NO CONCRETE, NO PROBLEM
ENVIRONMENTALLY SENSITIVE BRIDGE CONSTRUCTION IN TEMAGAMI

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Why did you get into the Geotechnical field

As a high school student, I always wanted to go into business consulting because I was really good at math. In my final two years at high school, I started to love physics and I then decided to go into engineering as I figured I could use both physics and math. Originally I was thinking biomedical engineering or engineering physics, but in the common first year of engineering at Queen’s University, my favourite class was geology. It was a natural fit to go on in geological engineering and I chose the geotechnical stream. Upon completion of my PhD from University of Toronto in 2004, I thought I wanted to be a professor in engineering, so I did a post-doctoral fellowship in underground mining rock support. During this time, although I enjoyed the work and learned so much about numerical modelling and rock mass support, I decided that I would rather be a GTA-based consultant than a professor somewhere in North America. At that point, my contacts through the Canadian Geotechnical Society and other friends led me to work with Terraprobe in the Greater Toronto Area. Now as a part-owner of Terraprobe and assistant manager of the geotechnical engineering department, I’m participating in both the engineering consulting as well as the business aspects of the company.

What trends have you seen in the Geotechnical field over your career and what has changed the most?

Numerical modelling and settlement calculation in conjunction with change in building code from working stress to LRFD is the biggest change I’ve seen. When I first started out, geotechnical reports simply provided bearing capacity in a working stress design methodology, using simple calculations or engineering experience. Shortly after I started, we had to provide factored ULS and geotechnical reaction at SLS. This change brought along computation and estimation of settlements at SLS pressures. Numerical modelling has also come a long way in the last decade. These once difficult to use and cost-prohibitive software programs are now both easy to use and relatively cost-effective. Many regulators are now asking for verification of settlement prediction based on numerical modelling. The challenge here is of course ensuring that the users are well educated on how to use the software, on how to properly input boundary conditions, and on using the right constitutive soil behavior models. As my original mentor at Terraprobe (Tim Orpwood) always said, you can make a model output whatever results you want it to output. The trick is to get the model and soil input parameters correct in order to see realistic and reasonable results. Modelling is also now being used in design of shored excavations to predict ground movement and stresses in structural members, both overall and during different construction stages.

In your opinion, what are the greatest challenges facing this field?

Recognition of value that geotechnical engineers bring to field.

As geotechnical engineers, we constantly face clients that do not see the value we can bring to a project. We face pressures to do less investigation, and do geotechnical reports for reduced fees. This is a “race to the bottom” that is a critical concern for our engineering field. There will be no winners if we continue this trend. A detailed investigation can identify not only potential issues with construction and design, but also opportunities for foundation options and potential huge cost savings for owners. However, many owners and developers only see our service as a check box on a site application. The design options, parameters, and evaluations we provide if we critically think about our job and value-engineer sites, can change non-viable projects to profitable projects for our clients.

The “race to the bottom”

The ‘race to the bottom’ is more prevalent now than ever. We face other practitioners who are low-bidding geotechnical engineering projects simply to cover costs with little to no fees, rather than attempting to bid projects for reasonable fees. We owe it to ourselves and our profession to request reasonable fees for reasonable work. Geotechnical Engineers have relatively low charge-out rates when compared to other professionals and
We have seen many projects go off the rails for the sake of saving a few hundred or few thousand dollars on large projects. Owners would never consider asking a different structural engineer to do field verification of the original structural engineer’s design. So why do they accept this for geotechnical engineering? Because of the ‘race to the bottom’. We need to educate owners to eliminate this practice in the future.

How do you see Geotechnical Engineering changing in the future?
The biggest change I see moving forward is the expanded use of numerical modelling as a design verification tool and instrumentation as a site verification tool. Numerical modelling is being requested more and more to verify design assumptions. Both 2D and 3D finite element modelling tools are more accessible to geotechnical practitioners. Field instrumentation is also becoming more acceptable as a cost to owners if we communicate and explain how instrumentation can mitigate risk to adjacent structures as well as the project itself. We are working together with Queen’s University looking at alternative methods of instrumenting shored excavations, and we are seeing amazing research, instrumentation tools, and field results that will add value to projects.

What are the top two projects you worked on and why?
1. Costco Warehouses
Typical big-box warehouse projects do not seem exciting on the outside, but working with Costco on warehouses, fuel outlets, and a new 750 m long depot building has been very challenging. Costco is a very large and very successful global company that demands excellence, and have people that know what questions to ask of their consultants. They see the value in all engineering disciplines and they push their consultants to come up with the best value recommendations. They push us to evaluate all possible solutions for the site, not just the conventional or solutions that are normal in the local market. With a global knowledge base, they challenge our recommendations which force us to critically think about our designs. Costco has a team mentality, working together as owner with consultants and contractors together at the design and construction stages. This is a client that very much values geotechnical engineering services, as this aspect of their developments always carries the highest cost risks. Costco has also demanded more out of the geotechnical engineering report than most clients, and this has helped Terraprobe to add value and meaningful options and recommendations in our reports.

2. The One Condos, 1 Bloor West, Toronto
The One Condos Toronto at One Bloor West is a new residential condo development by Mizrahi Development and Foster + Partners. This building will be Canada’s tallest building other than the CN Tower and will consist of an 80+ storey retail and residential tower with a 24 m deep basement. Located at the southwest corner of Bloor and Yonge Street, it will be approximately 320 metres high and will be Toronto’s deepest excavation in soil for a building development. Terraprobe is the geotechnical, environmental, and shoring design consultant for the project. As the design geotechnical engineer, I’ve been working closely with the structural engineer, RJC, to come up with innovative foundation options for this project that has a series of mega-columns that are to be supported on high capacity end-bearing caisson foundations. I’ve also been working closely with Terraprobe’s shoring designer, Mike Porco, to review the design and to provide ground movement predictions for the extremely deep shoring that needs to support adjacent buildings and public infrastructure.

What would you like to tell everyone about yourself that not many people know?
I’m an avid curler. I curl twice a week at Leaside Curling Club in Toronto, and regularly enter bonspiels across Toronto.
The Eastern Canadian Chapter of the ADSC is having a productive year, with solid growth. With new members, the association is comprised of contractors, suppliers, manufacturers and consultants fostering all perspectives of the drilled shaft/deep foundation industry to be heard. This broad spectrum of members has enabled the Chapter to take on some impactful initiatives.

One of the largest initiatives the Eastern Canadian Chapter is undertaking this year (in conjunction with the Western Canadian Chapter) is the development of a CSA Standard for the safe operation of drill rigs. New provincial regulatory requirements for drill rig operators were introduced in December 2015 under the Occupational Health and Safety Act. The new requirements that came into effect on July 1st, 2016 are:

- Technical and operational safety measures and procedures;
- Mandatory drill rig operator training and certification.

The requirements developed by the Canadian Chapters of ADSC through a CSA Workshop Agreement will help ensure that workers and all parties involved:

- Have adequate knowledge, proficiency and proper training when operating drill rigs;
- Follow safety practices when installing drilled shafts (i.e., site preparation).

The Safety Committee has also been active developing “best practices” with respect to working platforms for drill rigs. Changes to O. Reg 213/91 which describes the role of the professional engineer as it relates to platform design. The safety committee is comprised of contractors and consultants who have been developing methodologies that will become the industry standard. One of the biggest obstacles for local designers has been getting accurate track bearing pressures from the various drill manufacturers. A similar system is currently being used in the U.K. by the Federation of Piling Specialists and will likely be the model for Ontario platform designs.

The Education Committee will be hosting a training session November 21–23, 2016 designed to offer a field level perspective and education on topics such as shoring, drilled shafts and safety. Industry professionals will be sharing their knowledge and expertise in 9 different sessions over the 3 days. This event is a must attend for any field personnel looking to move into a supervisory role as well as junior to intermediate level engineers wanting a better understanding of drilled shaft construction.
Temagami, Ontario

A bridge required replacement along a power line corridor in Temagami. The site location was remote and access was limited due to environmentally sensitive areas which prohibited the use of large excavation and concrete equipment for traditional foundation construction. The option to construct and removed access roads for large equipment was determined to be cost prohibitive.

EBS Geostructural Inc. was retained for their specialized design with micropiles that met all challenges and allowed for the bridge installation without the use of concrete. EBS designed, supplied and installed 25 micropiles through soft organic soils and embedded into sloped bedrock. Limited access equipment and methodologies were employed by EBS to mitigate damage to environmentally sensitive areas and reduce the cost of mobilization.
Light Rail Transit, Waterloo

In the core of uptown Waterloo, a terminal substation was planned as part of the new 22 station Light Rail Transit project. Adjacent buildings, train tracks and poor soil conditions posed challenges for traditional foundation construction. Caissons and h-piles were not feasible options due to tight access and vibration concerns. As a result, helical piles were determined to be the best solution for high capacity loads, limited vibration/noise that would not disturb adjacent businesses and the ability to install in the tight access entrance next to rail line.

The project required quick mobilization, design contribution and also required completion within tight timelines. EBS Geostructural Inc. was retained to design, supply and install (156) SS175 helical piles to support the planned terminal station. EBS’s in-house engineering team assisted AECOM with helical pile design and quick mobilization allowed for the project to be completed 2 days ahead of schedule.