SITE VISITS
Date: 6 August, 2003 (Wednesday)
Time: 9:00 am to 1:30 pm

A National Library (NL) (courtesy of National Library Board) and Singapore Management University (SMU) (courtesy of Singapore Management University)

B Kallang/Paya Lebar Expressway (KPE) and Circle Line (CCL) (courtesy of Land Transport Authority Singapore)

C National University of Singapore (NUS) and Nanyang Technological University (NTU)

Registration is to be done at the Conference Secretariat on a first come first served basis. Participants are required to fill in an indemnity form during registration for site visit. Transport for all sites will leave at 9:00 am sharp from Meritus Mandarin Hotel. If there are last minute changes due to unforeseen circumstances, we would try to announce these changes during the keynote lectures on Tuesday (5 August, 2003) and post the changes on the notice board at the registration desk.

Site descriptions

National Library (NL)
The Singapore New National Library is located at Victoria Street, in the Central Area of Singapore. The project involves the development of 2 building blocks, consisting of a 3-level basement and up to 16-storey superstructures. The structural system of the building consists of steel frame and reinforced concrete composite elements. As the perimeter wall of the development is close to existing MRT bored tunnels, which are located at approximately 17 meters depth from the existing ground level, it is required to control the tunnel movements to the limits specified by the Code of Practice of Railway Protection. This is achieved by adopting a robust retaining wall scheme, coupled with top-down construction. A diaphragm wall system, 1000mm and 1200mm thick, and two layers of Jet Grout Piles (JGP) 1500mm and 2500mm thick are proposed. The top-down construction ensures that the diaphragm wall is restrained during excavation stages. The subsurface lateral yielding of the diaphragm walls within the thick underlying soft soil is also minimized by the lateral restraint offered by the two layers of jet grout slabs.

Singapore Management University (SMU)
The SMU- City Campus Piling and Basement Contract comprises of 5 parcels of buildings interlinked by a Concourse level Basement B1. The underpasses crosses Bencoolen Street and Queen Street and has the potential to link up with Dhoby Ghaut Station and Raffles City thus providing a continuous underground mall from Suntec City to Dhoby Ghaut. The major challenge is to build the basement in the 1st reserves of the existing MRT North South line and interface with the new Museum Station. Stringent control measures in the form of automated tunnel monitoring and numerous ground instrumentation were put in place. Contiguous Bored Pile walls were constructed to protect the existing tunnels, and Chemical grout piles were used to improve the ground where the basement would be built over the existing tunnels which is as close as about 1 tunnel diameter from the formation level of the proposed basement. The piling requires debonding and results in long length of pile socketed in difficult bouldery clay ground. Phasing of the works were adjusted to allow the easy construction of the neighbouring museum station. This added to the
challenge of building the campus basement on time. Major issues like coordination of the MRT vent shafts and the interface with the new station are some of the issues faced by the project team.

**Kallang/Paya Lebar Expressway (KPE)**
The KPE will connect the East Coast Parkway (ECP) in the south to the Tampines Expressway, to serve the growing traffic demands of the north-eastern sector of Singapore arising from the rapid developments of new towns in Sengkang and Punggol. The KPE will be 12km long, a dual 3-lane expressway, is the largest road project undertaken in Singapore. Overall about 9km of the expressway will be built entirely underground as road tunnels, using cut and cover method. This will make it the longest highway tunnel in South East Asia when completed in 2007. The civil construction works will be carried out in 6 contracts. Four of these will be for the tunnel section and 2 contracts for at-grade road interchanges. The tunnel box varies from 35.4m to 43.9m wide and 8.63 to 9.33m high, depending on the sections. The most challenging tunnel section will be through the soft marine clay under Geylang River where it will be diverted temporarily. Another section is at Pelton canal where the tunnel will run below a 27m wide storm water canal whose flow capacity has to be maintained at all times during construction. There are also commercial and residential buildings of up to 25 storeys lie along the route, some no more than 3m from the tunnel.

**Circle Line (CCL)**
The CCL is an orbital line linking all radial Rapid Transit System (RTS) lines running into the city. It is a medium capacity rapid transit system and will have interchange stations with the existing North-South and East-West lines, as well as the new North East Line (NEL) to provide better connectivity and convenience to commuters. The CCL is being built in stages. Construction for CCL Stage 1 and 2, from Dhoby Ghaut to Paya Lebar is currently on going while Stage 3 to 5 will be constructed at a later stage. CCL 1 will operate over a segregated alignment throughout, with the tunnels generally located underneath the existing roads to minimise sterilisation of land. There will be 6 stations and the 5.4km line will run from Dhoby Ghaut, along Bras Basah Road to Nicoll Highway, crosses the Kallang Basin before ending at Boulevard Station located adjacent to the National Stadium. The most challenging part of the construction will be carried out in the most vibrant corridors in the city area, from Dhoby Ghaut to the commercial and civil district in City Hall. Top-down construction approach is adopted for three of the stations, namely Museum, Convention Centre and Millenia Stations. The deepest station is at Museum, a 5 levels-station of about 35m below ground. The tunnel between the stations will be constructed using EPB tunnelling machine.

**National University of Singapore (NUS)**
*Extracted from www.nus.edu.sg/corporate/about/

NUS today is recognised as one of the leading universities in the Asia Pacific, with a global outlook and focusing on quality teaching, research and entrepreneurship. In today’s relentlessly innovating global economy, knowledge is not pursued in isolation. It is advanced by the global community of scholars and knowledge workers operating at the forefront of ideas. Moving forward in this global arena, NUS is building intelligent partnerships with universities worldwide and taking on strategic roles in global consortia that will continually strengthen synergies between the processes of creating, imparting, and exploiting knowledge. NUS aspires to be a dynamic connected knowledge community imbued with a “no walls” culture which promotes...
free flow of talent and ideas. Individual members of our community enjoy access to diverse opportunities for intellectual and professional growth and in turn add value to NUS becoming a global knowledge enterprise. Our vision calls for infusing a spirit of enterprise throughout the NUS community, for members to be resourceful and alive to opportunity. Learning and living in NUS – a microcosm of the global knowledge community – will foster an entrepreneurial and global mindset as well as hone the requisite skills and habits to thrive in a fast-changing global economy with no walls.

Nanyang Technological University (NTU)
Nanyang Technological University (NTU) stands on the beautiful 200-hectare campus of the old Nanyang University which was established in 1955. It is located in the south-western part of Singapore, about 25 km from the city centre. The University comprises 8 Schools, the Nanyang Business School, the School of Biological Sciences, the School of Civil and Environmental Engineering, The School of Communication and Information, the School of Computing Engineering, the School of Electrical and Electronic Engineering, the School of Materials Engineering, and the School of Mechanical and Production Engineering. It also hosts the National Institute of Education (NIE) and more 40 research centres and institutes. There are currently 2840 staff (among which 35% are academic staff), 16,000 undergraduates and 9,000 graduate students.

During this visit, we will tour the campus of NTU and visit the Geotechnical Laboratories in the School of Civil and Environmental Engineering. Facilities to be seen include fully computerised triaxial stress and strain path testing systems, plane-strain apparatus with a sophisticated axial stress control frame, a large torsional hollow cylinder apparatus, motorised triaxial cell, direct simple shear machine, large consolidation tanks, in-situ testing equipment including self-boring pressuremeter, piezocone, and dilatometer, a servo-controlled stiff triaxial compression system capable of testing rock specimens with confining pressure up to 70 MPa and axial load up to 300 tonne, and specialised equipment for testing unsaturated soils such as modified triaxial, direct shear K0 loading apparatus, apparatus for measuring swelling potential, permeameter, and various ranges of pressure plate equipment. If time permits, we may also visit the Environmental Laboratory and the Heavy Structural Laboratory. The 960 square metres Environmental Laboratory is equipped with the most up-to-date facilities to conduct wastewater and environmental research. The Heavy Structural Laboratory is equipped to conduct a full range of tests on construction materials as well as large sized structural elements and full-sized building components.