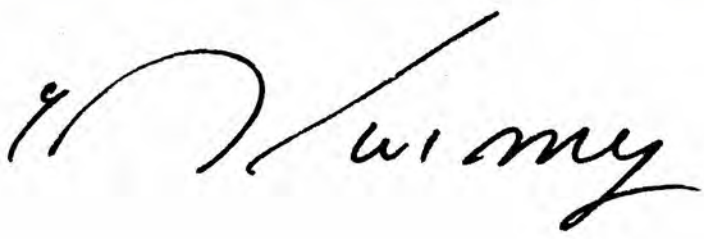
GURUVAYUR SUBRAMANIAM RAMASWAMY

(3 October 1923 - 9 March 2002)

Biog. Mems. Fell. INSA, N. Delhi, **25,**131-137, (2004)



GURUVAYUR SUBRAMANIAM RAMASWAMY

(1923-2002)

Elected Fellow 1972

EARLY LIFE, EDUCATION AND FAMILY

GURUVAYUR SUBRAMANIAM RAMASWAMY (GSR) was born on the 3rd of October 1923 in Guruvayur (the famous town associated with Lord Krishna's Narayaneeyam) in Kerala. His parents were Mr. R Subramania Iyer and Seethalakshmi. Subramania Iyer was working in the Indian Railways as Station Master and was moving from place to place on transfer. His last posting was Calicut. Professor GSR's mother has taken her Sironmani in Sanskirt. Professor Ramaswamy had two younger brothers, Professor GS Balakrishnan and Mr. GS Venkatramani. Professor Balakrishnan was the Head of the Department of English in PSG Tech, Coimbatore for nearly twenty years. He now writes short stories in Tamil Weeklies. Mr. GS Venkatramani (who is no more) was an Economics Graduate from the Annamalai University. He was working as Liaison Officer with the Hindustan Copper till his retirement. Professor GSR had four sisters, all younger to him.

Professor GSR had his early education at the Sircar High School, Wadakancheri. He completed his Inter Science from the St. Thomas College, Thrissur in the year 1940. He got his basic Engineering Degree specializing in Civil Engineering from the College of Engineering, Guindy in 1944. He had a brilliant academic record throughout his career. It was no surprise that he stood first in Engineering College too. He got the Government Scholarship to do his higher studies in the US. He got his MS and CE from the California Institute of Technology, Pasedena in 1947. He has taken modern drama and skits as special subject of study while in the US.

Professor GSR married Sow. Seetha in 1953. They have one daughter Usha and two sons Suresh and Prem. Usha is in UK with her husband. Suresh works for EDS in Australia and Prem for the British Aerospace in the US. Professor GSR has four grandchildren, one granddaughter and three grandsons.

PROFESSIONAL CAREER

Annamalai University

Professor GSR returned to India in 1948 and joined the Government Engineering College, Kakinada in the Composite Madras State as an Instructor (Assistant Professor). A year later he was appointed Professor of Civil Engineering in Annamalai University at an young age of 26. The first

batch of Engineeing students of Annamalai graduated after he joined the University. He had narrated to the author the challenge he faced in the Engineering Hostel soon after his taking over when the students went on strike and had made unreasonable demands. Hon. Avinasalingam Chettiar, the Education Minister of Madras State requested him to take control of the situation. He handled the problem with ease and diffused the tension in the campus. He continued to serve the Institution with distinction till 1957. The author had the privilege of being taught Basic Strength of Materials in 1957 by this Professor when he was a first year student in Engineering. It was Professor Ramaswamy who started a post graduate programme in Structural Engineering in 1953. This was not even thought of by Guindy Engineering College which was in the forefront of technical education those days. With Professor GSR's exit, this programme was subsequently discontinued. The prestressed concrete beam used by him for conducting experiments was lying in the lawn outside the main building when the author was a student. The author remembers using this beam to sit and chat with his friends as a student during later years. If the beam is still in the college campus, it will speak volumes of the leadership qualities of this great man. Annamalai which spotted his talent and got him into its faculty, can take the credit for having nurtured him early in his career. Professor GSR's student from Civil Engineering subsequently became the Vice Chancellor of Annamalai University (Late Professor RM Sethunarayanan 1987-90).

Council of Scientific and Industrial Research

Professor GSR joined the CSIR as an Assistant Director of the Central Building Research Institute, Roorkee in 1957 heading Structures group. He got promoted as Deputy Director very soon. Recognising his talent CSIR established a separate unit known as the Structural Engineering Research Centre. Professor GSR took over as its Founder Director in 1968. He shifted its headquarters from Roorkee to Chennai subsequently. It was during this time the author had the privilege of being examined by Professor GSR for Ph.D. dissertation at IIT, Madras in 1970.

Achievements Abroad

After retiring from CSIR in 1977, Professor GSR worked as UN Chief Technical Advisor to the Government of Trinidad and Tobago, UN Advisor to Deputy Minister of Transportation, Saudi Arabia. Earlier he has served as UN Advisor to the Government of Iraq. He was a Visiting Professor in the University of West Indies and the University of Arizona, Tuscon, USA. Professor GSR was largely responsible for the setting up of SERC, CSIR in India, Building Research center, Baghdad in Iraq and Carribean Research Institute, Trinidad, West Indies.

Professional Activity After Retirement

Professor GSR became the Chairman of Octatube Space Structures, India. He was the Managing Partner, Civil Engineering Construction Consortium till his demise in March 2002. The author had the opportunity of taking the role of a Consultant to this firm for two years. The author was involved in checking the modelling and design of the different members of space trusses. Professor GSR's last book on "Steel Space Frames" was published a month prior to his death.

RESEARCH ACHIEVEMENTS

Professor Ramaswamy's major contributions by way of research, development and innovation during the past 50 years have been in the area of long span roofs and floors which provide large unobstructed spaces uncluttered by columns for auditoria, conference halls, indoor sports stadia, cathedrals,

industrial sheds and institutional buildings. His first attempt in research was in prestressing segmental granite blocks while he was working in Annamalai. The research carried out has led to the development of new or improved material, new structural forms, simplified methods of structural analysis and appreciable savings in critical materials such as cement and steel which are often in short supply. The underlying objective of all his research activities has been the development of structural forms and techniques that result in the use of minimum of material to maximum of structural advantage. These considerations led him to concentrate his research efforts on two major are as (i) concrete thin shells (ii) reinforced and prestressed concrete, which offers considerable scope for developing cost-effective structural schemes for long spans. The research carried out in these areas has led to the publications of two internationally known and widely used text books.

Varied experience made it possible for Ramaswamy to bridge the yawning gulf that often separates research from practice by incorporating the findings of his research in some of the pace-setting structures that he designed as a consultant. Another major achievement was the establishment of the Structural Engineering Research Centre.

CONTRIBUTIONS TO THIN SHELLS

Although Professor GSR has made several original contributions to the theory of cylindrical shells, conoids and prestressed hyperboloids and shared the Gammon prize for developing the design principles for the first ever folded plates build to be continuous over three spans, his most significant contribution is the development of a new form of shell which was to come to be known as funicular shell. The motivation for developing this new form of shell was rooted in necessity. In the late 1950's. the country was faced with unprecedented shortage of cement and steel. Just at that time, the Ministry of Defence had plans to build 1400 houses for army personnel in Ambala. He was asked to come up with a roofing element that can be made sans cement sans steel. He thought of some form of shell roof. But all shell forms, then known, have tension regions and they cannot be cast without steel reinforcements. Lime-surkhi mortar that he proposed to use to save cement is fairly strong in compression, but has hardly any tensile strength. Obviously he had to find out a shell form that will develop only pure compression when subjected to the action of loads. He was led to the conclusion that to achieve it, the normal sequence followed in the design of shells must be reversed. Instead of assuming an arbitrary geometry and topology to start with, one must assume a desired state of stress, say uniform compression, and then proceed to find the appropriate shape. This led to the funicular form. The first set of papers on this new form of shell was published in 1958.

A simple casting technique using a hessian fabric sagging under the weight of wet surkhi mortar to let the shell cast itself to the appropriate shape was also divised and patented to permit the mass manufacture of such shells even in remote villages of India using unskilled labour. The shape of funicular shell is governed by Poission's differential equation and the casting technique just described amounts to letting gravity solve the differential equation. The best examples of funicular brick shells built in India and designed by Ramaswamy and his colleagues are for the National Institute of Design, Ahmedabad and the Structural Engineering Research Centre at Chennai. These were cast on accurately cut forms conforming to funicular shape. Other notable examples are the shell roof over the municipal auditorium at Kanpur, and the Catholic Cathedral at Lucknow. Shells were also used for an unprecedented application at Madras Port for heavy duty floor of a loading platform for carrying

heavy industrial loading. Very recently he was involved in the design of roof structures over the platforms of all the stations between Chintadripet and Thiru Mayilai for the MRTS project of Chennai.

CONTRIBUTION TO PRESTRESSED AND REINFORCED CONCRETE

Professor GRS's efforts in the area of prestressed concrete have been aimed at gaining a better understanding of twilight zone between fully prestressed and reinforced concrete so that an integrated approach to the design becomes possible by regarding them as two ends of the spectrum of structural concrete. This approach has been presented in his book and in the paper presented at the FIP congress in New York.

In a joint paper with his coworkers, Ramaswamy conclusively demonstrated that a saving of around one third in the steel used as concrete reinforcement aggregating a total of 0.45 million tones of steel per annum can be effected if reinforced concrete structures are designed on the basis of ultimate strength and high yield strength deformed bars replace mild steel reinforcement. This paper had a far-reaching impact on the building industry. It ushered in a change over from elastic to ultimate strength design; it also generated a demand for high strength deformed bars. To meet this demand, he developed alongwith one of his colleagues and patented a high strength deformed bar, manufactured and marketed under the trade name of TISCON by TISCO. It replaced imported TORSTEEL technology.

LATER DIRECTIONS OF RESEARCH

The following were his plan of activities:

(i) Compiling a monograph on funicular shells: This was to document his contribution and published work of others widely scattered in numerous publications. This will generate lot of thesis material.

(ii) Development criteria for the design of tall structures subjected to wind loads: Because of the current trend towards the setting up of super thermal power stations, a large number of tall chimneys and cooling towers ranging in height from 100 to 250m have become common. Such structures can be designed economically taking into account the wind velocities and consequent wind pressures. A stochastic approach based on the data available must replace the current deterministic codes. These computer based structural codes are to be prepared.

(iii) Development of inflatable forms for casting concrete shells: the cost of form work constitutes a major portion of the total cost of concrete shell roof. An appreciable reduction in cost can be realized if inflatable forms can be developed and used. The scope of research includes the formulation of design principles and development of practical designs.

The author learns that the first two have been accomplished by the Structural Engineering Research Centre.

HONOURS AND AWARDS

Professor GSR was elected Fellow of the Indian National Science Academy in 1972 and a Fellow of the Indian Academy of Sciences in 1974. He served in the INSA Council during 1975-77. He has received the following Awards: Indian Merchant Chamber Diamond Jubilee Award, Import Substitution Award on Grip Bars along with two others in 1972, Invention Promotion Board Shield and Gammon Award (Institution of Engineers, India). He has six patents, authored three books and written over 100 papers. He was a Member of the International Advisory Board of the International Association of Shells and Spatial Structures, Madrid.

GSR AS A PERSON

Professor GSR came from a middle class family. His father retired from railway service when GSR was around 30. As the eldest son of a large family, he shouldered the responsibility of looking after his parents, educating his four sisters who were younger to him and marrying them off. He was very kind to his students and friends. He has helped many of them in their career. He avoided invitations for giving popular talks and restricted his participation in professional meetings and seminars only.

Besides possessing technical excellence and a special eye for Engineering details, he also evinced keen interest in ancient scriptures and classical languages. He was conducting Geetha chanting classes on Thursdays in Roorkee. In fact, Professor GSR was regularly reading one Chapter from the Geetha everyday till his death. He breathed his last on 9 March 2002, and kept himself professionally very active till the end came in. An admirable achievement, perhaps due to his creative bent of mind and a zeal to interact with young and bright graduate engineers, all the time, many of whom he trained under his watchful eyes. His passing away is an irreparable loss to the Structural Engineering fraternity.

ACKNOWLEDGEMENTS

The author takes this opportunity to thank his wife Mrs Seetha Ramaswamy, his brother Professor GS Balakrishnan and Mr. CV Vaidyanathan, Deputy Director, Structural Engineering Research Centre, Chennai, for the information provided in preparing this memoir.

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