

Appreciation

Deshabandu Dr. A.N.S. Kulasinghe

Deshabandu Dr. A. N. S. Kulasinghe bestrode the stage of Sri Lankan engineering practice over the past half century like a colossus, quite in contrast to his diminutive physical stature. He is a household name in our country - a feat rarely achieved by engineers, whose indispensable contributions to society are almost always shrouded in anonymity. He demonstrated pioneering leadership and remarkable ingenuity in many fields of engineering, displaying a virtuosity that is hardly ever seen in these days of ultra specialisation.

Dr. Kulasinghe was at the helm of four great institutions in their heyday. His career started at the Colombo Port Commission (CPC) in the 1940s, where he ended up as Port Commissioner in 1968, the first non Civil Service person to hold the post. He was Founder Chairman and General Manager of the State Engineering Corporation (SEC) from 1962, and many are the eminent structural engineers who came under his tutelage in their formative years at the SEC. He was appointed Chairman of the Central Engineering Consultancy Bureau (CECB) in 1978, from which position he presided over the Accelerated Mahaweli Development Project, a project that rekindled pride in our engineering skills and harked back to our glorious heritage of directing Lanka's water resources towards the needs of her people. In the same year, he was appointed Founder Chairman of the National Engineering Research and Development (NERD) Centre, where innovation informed by theoretical insight has resulted in some very impressive appropriate technology.

Apart from these aspects of his illustrious career, Dr. Kulasinghe made many contributions through learned society activities. He was President of the Institution of Engineers, Sri Lanka in 1969, General President of the Sri Lanka Association for the Advancement of Science in 1970, Vice President of the Federation Internationale de la Precontrainte (FIP) in 1981 and President of the National Academy of Sciences in 1987.

Although Dr. Kulasinghe's prodigious output virtually defies classification, his main structural engineering exploits (which I shall focus on) can be broadly grouped into three areas, namely prestressing, shell structures and appropriate technology. Dr. Kulasinghe introduced prestressing to Sri Lanka even before the technology had crossed the Atlantic from Europe to America.

The great advantage in having tension free (and hence crack free) concrete in the harsh marine environment of the Colombo Port would certainly have given him the impetus to develop this technology. The Kulasinghe-CPC prestressing system that he developed was widely used for tensioning and anchoring up to 12 wires in a single anchorage. Prestressing however could not be confined within the boundaries of the Port Commission: it runs like a golden thread (or should I



say strand) through much of Kulasinghe's work. It was used for correcting the corner droop problem in umbrella type hyperbolic paraboloid shell roofs (to be seen at the Ports Authority car park); and also for stringing together discrete truss panels into concrete Vierendeel-type trusses (visible in the Institution of Engineers Auditorium). It is curious that Kulasinghe's father was named Eugene, the very same name borne by Eugene Freyssinet, the French engineer who invented prestressing.

Shell structures are a joy to behold - possessing geometries that bestow counter-intuitive strength and stiffness to their slender walls; the eggshell is a good example from nature. Our ancients, great structural engineers in their own right, knew nothing of shell structures. Their dagobas and chaithyas were solid brick structures. Kulasinghe injected modern technology into these ancient forms to give them new life. His chaithyas, at Kalutara and Kotmale, are hollow domes, and yet able to carry the heavy loads from the square chamber and spire. These structures, along with the folded plate structure of the Colombo Planetarium, the Buddha Jayanthi Chaithya at the Colombo Port and the tension shell roof at the NERD Centre Auditorium, add lustre to our built environment and pay tribute to their designer.

Research and development in appropriate technology was the main focus of latter part of Dr. Kulasinghe's career, not only at the NERD Centre, but also in his own backyard at Ja-ela. His passion was to use innovative and technology-rich ideas to produce low cost building materials and elements. This approach is best epitomized by the double pitch asbestos roof that stands up without any timber framing, being designed on the basis of a tied arch.

Another example is the use of discrete hollow clay blocks in roof rafters - after they have been pretensioned together by a single strand running through them. His work at the NERD Centre also tended towards the use of cement and concrete products to replace either steel (which has to be imported to the country at the expense of our foreign exchange reserves) or timber (the supply of

which is fast diminishing as a result of forest denudation).

Some of Kulasinghe's work has been documented in technical papers, published and read both at home and overseas. His presentations at international conferences brought him worldwide acclaim and enabled him to rub shoulders as an equal with the likes of Professor Guyon (who was Freyssinet's theoretician on prestressing), Californian consulting engineer T.Y. Lin (one of the best exponents of prestressed concrete), and Architect Eduardo Torroja (internationally renowned for his shell structures).

It could be argued that the principle of eliminating the unnecessary (probably the flip side of detachment) is central to Buddhist philosophy, of which Dr. Kulasinghe was a serious student. This is perhaps why many of his structures appear to eliminate bending (which is such an inefficient state of stress) so that only axial or membrane stresses are left; and perhaps why he has eliminated or at least greatly reduced the need for formwork and falsework (once again such a wasteful construction input), in many of his structural systems and construction methods.

One of the guiding principles of Dr. Kulasinghe's career was that of national self reliance. Even his musical avocations were directed towards the mastery of the tabla, as opposed to a western instrument. His career began at the end of the colonial period; it has drawn to a close in an era of globalization and neo-colonialism, when everyone seems to think that what is imported is better than what is locally produced.

He must have been heartbroken when Sri Lanka turned towards foreign technology for prestressed concrete railway sleepers in the nineties, a technology he had home-grown in the seventies. In spite of this, he trod the often lonely path of innovation and self-reliance.

That in fact is the very appropriate title of the Kulasinghe Felicitation Volume produced by the Institution of Engineers, Sri Lanka: "Innovation and Self-Reliance". The era of engineering in Sri Lanka covered by the volume is also called the "Heroic Age". Innovation then was the other driving force in his career. T.Y. Lin's well known text on prestressed concrete is dedicated "To engineers who, rather than blindly following the codes of practice, seek to apply the laws of nature". The editor of the Felicitation Volume speculates as to whether Lin could have had the young Kulasinghe in mind.

Younger engineers would do well to emulate Dr. Kulasinghe's commitment to lifelong learning. Although he started his career as a professionally qualified engineer, he sat for, and obtained a 2nd Class Upper for his final year engineering degree examinations in London after around 15 years of practice as an engineer - a stage at which most other practising engineers would have been completely out of touch with engineering theory. It is undoubtedly this same commitment to learning that enabled him

to successfully transfer prestressing technology to Sri Lanka from Europe, adding his own innovations to that technology in the process. Even till recent, he was a regular participant at the Society of Structural Engineers' Question Times; and a couple of years ago I saw his name on a joint paper reporting research results on slipformed walls tested at the University of Peradeniya. It must also be mentioned that he dabbled in mechanical engineering (wood gassification), chemical engineering (biogas digesters), electrical engineering (linear induction motors) and even automobile engineering (fuel saving devices).

Many are the honours that have been bestowed upon A.N.S. Kulasinghe. The national honour "Vidya Jyothi Class 1" was conferred upon him in 1986. Last year he was honoured with a "Deshabandu" title. He received honorary doctorates from the University of Moratuwa (in 1980) and the Open University (in 2000). As stated before, the Institution of Engineers Sri Lanka (IESL) issued a felicitation volume in his honour in 2001. Most of this appreciation is gleaned from a citation I prepared when the Society of Structural Engineers, Sri Lanka made him an Honorary Fellow in 2003.

In 1979 Dr. Kulasinghe endowed the University of Moratuwa with an award in his name for the best Civil Engineering graduate, to be presented at the annual convocation. Recently, when the university decided to convert such awards to gold medals, he responded again with a generous contribution, despite his ailing health and attendant expenses. I had the great privilege of meeting him, as it happened just 3 days before his demise, to thank him in person. His movements were slow but his mind as agile as ever at 87 years of age, and still focused on his three main areas of interest.

He was anxious that I see for myself his prestressing exploits embodied in some factory buildings that had been erected in record time. He bemoaned the fact that engineers were reluctant to design shell structures and felt that at least our engineering faculties should commission such structures. Finally, he was concerned that research institutes continue to be staffed with those having a genuine interest in research; and also that university academics who do have such interest are exposed to engineering practice - where they would find a rich vein of problems to tackle. He spoke also of his two engineer sons, far away in Aberdeen, but very supportive of his inventions and patents. His wife, probably his most ardent supporter, predeceased him by almost 20 years.

His was and is a hard act to follow; an engineer *sans pareil* (without equal), as the IESL felicitation volume describes him. May his life and work be an inspiration for us to try.

Prof. Priyan Dias,
University of Moratuwa