As winner of the 2003 UKSTT Young Engineer's Award, I was provided financial support to travel to a destination of my choice in order to learn more about the use of trenchless technologies in other areas of the world. I have recently returned from a two-week trip to Tokyo and Hong Kong where I was fortunate to be able to meet with various experts in the field of trenchless, visit several interesting project sites, and get a taste of Asian culture. My journey was extremely valuable to me and I am sincerely grateful to the UKSTT and all of those who assisted me with my trip.

My choice to visit Japan and Hong Kong was driven by several factors. Firstly, because of the extensive involvement in the use and development of trenchless techniques in these areas, there is an abundance of truly knowledgeable and experienced people to meet and learn from. Secondly, due to the densely populated nature of Tokyo and Hong Kong, the cities and environs are excellent candidates for the use of trenchless techniques and provided me with a variety of interesting projects to visit. Lastly, as I had not yet been to Asia, I was keen to experience and learn more about the fascinating history and culture of these areas.

My interest in trenchless technologies began during several of my work placements during my co-operative undergraduate program in Civil Engineering at the University of Waterloo in Canada, where I was exposed to the use of several trenchless techniques for underground utility installations and repairs. While at the University, I became involved with the NASTT and eventually became student chapter president. My MASc degree research focused on furthering the understanding of the effects of directional drilling with little overburden. I also worked for CATT (Centre for Advancement of Trenchless Technologies) on various projects related to trenchless, including testing of CIPP pipeline materials. I have a strong belief of the importance of effective underground infrastructure systems and I know that trenchless techniques will play a major role in the construction and maintenance of these systems in the future. I have joined the UKSTT Council in order to help promote trenchless and to educate others on the benefits and use of these innovative construction techniques. I am currently employed with Mott MacDonald in the UK and am involved in a wide variety of underground construction projects. I believe that keeping informed with developments in trenchless technologies is very important to my work.

My trip began in Tokyo where I was immediately welcomed by Mr. Hiroshi Wada and Miss Kyoko Kondo of the JSTT, two people I owe a great deal of thanks to for their assistance in planning my time in Tokyo and for acting as my guides and interpreters while there. They provided me the opportunity to learn about the trenchless work in Japan by means of project visits and meetings with various Japanese trenchless experts as well as showing me some of the cultural side of Japan, including a wonderful visit to the Kamakura area and its shrines and temples, a sampling of some fantastic Japanese food and, of course, a fair amount of sake.

Hiroshi Wada and Kyoko Kondo in Kamakura

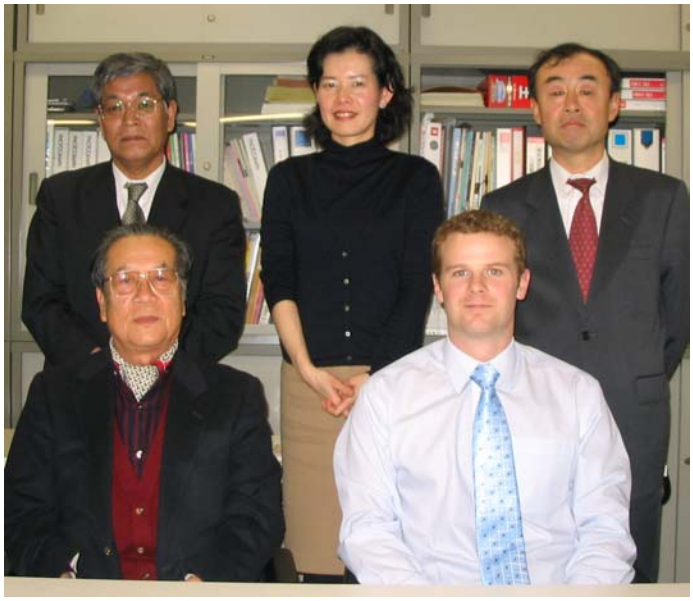
One of the highlights of my time in Tokyo included a visit to a pipejacking project near Toyoda where NTT's (Nippon Telegraph and Telephone Corporation) ACEMOLE equipment was being used to install a 500mm diameter sewer line with multiple, alternating curves, one having a radius of only 56m. I was impressed by the ability of the technology to work within very tight space constraints, having launching shafts of only 4.1m x 2.0m, which allowed the construction to be completed without blocking road traffic.

I also visited the NTT Access Network Service Systems Laboratories in Tsukuba where research into further developments of the ACEMOLE method and equipment were being carried out. I was given a presentation on the use of high-frequency vibrations within their non-soil discharge press-insertion pipejacking equipment that enabled the installation of conduits of up to 450mm with little disturbance to the ground surface. The researchers had performed laboratory and field trials of the equipment and developed relationships that showed the required depth in various soil conditions to limit surface deformations. The press-insertion technique is a cheaper alternative to slurry-type machine excavation but is generally used for smaller pipe diameters due to its effect on local soils. Increasing the applicability of the press-insertion technology to larger diameter pipes therefore has significant financial benefits. My impression was that this technology could be very beneficial to the trenchless construction industry. Also presented by NTT was their development of forward-sensing electro-magnetic wave detection systems located within the drill head of the press-insertion machines. This technology can be used to detect other pipes within the ground in order to prevent unwanted collisions. NTT developed several innovative solutions to common problems for this technology, including a multiple transmitter system that provided good results within very tight space constraints, and an effective processing algorithm that aided with the interpretation of scanning results, something I understand is often very hard to achieve.

While in Tsukuba, I was also introduced to Dr. Liming Li, Senior Researcher at the Nippon Koei Research and Development Center. I was given a presentation on their work in evaluating the residual load-carrying capacity of existing deteriorated sewers and the development of a design software package for the economic renovation of sewers, an area that I definitely believe deserves attention. I was also given a tour of the research facilities which include a large centrifuge testing laboratory and diverse geotechnical and hydrological testing equipment. I learned from Dr. Li that in Japan, it is usually the large Contracting and Consulting companies, rather than the Universities, that have the leading research laboratories. In my experience, this is very different to North America and Europe, where research is generally done within Universities.

I was fortunate to also be given a tour of the 12m diameter TBM highway tunnel that is being constructed beneath Yamonote Road by the Okumura Corporation. The scale of the TBM and several aspects of TBM design and construction sequencing were very impressive, including a separate rail-transport platform that allowed for construction of the road deck behind the TBM (which saved considerable time in the overall construction programme) and a semi-automatic segment erector for mechanized (non-man) movement of segments from the off-loading area into the erector arm.

I have also had the pleasure of having discussions with a variety of experts within their respective areas of trenchless technologies. I spoke with Mr. Shigeru Harada of Komatsu Ltd. and Mr. Masashi Nakayama of HDD Technology and Construction on the use of horizontal directional drilling (HDD) in Japan. It was interesting to learn that there are currently only approximately 70 HDD rigs in operation in Japan, a value which is significantly less than the number of pipejacking machines. It was my observation that this is different to the situation within North America and Europe where I believe HDD is at least as popular as pipejacking. I was also told that the use of polyethylene pipes was not favoured by the water industry in Japan, a fact that has resulted in very few water lines being installed by HDD. This was somewhat surprising to me given that I know HDPE is used for potable water systems in North America and has been approved by various regulatory agencies. I also learned of an intelligent HDD system in development in Japan that uses forward sensing technology located within the drill head to detect nearby obstacles. A tool such as this could prevent damage to other buried pipelines and in my opinion would be very useful to the HDD industry on a global scale.



Me and Mr. Ishibashi with Mr. Nishimura (on left), Miss Kondo, and Mr. Morita at the JSTT office

While in Tokyo, I had the privilege of meeting Mr. Nobutoshi Ishibashi who provided me with a background of the development of micro-tunnelling in Japan. I also met with Mr. Nishimura of the Japanese Pipejacking Association and Mr. Yoshiki Morita of the Okumura Corporation who provided me with some interesting details of future pipejacking developments that are being pursued. These include long distance and large-diameter pipejacks, narrower curves, and hard-rock cutting techniques. The future for pipejacking in Japan looks to be very promising.

After 7 days in Tokyo, I packed up my things (and a couple bottles of Sake) and headed to Hong Kong, where I spent the following 6 days meeting representatives from the HKSTT, visiting more underground construction sites, and trying to keep up with the fast-paced lifestyle.

I met with representatives of the HKSTT - Dr. Alan Kwong, chairman of the HKSTT, Derek Choi of Balama Prima – Vermeer, and Darvin Lo of Preussag Pipe Rehabilitation - for some Dim Sum lunch to talk about the current state of the trenchless industry in Hong Kong. I learned that the sales of large to medium sized HDD machines is up within China and that there is new work coming in from both Hong Kong and Malaysia for the replacement and renewal of hundreds of kilometres of water pipelines in these areas. The CIPP industry is also very busy within Hong Kong. I was intended to see a CIPP installation with Darvin Lo and Dr. Kwong; however, due to a last-minute rescheduling because of traffic management issues, the project was delayed and I was not able to attend. Additionally, I learned that plastic pipe has only recently gained full

approval for water and gas within China.

I met with Mr. Ian Vickridge of Black and Veatch who was kind enough to spend a day with me to explain the work that is being done by the Hong Kong Water Supplies Department for the replacement and refurbishment of several of their sections of underground pipeline networks. We visited several project sites where HDD was being used to install pipelines below heavily congested city streets. We also visited a site with Miss Fanny Wang of the Water Supplies Department where pipejacking had been used to install a pipeline through the centre of a busy traffic circle. It appears to me that trenchless has been readily adopted within Hong Kong as a valuable tool for installing underground infrastructure within their congested city.

Visit to a Pipejacking site with Fanny Wang and Ian Vickridge

Connell Mott MacDonald of Hong Kong provided me the the opportunity to visit the Chi Ma Wan Cable Tunnel on Lantau Island where Dragages had completed a 3.3m diameter hard-rock TBM tunnel. Blasting operations were ongoing during my visit to the tunnel in order to enlarge certain sections of the tunnel. The bulk of the tunnel was excavated through intact granite and needed no to very little support. Spot bolting and shotcrete was used in some areas of faulted ground. The tunnel provided an excellent view of the granite and basalt geology of the area. I was impressed at the smooth rock surface created by the TBM. Environmental and social considerations were high on the priority of the project. Water from the tunnel was treated on-site before being pumped back up into the mountain and effort was made to both inform the local townspeople of the work as well as reduce the impact of the work on them.

At one end of the Chi Ma Wan Tunnel, A J Lucas was using an American Augers Directional Drill to install two 31" (787mm) diameter conduits beneath a beach and water outlet to provide passage for the cables from the Chi Ma Wan Tunnel. HDD was selected for the installation rather than continuing the TBM tunnel beneath the area because it was a cheaper alternative. The HDD team were having to overcome various difficulties including drilling through a variety of materials, ranging from marine


HDD Site at end of Chi Ma Wan Tunnel

sands (where steel tubing had to be installed to maintain the bore) to granite. The work site was restricted to a very small area and was enclosed within soundproofed walls. Additionally, all water from the site was collected and treated.

I will try to summarize the general impressions that I had during my brief stay in Tokyo and Hong Kong. I was impressed at the welcoming nature of the Japanese and the effort that was made to promote and publicize their work and the developments they have made. I would have to say that language is definitely a major hurdle to overcome for anyone trying to work in Japan who is not from the area. It was my impression that most of the work done in Japan is done by locals and that there is not a substantial international workforce in Japan. Tokyo as a city is fantastic. It has an efficient (and very well used) transportation system which makes getting around very easy (as long as you can read the signs). Hong Kong felt like a city in fast-forward. I was told repeatedly that construction work was currently going through a slow phase however, from what I saw, it still seemed to be very busy. There is definitely an international feel to the city which made it easy for me to feel comfortable, and communicating in English was generally easy. The landscape of the city was what impressed me the most, with buildings appearing to be growing out of the mountain to what seemed to be a limitless height.

I thoroughly enjoyed my visit to Japan and Hong Kong and would like to sincerely thank the UKSTT for providing me this unique opportunity. I would also like to thank my employer, Mott MacDonald for providing their support. I am grateful to all the people who provided assistance to me, with special mention to Mr. Dec Downey of the UKSTT who provided me with several key contacts and some great advice based on his previous experiences in these areas. I would also like to thank the many people who gave up their time to meet and talk with me about their work and to show me around the various work sites that I visited.

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