JSCE Study Tour Grant 1998

Report to the Japan Society of Civil Engineers and The Institution of Engineers, Australia

Civil College Board

Jerome J Argue, MIEAust CPEng

I was a great honour to be the recipient of the Japan Society of Civil Engineers Study Tour Grant for 1998.

I visited Japan between the 10th and 26th of October, 1998, primarily to visit installations which form part of the Japanese stormwater management system.

Dr.Aoki (Chief Secretary of Int'l Exchange Fund Committee), Mr.Argue, Mr.Miyoshi (Executive Director of JSCE 1997-present), Mr.Isami (Secretary General of JSCE)

The situation in Japan is complicated by the fact that the vast majority of urban areas there are served by a combined system; that is sewer and stormwater run together. The Japanese design criteria is actually the same as Australia's, in that the pipe is sized three times to dry weather sewer flow. The implications of this, however, are that approximately 100 sewer overflows occur in the Tokyo region each year. This results in significant pollution entering the l0 main drainage rivers that pass through Tokyo Similar problems also occur in Nagoya and Kyoto, which I also visited.

Combined sewer overflows are a particular problem in most of the world, but the density of development and the reliance on receiving waters as a source of food make the problems in Japan of great significance.

Various strategies are being applied to reduce the problem, but two thrusts are evident. The first of these is to hold pollutants on the site (at-source control) by measures such as infiltration of roof water into the ground, the use of permeable pavements and the like. The second thrust is the reduction of stormwater inflow through the use of gravel trenches and pits and the installation of large storage facilities to collect overflow and store it for later treatment.

Tokyo also suffers from flooding problems, particularly as a result of total urbanisation of catchments and river systems. Lack of capacity as well as lack of available space to undertake augmentation works requires dramatic solutions. Various types of installations are constructed,

but most are underground, resulting in the largest urban scale undertakings that I have ever seen.

The largest of these facilities I have visited was an underground storage system of some 240,000 m^3. It was part of an underground "river" designed to intercept the ten rivers in the Tokyo metropolitan area and to direct flow to Tokyo Bay. The scale of this river is colossal, from its 37 km length, to its 12.5 m concrete lined diameter located some 50 m underground. The alignment is below a Tokyo ring road so as to avoid passing below private land, the rights to which are considered sacrosanct.

The pump station at the end of this tunnel will have a capacity of some 900 m^3/sec, a quite staggering flow rate. The first 2 km stretch of the river has been completed at a cost of some $700 million. In reality it is not expected that it will ever be completed, but the individual 2 km stretches currently being undertaken, contribute significantly to the flood storage capacity of the system, and therefore act to reduce flooding. It must also be understood that this work is being undertaken by the Tokyo Metropolitan Government (TMG), the equivalent of a Town Council, though of a very sizeable town.

A further consistent theme of recent constructions in Japan is the recycling of resources. I visited a district heating system, in which heat was being extracted from sewerage flowing in a nearby main, through a heat exchanger, to provide heated water for the air-conditioning of 4 multi-storey buildings. In summer the process is reversed to provide cooled water.

It was estimated that this plant saved 40% of the CO_2 emissions that would have otherwise have resulted from electricity generation. Unfortunately at this stage the economics of the scheme were not encouraging, but it certainly was an innovative use of the heat contained in sewerage.

Of more economic viability was the sludge recycling plant, using about 60%, of the daily sludge production from Tokyo's treatment plants. I visited a plant which produces both pervious and standard brick pavers at the rate of about l00, 000 per annum. These are used in all government projects in Tokyo for landscaping, but as yet resistance to their availability (by existing manufacturers) on the open market has 1imited their success beyond this. None-the-less the plant, a joint venture between private concerns and the Government, has been established and produces product.

Other uses to which sludge is put are: as an additive to cement, to produce aggregate for concrete, pulverised for use to rehabilitate soil, mixed with clay to produce vases, used to make jewellery in a crystal form, and substantial amounts used in the production of fertiliser, Many of these uses were for demonstration projects, but most of the building and agricultural uses were for money generation operations.

Japanese environmental standards are quite stringent now, and are becoming more so. This has resulted in the Sewerage Bureau of the TMG having to upgrade, over a thirty year period,

all its existing sewerage treatment plants. Most are older secondary style treatment plants, but A_2O systems are being retrofitted to all. The ultimate aim is to meet nutrient discharge standards of l0 mg/l Total Nitrogen, and 0.5 mg/l Total Phosphorous. I visited a range of plants in various stages of upgrade, some even featuring Australian membrane technology, as part of trial schemes to improve effluent quality.

One of the main reasons for this standard improvement is that the people of Tokyo are demanding the restoration of the original creek systems, with permanent flow environmental restoration. While the latter is virtually unachievable, the direction of highly treated effluent to some of the creeks, with the construction of a linear park along the creek line, has resulted in an appreciable improvement in the amenity of local residents.

Successful pilot schemes have created considerable support among the populace, so gradually all creeks and streams will receive some form of beautification.

This report will give readers a small appreciation of the types of facilities I visited in Japan. Actual details of my visit itinerary are appended at "Attachment A" for reference.

Overall Japan is one of the most fascinating countries I have visited. I am very grateful to the Japan Society of Civil Engineers for having provided me, through the 1998 JSCE Study Tour Grant, the opportunity to undertake my study tour, and I trust my visit to Japan will further strengthen cooperation between members of the engineering profession in both Japan and Australia, and between the JSCE and the Institution of Engineers, Australia.

Jerome J Argue
11 November 1998
Newcastle, Australia

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9 - 26 October 1998

Friday, 9 October
1835 depart Newcastle on Qantas Airways flight QF 2155
1920 arrive Sydney
2215 depart Sydney on Qantas Airways flight QF 21

Saturday, 10 October
0640 arrive at Tokyo (Narita) from Sydney at 0640

Accommodation:
Tokyo Hilton, 6-2 Nishi Shinjuku 6 chome
Tel: 33444-51l1, Fax: 3342-6094
In 10 - Out 19 0ctober

Sunday, 11 October
Free day

Monday, 12 October
Morning: Visit Japan Society of Civil Engineers. JSCE will explain Study Tour Grant requirements.

Mr Masakazu Isami
Secretary General JSCE
Address: Mubanchi, Yotsuya l-chome Shinjuku-ku
Tokyo 160
Ph: (81-3) 3355-3441. Fax: (81-1) 5370-2769/0l25

Afternoon (1300, or as soon as JSCE visit finished): Visit to the Office of Tokyo metropolitan Government (TMG).
Discussions with engineers of TMG. Visit to Radar rain gauge system, Sewer mapping system, Wastewater reutilisation system, Optical fibers in sewers etc (TMG engineer to take on site visits and introduce to TMG works).

Tuesday, 13 October
0930. Technical Tour to a wastewater treatment plant, a large pumping station, An urban heat utilization system, sludge utilization system, etc. (a TMG engineer will escort for a general survey of the TMG Sewerage Bureau and sites).

Wednesday, 14 October
1000. Pick-up at hotel. Technical Tour to urban stormwater management facilities. (Mr S Fujita and Mr Zaizen of TMG to escort Mr Argue).
1600. Visit practical rainwater utilization facility in the "Big Egg", baseball stadium Evening. Sukiyaki Dinner

Thursday, 15 October
Technical or other visits arranged by JSCE, or technical visit arrangements made by Mr Argue (because of TMG executive meeting Mr Fujita/TMG cannot arrange activities for Mr Argue on this day).
Friday, 16 0ctober
1000. Visit to Mr S Fujita's office, 30 km west from the central part of Tokyo. Discussion and Technical Tour to construction sites. Escorted by Mr S Fujita.

Saturday, 17 October
Full day with Mr S Fujita and family, including visit to local folk museum

Sunday, 18 October
Sightseeing in Tokyo, and Kamakura (e.g. in Tokyo visit Asakusa, Meiji Shrine, Tokyo Tower and so on) Escorted by Mr Fujita and Mr Zaisen.

Monday, 19 October
Travel to Nagoya by Shinkansen. Arrive 1200. Met at Nagoya Station by Mr Jun Fujita (son of Mr Fujita and student at Nagoya Technical University) and Mr Miyata (engineer at NGK) Afternoon familiarisation with City of Nagoya. Escorted by Mr J Fujita (son of Mr S F ujita).
1600. Visit NGK factory with Messrs Fujita and Miyata
Evening. Night life of Nagoya City with Messrs Fujita and Miyata

Accommodation:
Dai-Ichi Hotel, 3-27-5, Mae-eki, Nakamura-ku, Nagoya (near railway station)
Tel: 52.581-4411, Fax: 52.581-4427
In 19 - Out 21 October

Tuesday, 20 October
Visit to the Sewerage Bureau of Nagoya City, Discussions with City engineers. Mr Otchi, (friend of Mr S Fujita) will arrange visit to City of Nagoya facilities, especially sludge treatment and utilization facilities. If time permits visit NGK company in Nagoya (or on other date).

Wednesday, 21 October
Travel to Kyoto. 1300 - visit the City Offices of Kyoto. Discussions with the engineers and technical tour to urban storm water management facilities of Kyoto.

Accommodation:
New Miyako Hotel, Hachijo-guchi, Kyoto Station, Kyoto
Tel: 75.661-7l l l. Fax: 75.66l-7135
In 21- Out 22 October

Thursday 22 October
Morning in Kyoto. Afternoon travel back to Tokyo for meetings with JSCE.

Accommodation :
Tokyo Hilton, 6-2 Nishi Shinjuku 6 chome. Tokyo

Tel: 33444-5111, Fax: 3342-6094
In 22 - Out 25 October

Friday 23 October
Meet for discussions with members of the JSCE (including report to JSCE on visit). Visit as arranged by JSCE (if appropriate).

Saturday 24 October
Free day in Tokyo or activities arranged by JSCE

Sunday 25 October
Visit concludes.
2030 depart Tokyo (Narita) 2030 Qantas Airways flight QF22

Monday, 26 October
0755 Arrive Sydney
1005 depart Sydney on Qantas Airways flight QF 2138
1045 arrive Newcastle