privilege to serve on this Board from the outset. Service on this project led to the involvement of Inco/Vale's mining operations elsewhere in Canada and in several other countries.

Q: You've interacted with many influential contributors in the geotechnical field. Are there common or important skills and perspectives among these people?

They all stressed the need for high quality and standards for all geotechnical projects. This was true irrespective of whether the work was conducted on a consulting basis or performed internally in owner organizations. Other important attributes included recognizing the value of seeing first-hand a site at which geotechnical data was obtained and giving attention to geological details. I recall many instances when influential contributors spent time in a lab carefully examining samples and cores for evidence, such as thin layers of clay, that could potentially lead to slope stability problems. I remember Arthur Casagrande painstakingly examining soil samples and rock cores, for example, while on consulting assignments or service on geotechnical review boards. There are many precedent-defining cases involving geotechnical problems on projects where the cause can be attributed to geological details.

L to r: Fred Matich, Bob Quigley, and John Brown on the Athabasca River for the Syncrude Canada Ltd. Oil Sands Mine in 1962.

Q: You've been a member of several special committees and have taken on numerous leadership roles in the engineering industry. What reward do you get from being involved in these types of endeavours?

Get involved in the activities of engineering associations and committees because it's a very valuable part of professional development. You'll be rewarded in several different ways. First, you'll continue to learn, and second, they'll provide you an opportunity to contribute to growth of the profession. You get to participate with other engineers and the more senior members of the profession who serve in associations and on committees like those set up by Professional Engineers Ontario and the CGS. You can greatly benefit by being actively involved, and I strongly encourage it.

Q: We've learned your latest passion is preserving and archiving geotechnical reports, which is especially important for large earth structures with long lifespans. What are your thoughts on preserving and archiving?

The preservation of project archives and retained documents, preferably in a catalogued fashion, has always been important during my 60 years of experience. It's becoming increasingly important as many major structures age, and we can no longer rely on "institutional memory" for various reasons, including that employees may change careers and locations, or retire.

Archives are obviously important when a project experiences a problem

L to r: Norbert and Patricia Morgenstern, Fred and Helen Matich, and K-Y and Beatrice Lo at the 2017 Engineering Institute of Canada Gala in Gatineau, Quebec.

Having served on Syncrude's Geotechnical Review Board since 1972, Matich was given permission to sit in the operating cab of one of the company's 7,500-ton draglines when he retired from the Board in 2004.

or is being expanded. The failure of the Mt. Polley tailings dam in 2014 is an example. The comprehensive forensic investigations carried out in connection with this failure highlighted the value of complete and transferable documents that allow a reliable reconstruction on paper of the dam and its historical background. Comprehensive archives are also vital where an independent peer review is involved. If archives are lost or discarded, it's costly, and sometimes impossible, to retest a site to replace missing data. There's now an increasing trend toward preserving archives because of their importance in many ways. Examples include ongoing evaluations of existing structures to meet regulatory requirements and upgrading purposes, particularly when structures are intended to have long service lives. Project archives have other important uses; they can help with preparation of operation and maintenance manuals, conducting staff training, and creating technical publications.

An interesting example of the value of archives is described in various publications on the planning of the Normandy landings of World War II in 1944. During aerial reconnaissance for the invasion, dark patches were observed on the beaches immediately after storms. The patches could have had serious implications to vehicle trafficability and had to be checked. There was little geotechnical data available for the beaches, and it was obviously difficult to obtain any directly. So as part of the investigation, a variety of historic documents were studied, and archaeological evidence was collected. This information indicated that peat used for heating by the Roman Army came from the Normandy area. A clandestine check by Special Forces verified that the dark patches were indeed peat, and were so marked as exclusion zones for vehicles during the landings.

Q: What advice can you offer to young engineers who want to make a big impact on the industry?

Focus on improving your capabilities in your chosen field after graduation. Learning is a lifelong process because the field is continually changing as new tools become available and new problems need to be addressed. Take advantage of opportunities to continue to learn. For example, when working on complex projects, seek review from experienced colleagues or perhaps engage your former professor(s) as a consultant(s). Participate in advanced courses at universities and special lectures by practicing engineers. In addition, make an effort to view

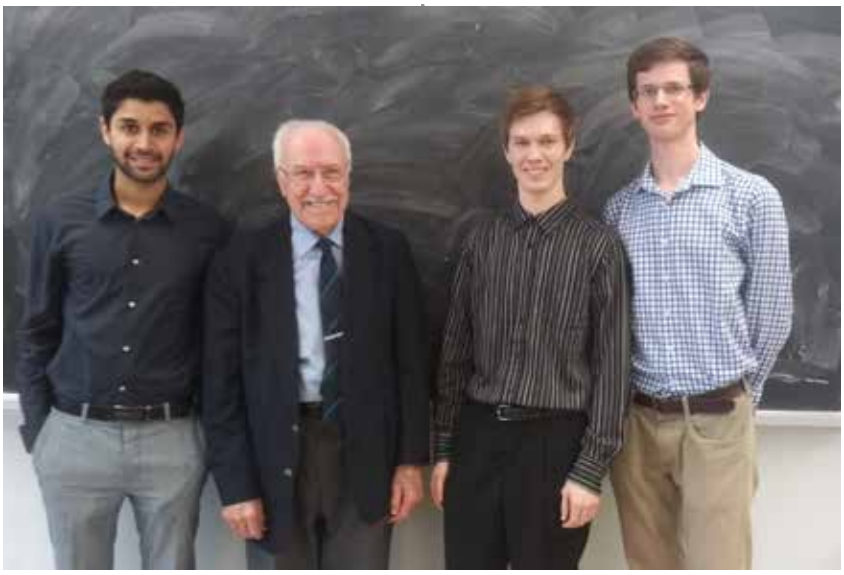
selected projects firsthand and learn from them, even if you aren't directly involved.

As I've already mentioned, the application of judgment is often important. If I may quote Ralph Peck in this regard, he stated during his presentation to a chapter of the Canadian Geotechnical Society (CGS-SOS) in October 1983: "There is no job without its lesson. Every job has the potential of teaching something to every engineer. Those engineers who take advantage of the potential are developing that priceless ingredient known as judgment."

Q: What advice do you have for those engineers in their mid-30s to mid-50s who have a great deal of experience, but who still have a sizable amount of their careers ahead of them?

For the younger members of the group, it would be timely to review where best to build on the experience already gained. That might be in different fields, such as teaching, government service, or consulting. Where not already being done, it would be desirable to get some practical and diversified experience. Changes in methods of generating and applying engineering data are occurring more frequently than in the past, and it's necessary to keep abreast of them. The older members of the group would likely have already selected the direction that their careers would take. However, the need to keep abreast of new developments would apply to them as well. Some in this older group would likely already be involved in a peer-review capacity.

I would add another dimension to the above advice that relates to the troubling increase in disputes involving geotechnical matters. This would apply to all in the subject group and particularly the older members, who may be in senior or supervisory positions. It's important that defensive measures are taken in preparing all documents to avoid pitfalls that could lead to disputes. If such disputes do occur, experience shows that alternate dispute resolution (ADR) methods are preferred. Including such a provision in contract documents should therefore be encouraged as a possible defensive measure.



Matich with the student authors. L to r: Sartaj Gill, Fred Matich, Markus Jesswein, and Andries Kirstein.

Q: Is there anything you would like to add?

It's important to keep in mind that geotechnical engineering involves much more than technical issues. In practice, communicating with people who have different qualifications and cultural backgrounds is important to effectively and successfully deliver a project. On a given project, many individuals are involved; they might be involved as field investigators, technicians, engineers, geologists, scientists, designers, contractors, operators, and the client (owner). In making your own contribution to a project, you'll find it rewarding to learn about the roles of others involved, and liaise closely with them.

I'm most grateful for the opportunities I've had to work on challenging projects and with many people and organizations too numerous to mention individually. I also thank Markus, Andries, and Sartaj for their kindness and efforts in carrying out this interview. GS

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