THE INSTITUTION OF ENGINEERS, SRI LANKA

TRANSACTIONS 1989

Volume 11

"To promote the acquisition and interchange of technical knowledge, advance the science and practice of engineering in all its branches and regulate professional activities in Sri Lanka"

THE INSTITUTION OF ENGINEERS SRI LANKA

(Formerly the Engineering Association of Ceylon. Established 1906. Incorporated by Act of Parliament in 1968)

TRANSACTIONS 1989 VOLUME II

Proceedings of the 1989 Annual Conference

This Institution does not, as a body, hold itself responsible for statements made or opinions expressed either in the Papers read or the discussions which have occurred at the Meetings.

- Executive Secretary

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ADDRESS BY THE CHIEF GUEST

Hon. P. Dayaratne

Minister of Lands, Irrigation & Mahaweli Development

Mr. President, Your Excellencies, Ladies & Gentlemen.

I consider it as a great honour and privilege to be asked to open this 83rd Annual Sessions of the Institution of Engineers, Sri Lanka and to deliver the inaugural address. I am happy to be in the midst of engineers this morning. As a member of the Cabinet of Ministers, I am happy to say that I am able to represent the engineering profession in the government and to ensure that decisions relating to engineering aspects are taken in full knowledge of the effects they would have. In the modern world as technology advances rapidly new vistas are being opened up for the engineer. I have no doubt that engineers will meet the new challenges, directing the great sources of power in nature for the use and convenience of man.

Engineering is an demanding and exacting profession, covering as it does, and enhance the way of facilities required to the well being of the community. Indeed it supports the whole complex structure on which a civilised society depends. Last year, Ex-President, J.R. Jayewardene while delivering the inaugural address at the 82nd Annual Sessions of the Institution, spoke about the engineers' contribution to the progress of our country. "I think your Society has in it members who are absolutely essential for the progress of our country, because you are involved in every sphere of human activity; to go to a house and living in it, it's work of an engineer; to travel on a road, it's work of an engineer; to travel in a train, a bus or a motor car, it's work of an engineer; put on a light, it's work of an engineer; we eat food cultivated in fields watered by irrigation schemes which are works of engineers. So there is no field as far as I can see in which engineers of some type or other do not help in construction and building".

Thus an engineer has a considerable influence on the every day life of community and consequently of the structure of society. Engineers must therefore study society and the effect of their work, and similarly society must attempt to understand the mind of the engineer. It is very necessary that engineers as a professional group should not isolate themselves. They should establish close contact with those who administer and govern the country. Some of you may have reasons to lament about the apparent low status of the engineer in society. This may well be the result of your trying to live in isolation. Only when engineers are seen by the general public, to be responsible members of society, using their specialised knowledge for the general good, will the profession attain the status it seeks and so richly deserves.

My Ministry has under its purview Departments and Statutory Boards which employ about 800 engineers. Perhaps the largest number of engineers under any Ministry. The majority of them are engaged in activities connected with land, water and water resources development on which successive governments of Sri Lanka have made large investments. Billions of rupees are invested in the implementation of the national development programmes the bulk of which is on construction works supervised by engineers and other technical staff. It is well known that all such work is carried out according to technical specifications to ensure that the finished work would be of high quality. But there are occasions to believe that in certain instances, the quality of work is below specified standards, the obvious conclusion is that due to some reason or the other supervision of the work during construction has been inadequate and the important aspect of quality control has been neglected. It would be unprofessional to accept such sub standard work.

I note with satisfaction that the Institution has created a new class of membership for those technician engineers who by virtue of their academic qualifications, training and experience play a vital and complimentary role in the engineering profession. This has been done in other developed countries as well, and I think you have taken a step in the right direction by making provision for the technician engineers to become members of this umbrella organisation. It does enhance the status of these technician engineers in society and provide them with opportunity to participate in the learned society activities organised by the Institution. It is also in the interest of the country not to have this important group separated from the main body of the profession.

It is gratifying to note that the Institution of Engineers is making two annual awards - Junior Inven-

tor of the Year and Young Engineer of the Year. Those eligible to compete for the Junior Inventor of the Year are in the age group of 12 - 20 years; obviously they are not members of the Institution. I believe it is a very notable attempt on your part to create the liaison between the profession and schools. So that, boys and girls will be aware of the essence of engineering and its creativeness. This I hope will eventually result in attracting in appropriate proportions the most able young men and women to the profession. The second award is undoubtedly intended to improve the quality of young members of the profession. As I said earlier the standing of the profession was to be measured by services to the community.

One of the long felt needs of the profession is a system of registering and licensing of engineers, for unlike in the medical and the legal professions, members of the engineering profession are not required by law to register and obtain a licence to practice engineering. This leaves room for unscrupulous and unqualified individuals posing off as engineers and engaging themselves in activities which are harmful to the public health, safety and welfare and causes irreparable damage to the image of the professional engineer. I am very pleased to hear that the Institution has prepared the document dealing with the subject of Registration and Licensing of Engineers which can be presented in the form of a bill in Parliament. I will be only too glad to give on whatever assistance necessary to get this bill passed in Parliament.

Mr. President, in conclusion, I thank you very much for the honour you bestowed on me in inviting me as your Chief Guest on this occasion. While wishing you all success in your deliberations at the Annual Sessions to follow, I have great pleasure in declaring open the 83rd Annual Conference of the Institution of Engineers, Sri Lanka.

Thank you

PRESIDENTIAL ADDRESS

by

Mr. S.M.B. Dolapihilla

CEng, FIMechE, MIMarE, FIE(SL)

President, Institution of Engineers, Sri Lanka

Honourable P. Dayaratne, Minister of Lands, Irrigation & Mahaweli Development, Honourable Ministers, Your Excellencies, Distinguished Guests, Friends, Ladies & Gentlemen.

It is indeed an honour and a privilege that as President of the Institution of Engineers, Sri Lanka accepted by the membership to serve the Institution that I address you at the 83rd Inauguration of the Annual Sessions this year.

In my address I wish to make passing mention of noteworthy events and activities of the Institution during the Session 1988/89 in a year of turmoil in the country. In my opinion such a situation did have adverse effects in planning some of our programmes but yet we did make a success of its deliberations due to active participation of every member of Council, as well as its functional and sectional committees.

The immediate past President for the Sessions 1987/88, who is present here today on this occasion, will rest satisfied that the carry-over of several matters such as those relating to the training and continuing education of engineers, course on Management Development for Engineers, etc. were actively continued. In view of the importance of continuing engineering education for all grades of members, a special committee on Continuing Engineering Education was set up during the latter part of the session, and I am sure that their deliberations would be put to fruitful use during the incoming session.

The Construction & Manufacturing Industry

With the sudden upsurge of activities in the domestic construction industry, it was found necessary to devise methods of overcoming poor construction management, inadequate work, lack of continuing of work, delays in payment to contractors, inadequate facilities of financing, indebtedness to contractors from banks and other financing agencies. These were areas identified by a special committee set up by the Government in order to remov such constraints.

Further our Institution in order to create an awareness of construction management conducted discussions and seminars on the subject at our headquarters as well as in the Kandy Centre.

Last year my predecessor in his speech stated that the open economic policies of the government had brought many beneficial changes in the life style of Sri Lankans, as well as certain adverse effects on the Construction and Engineering Industry. While remedial measures to alleviate the problems of the domestic Construction Industry as a result of representations made by IESL, had been taken last year, it was found during the year under review that many public sector organisations were reluctant to implement these decisions, perhaps due to lack of instructions. We earnestly hope that necessary action will be taken to implement these decisions.

As far as the manufacturing Engineering Industry is concerned a lot will have to be done to bring it back on its feet. The local manufacturing industry was doing a great service to the country not only in saving valuable foreign exchange, but also in providing employment to thousands of workers. Many products also used local raw materials. We appeal to the government once again to have another look at the local industry and bring in some safeguards such as Tariff Protections and Quota Systems. It will not be out of place for me to mention that in many ardent capitalist countries such as the United States, Japan, West Germany and South Korea, these quota systems exist to protect the local industries. One argument that is always used against local products is 'poor quality'. While manufacturers should do their best to improve quality, the relevant government agencies too should assist financially as well as with technical know-how to improve quality of products.

New Fields of Engineering

Our Institution, in its endeavour to bring in as many disciplines as possible under one umbrella and in an effort to unify the profession, gave due recognition to those engaged in the practice of Marine Engineering by making adequate provision for Marine Engineers too, to become Corporate Members.

In making the case for Marine Engineers, the Institution took notice of their senior and middle level positions in management in the Public Service and State Corporations where they are employed and the contribution they have made towards the progress in ship management, ship construction and repair

industry leading to conserve the scarce foreign exchange.

Similarly recognition was given to the field of Production Engineering.

Other allied professions in the engineering industry that deserve similar consideration will be treated likewise and hope the new Council for the year 1989/90 will continue to upkeep this policy.

Technician Engineers

During the Session, IESL opened the door for Diplomates and Non Professionally Qualified Engineers to join in as Technician Engineers. They could now use the designatory letters 'T.Eng.' and can take part in Institution activities along with Chartered Engineers and Graduates. As their strength grows they could form their own executive committee and I am sure their contributions in the coming years will benefit the entire profession.

Registration of Engineers

The outgoing session also saw the finalisation of the proposals for the Registration of Engineers in Sri Lanka, which was a long felt need. The proposals are meant to safeguard the Engineering Profession in this country, so that only those registered engineers are allowed to practice. These proposals will soon be submitted to the government and Sir, we are counting on your active support for their approval.

Availability of Engineers for Top Decision-Making Posts

One of the laments of the Engineering Profession has been that we are been kept away, for far too long, from top decision making posts. We are indeed happy that one of the Provincial Councils, namely the North Eastern Provincial Council has selected several engineers to fill the posts of secretaries to ministries. We sincerely hope that the other Provincial Councils too would follow suit and appoint Engineers as well as other professionals to similar top posts so that the country at large would reap the benefits.

Transfer of Technology

Technology has taken giant strides in the developed countries, during the past few years. These developments continue every day. We in Sri Lanka have not been able to utilise the full benefits of these developments, although some work had been done in limited areas. By a proper transfer of technology we should gear ourselves to make the full use of advancements reached in those countries.

The IESL is a member of several International bodies such as the World Federation of Engineering Organisations, Commonwealth Engineers' Council, and Federation of Engineeering Institutions of South and Central Asia. However, we have not been able to attend many seminars and programmes organised by these organisations due to limited resources. We intend seeking assistance from International funding agencies and would welcome the backing of our government to obtain sponsorship from these organisations so that engineers, particularly the young engineers, could benefit from these International activities.

Training and Experience

Honourable Minister, Your Excellencies, Distinguished Guests, Ladies & Gentlemen.

In a message captioned 'Maintain Professional Standards' to our Institution on the inauguration of the 82nd Annual Sessions, His Excellency the President of the Democratic Socialist Republic of Sri Lanka, Hon. Ranasinghe Premadasa said when he was Prime Minister:

'Engineering is not an alien science to the people of our country. For over 25 centuries we have practised its skills with great precision and remarkable efficiency. Our engineers have inherited the skills and ingenuity of our ancestors who constructed the massive reservoirs and the great stupas. Their skill must be harnessed for the economic and social development of modern Sri Lanka. The Institution of Engineers has to play a predominant role in this endeavour'.

Our Institution graciously accepts His Excellency's views that we Engineers have proved this beyond doubt by our contributions in a large measure towards the completion of one of the largest multimillion rupee project ever to be undertaken by the government of Sri Lanka, namely the 'Accelerated Mahaweli Programme' which is now paying dividends on the investment.

In order to keep the pace of continuing development in various fields of engineering, it is the duty of senior engineers of the profession to give the necessary guidance to our younger engineers and also be assured of the availability of properly trained technical skills. It must be remembered that bridging the gap between aquisition of knowledge and developing the ability to use it, needs guidance and intensive training. Training of mental processes alone will not suffice unless practical training goes hand in hand.

Youth of today whether student or university graduate must be provided with all opportunities to enable them to reach their goals and our Institution plays a major role in producing engineers from such youth by way of conducting special courses and examinations.

At the Commonwealth Board of Engineering Education and Training (CBEET) and the Commonwealth Engineers' Council meetings held in Cyprus recently, I had the privilege of representing our Institution. A topic of discussion was whether the Commonwealth Engineers' Council should investigate the establishment of a Commonwealth Standard for engineers which should be accepted internationally. With this in view it was found necessary that the Commonwealth Council publication on 'Acceptable Qualifications' needed updating and expansion to cover several additional items of information and this will be resolved most probably at the next meeting planned to be held in Mauritius in the year 1991.

Multi-purpose Hall for the Headquarters

I wish to refer to the construction of the multi-purpose hall for the Institution which is due to commence shortly and proceed with the work as much as we could achieve with limited funds available to us at the moment. The search for funds to put up this Building has had poor response and I appeal to our Chief Guest Hon. P. Dayaratne who is none other than an engineer and an Honorary Fellow member of our Institution to consider rendering the necessary financial assistance in this regard. I will be failing in my duties if I do not mention that last year the President Mr. J.R. Jayewardene who was present as the Chief Guest at the sessions, raised the government grant to Rs.75,000/- from Rs.31,000/- we were receiving during previous years.

Benevolence

We are happy to record the creation of a Benevolent Fund having the desired purpose of doing good to the needy members rather than for gain or profit and is chiefly as a good gesture on the part of a professional body such as ours. This is yet in a stage of infancy and I express the hope that it will grow from strength to strength.

Before I conclude, on behalf of the nearly 4000 strong membership of our Institution it is my duty to express our sadness at the loss of Professor C. Patuwathavithana, Vice Chancellor of the University of Moratuwa. This was a great blow to the engineering student population in Sri Lanka. As Senior Vice President he was the President-Elect for the next Session 1989/90.

Honourable Sir, Your Excellencies, Guests, Ladies & Gentlemen.

Despite the setbacks the country suffered in the recent past we are aware of the efforts of the government at nation building, for which we had rendered our whole hearted co-operation. We assure you of our continued participation in future development projects and look forward to an era of peace and harmony which we hope will dawn soon.

In conclusion I take this opportunity to thank you all present on this occasion giving me a patient hearing. I also thank all members of Council of the outgoing session, the Executive Secretary and the entire staff of the Institution Secretariat for all their support and effort to make this event a success.

I wish the incoming President and his Council all success for the Session 1989/90.

Thank you.

CITATIONS

HONORARY LIFE FELLOWS :

Mr. T.D.R. de Silva -

Mr. T.D.R. de Silva joined the Institution in 1948 as a Fellow. He has held various posts and retired as a District Director of Works, Territorial Civil Engineerin and served as a Senior Executive Engineer, Ministry of Works & Housing, Kaduna, Nigeria.

Mr. R. Alexander -

Mr. R. Alexander joined the Institution in 1947 was elected a Fellow in 1975. He has held various posts in the Public Service and presently working as a Convenor and Head of the Technical Evaluation Committee under the Ministry of Highways.

Mr. K. Sundaranadarasa -

Mr. K. Sundaranadarasa joined the Institution in 1948 as a Fellow. He has held various posts in the Public Service and retired as a Director of Buildings. Presently, he is a Consulting Engineer.

Mr. N. Saravanapavanathan -

Mr. N. Saravanapavanathan joined the Institution in 1948 as a Fellow. He has held various posts and retired as a Deputy Director, Department of Water Supply & Drainage and joined W.H.O. as a Sanitary Engineer - Team Leader in 1975. Presently, he is a Consultant.

Mr. W.A.D.M. Wijesinghe -

Mr. W.A.D.M. Wijesinghe joined the Institution in 1948 was elected as a Fellow in 1977. Presently, he is a Consulting Engineer at Resources Development Consultants Limited.

Mr. N. Kanthasamy -

Mr. N. Kanthasamy joined the Institution in 1948 was elected as a Fellow in 1980. He has held various posts in the Public Service and retired as a Deputy Director, Irrigation Department.

VOTE OF THANKS

by

Professor A. Thurairajah

Senior Vice President

President, Chief Guest Hon. P. Dayaratne, Minister of Lands, Irrigation & Mahaweli Development, Hon. State Minister, Mr. H.G.P. Nelson, our Guest Speaker, Prof. Boris Zhivotovski, Your Excellencies, Distinguished Foreign Guests, Fellow Members, Ladies & Gentlemen.

Traditionally, the President-elect proposes the Vote of Thanks at the ceremonial inauguration of the Annual Sessions. Unfortunately, our President-elect, Prof. C. Patuwathavithana is no longer with us to do this onerous task. It has now become my duty, as Senior Vice President to propose the vote of thanks.

Hon. Dayaratne, you have been so gracious to accept our invitation to be the Chief Guest and inaugurate the annual sessions this year, inspite of the heavy work-load you have in your new Office. We are very happy and proud to have you, an Honorary Fellow of this Institution to inaugurate this session. You have assisted this Institution in many ways, we are very grateful for that and look forward to further assistance. Our building programme for the Institution has come to a stand still due to lack of sufficient funds. We hope that you will be able to get the government to help us to commence work on this soon. Sir, you are in-charge of a Ministry which employ large number of engineers and spent large amount of money on engineering works. One of the complaints of Sri Lankan engineers is that their talents are not fully utilised by the State.Foreign specialists and consultants are brought in even when suitably qualified persons are locally available.You being one of us, are aware of with our capabilities. We trust that you will be able to correct this situation and make best use of the local talents available while giving these engineers the opportunity to develop their capabilities. As a professional association of engineers, we are interested in the production of young graduate engineers. The large numbers of our engineers are leaving the country looking for greener pastures in developed countries and we need replacements. This Institution is deeply concerned that the Faculties of Engineering have remained closed for sometime. We request you Sir, to take the necessary steps to get the Universities to function normally at the earliest. I thank you Sir, for your presence here today.

I also thank the Hon. Minister of States Mr. Nelson for his presence here.

Your Excellencies, Distinguished Guests, Ladies & Gentlemen, I welcome you all and thank you for your kind presence this morning. We are encouraged by your presence and we assure you that we will continue to serve well, the engineering profession and our country.

Dear Fellow Members, I take this opportunity to thank you for being present here in such large numbers and making this event a success. We hope that you will continue to give your whole hearted support and encouragement to the Council of the Institution and enable it to develop the engineering profession in this country. We look forward your active participation and deliberations in the technical sessions that follow the ceremonial opening.

I also wish to thank the members of the Annual Sessions Arrangements Committee, the Press, Sri Lanka Broadcasting Corporation, Sri Lanka Rupavahini Corporation and the Managements of the BMICH and Hotel Lanka Oberoi for their assistance in making this event a success.

Finally, on behalf of our Council and our Members, I thank the Executive Secretary and the staff of the Institution Secretariat who work very hard to make the ceremonial opening and the 83rd Annual Sessions a success.

Thank you.

Discussion following the paper on "SOME SUGGESTIONS FOR THE STRUCTURAL DESIGN OF BUILDINGS IN COMPRESSIBLE GROUND WITH SPECIAL REFERENCE TO HOUSING IN LOW LYING AREAS"

by

Professor B.L.Tennekoon, Mr. K.S. Senanayake and Dr. J.J.P. Ameratunge

Dr. S.M.A. Perera -

I would like to ask Prof. Tennekoon how we could use his criteria of stiffness and deflection in a situation where the compressible layer varies in thickness over the length of the structure, and where there is a variable water table ?

Prof. B.L. Tennekoon -

The method of analysis that I have developed is applicable only when the thickness of the compressible layer is constant. One of the things that we generally do in these designs in compressible areas is that we recommend that the plan dimensions of the building be kept as small as possible to minimise the large differential settlements that usually take place. We also observed that when there is a highly variable compressible layer, the structure tends to tilt; i.e. there is a rigid body tilting that is taking place. Therefore, assuming for example, that the dimensions of the structure are not very large, we can in fact talk of an 'average stiffness' over that small length of the building. In the method of calculation that I have given, although it does not include a variable thickness, it does provide for varying soil strata which is the situation that we often have in the low lying areas.

The second question that Dr. Perera raised was regarding the variation in water table. The soil stiffness calculations are done on the basis of certain soil properties such as cohesion for the clays or the N values for sands. The effect of water table is already reflected to some extent in these values. So there is no special calculation that we do for stiffness if the water table is present. But of course in calculating total settlements the effect of water table is taken into account.

Brig. P.N.K. Dias -

I must first thank the Author for the very interesting paper, and wish to ask the following question. How does the stiffness of a structure such as a block of flats where a number of storeys are built wall upon wall with only reinforced concrete slabs compare with the stiffness of a reinforced concrete framed structure with panel walls ?

Prof. Tennekoon -

It is our recommendation that for the low lying areas the best type of structures are the load bearing wall structures. In these structures most of the stiffness comes from the load bearing walls. So when you have a load bearing wall structure (wall on wall), there is a lot of stiffness provided. On the other hand when we compare this with frame type structures, we find that the frame structure has very little stiffness. When planning houses, architects often like to have large open spaces with openings for large glass windows, glass doors, both for beauty and for ventillation. But the effect of this is that the stiffness of the structure in fact is considerably less. So our recommendation is that if you are trying to design from the point of view of stiffness, then certainly the load bearing wall structures of wall on wall is far preferable to having open structures. Of course, if the client still does not like it and would like to have the large open areas, then you may have to think of other methods of increasing stiffness. We have suggested that in such cases to use the Vierendeel foundation as these provide a certain amount of stiffness like a load bearing wall underneath the ground.

Mr. M. Chandrasena -

Prof. Tennekoon has presented a very interesting paper which is very useful to the present day builders. There are a large number of buildings being built in filled up areas and you get very odd types of foundations being done by various unqualified people. I came across a case where without a qualified engineer or a qualified architect, they have designed a very big house in a filled up area without proper foundations. After some time the client got worried and he came to me for advice as to how to strengthen the foundation. I suggested the Vierendeel type foundation. What I did was that I used the bottom strip footing as one arm of the Vierendeel and the Damp proof course as the other. Then I had little columns about 3 inches thick filled with concrete connecting the strip and the DPC. The strip foundation was about 9 inches thick and the DPC was about 3 inches thick reinforced concrete. I would like to know from Prof. Tennekoon what sort of Vierendeel foundations he has used in any of these buildings ?

Prof. Tennekoon -

I didn't have time to present the design of the Vierendeel foundation. The strip is at the bottom of the Vierendeel and there is a beam at the top. The height of the Vierendeel is presently designed empirically. I have proposed a design method based on limit deformation criteria which gives a method of doing this analytically. In the Vierendeel foundation the shear is taken entirely by the brickwork and the stub columns are like the nominal reinforcements which are placed at lever arm distances. We have checked our method of design with 2 or 3 Vierendeels done by well reputed consulting engineers, and we find that the designs based on our method compares very well with the empirical designs that are being presently used.

From the audience -

If in framed structures, instead of angular distortion you get some sort of rotation, how are you going to apply this theory ?

Prof. Tennekoon -

There is always angular rotation and what is called tilt rotation. Especially when there are variations in soil strata as found in these marshy areas you find that even if you can have perfectly centralised column loads, still we find the structure as a whole tilts. This is true for framed structures and for load bearing wall structures. But angular distortion is always the distortion of one column relative to the other.

Dr. B.M.A. Balasooriya -

Prof. Tennekoon, you referred to the Navagampura Housing Scheme where you found that very large settlements were experienced and still masonry foundations had performed well. Is it not possible that the foundations at Navagampura behaved well because there were very few openings in the walls? Would it be correct to generalise this result for all types of masonry structures, as I think that RC foundations are preferable to masonry foundations when settlements are large?

Prof. Tennekoon -

Our results are based on the case studies of a large number of buildings in the low lying areas; and so may be there are certain inherent assumptions already about the structures that we are analysing. We established that for load bearing wall structures the limiting deformation criterion was 1/2750. Similar results have been established elsewhere and these do not differentiate between the type of foundations - i.e. rubble foundations or reinforced concrete foundations. This refers to the limiting deformation criteria. But when it comes to the stiffness calculations, then there is a difference in the contribution of the foundation to stiffness. So that is why I am to some extent still cautious; but I accept what Dr. Balasooriya says; i.e. in using the theory that we have developed, we have not differentiated between rubble foundations and reinforced concrete foundations.

Mr. L.W. Seneviratne -

I thank Prof. Tennekoon and wish to ask this question. I find that because we experience many hydrological problems, specially the removal of material from beneath the foundations, many of the foundations fail due to the removal of material. Do your recommendations remain when the removal of materials take place, can you suggest any corrections to be made later such as grouting or some other means ?

Prof. Tennekoon -

The design method that we are proposing in fact is very useful for this type of situation, because this failure takes place not because of any loads that are coming on it but because of the settlement of the foundation. The method that we are proposing is called design by limit deformation criteria, where the design of the structure is done by consideration of deformations likely to cause failure. But of course the fact still remains that if the soil keeps being washed away, then as an engineer you must ensure that the soil doesn't get washed away or eroded or removed.

Discussion following the paper on "DURABILITY OF REINFORCEMENT IN REINFORCED BRICKWORK MADE WITH LOCAL MATERIALS"

by

Professor S.R. De S. Chandrakeerthy

Mr. D.L.O. Mendis -

Considering the labour required for this reinforce brickwork for lengthes, I wonder whether you could make a statement on a comparison with the thin lintel in reinforce concrete and the brickwork thing as a composite beams; comparative statement of the advantage of this as against that on which work has been done by Dr. Ameratunga and Dr. Kulasinghe earlier; Could you make a firm recommendation for this.

Dr. W. Samarasinghe -Reinforced brickwork lintels are economical compared to its alternative solutions, (eg. brickwork with reinforced concrete lintels or beams) in unexposed situations or in exposed situations where no shear links are used. For exposed situations where shear links are used, it becomes uneconomical.

Mr. K.D.G. Kulatunga -I just want to clarify some thing regarding the test procecure, that you tested the steel bars, that were used 9 days and check the corrosion that has taken place which compared very well with 40 years of exposure; later these reinforce bars was embedded in your brickwork and again tested from 9 days; at the end of it, you said again it was removed the reinforcement bars were removed and check for corrosion, was to extension of corrosion in when it is in case in brickwork and after 9 days, when it was the first simulation was done; the section of corrosion same; 9 days of testing of the form reinforce brickwork not simulate 40 years.

Dr. Samarasinghe -

The experimental results have revealed that the acceleration corrosion technique adopted very well simulates the 40 years of exposure. The corrosion is accelerated by a suitable medium over a period of 90 days and checked with the expected corrosion penetration in 40 years with no acceleration.

Mr. J.P. Senaratne -

One question I want to ask; this being done even recently in a small house, why we don't use the brick arch without the any of the reinforce; I have seen the house scanning beautifully; the olden day houses, there were no lintels even over a windows and the doors, even the precast and their standing very well; as far as the question of cost is concerned, low-cost if we are trying to cut down the use of cement and steel.

Dr. Samarasinghe -

Using a brick is always satisfactory. However, labour cost may be comparatively high. Use of brick arches is purely an architectural aspect rather than a structural aspect. If an architect requires a typical lintel type door or window opening, then the engineer has no choice but to use a lintel.

Discussion following the paper on "DEVELOPMENT OF UNDERDEVELOPMENT IN SOUTHERN SRI LANKA DE-STABILISATION OF ANCIENT IRRIGATION ECO-SYSTEMS BY THE IMPACT OF HYDRAULIC ENGINEERING"

by

Mr. D.L.O. Mendis

Mr. D.L.O. Mendis -

I apologise for the mis-print of the word 'de-stabilisation' in the title of my paper.

Mr. A.T.G.A. Wickremasuriya -

I did not intend to attend this year's Annual Sessions, but after reading Mr. Mendis's article I decided to do so. I thank the Institution of Engineers for publishing that article and I shall be glad, if that article is given a lot of publicity in the press. Because people like Mendis and a few other grey-haired gentlemen here, are a dying race. We have no obligations to individuals in government, but to the country. We say what we have to say, and that should go on record.

As I read through Mr. Mendis's article, almost for the beginning I began marking with a red pencil - there are about twenty points on which I would like to make comments and observations but because time is short it is not possible to do so. I must thank Mr. Mendis, congratulate him, and request this Institution to do something meaningful if this Institution is to be of same meaning. This morning papers had a news item: "The OPA, Organisation of Professional Association, renews efforts in search of peace". Another item: "Engineers should not isolate themselves". I had hoped that the Hon. Minister, even the President, would comment on these things, but I was disappointed. Then I read of the funeral of Mrs. Vincent Perera, wife of the Minister. A man who has been several times the Mayor of Colombo. Gentlemen that is an example of serving the people, being a servant of the people. Another item: "Thirty thousand families appeal for immediate relief: drought in Puttalam district". Do you know that an investigation was carried out for flood control and drainage in the Puttalam district, in the eighties by a team of 12 Sri Lankan specialists in various fields.

Men like Prof. Weerakoon who call a spade a spade without any fear, were in that team. What happens to that Report? World Bank paid about 1 million rupees. Volumes have gone to the Planning Ministry; shouldn't those people be brought before a Commission ?

Another item: "38 hectares of jungle razed every minute to the ground". Again: "Engineers were kept away from decision-making posts". There are subjects on which I can speak at length, but time is short.

There was a Seminar in this room some months ago on Drainage problems in Colombo, but the discussions were mostly rubbish. I had presented a Report on the Flood Drainage problems in Colombo, but that report was suppressed. Instead Consultants have been engaged on a cost of Two thousand million rupees.

There things should go on record. The Institution should do something about it.

I mentioned the OPA. Just before the Eletions there was a meeting there; I said how many of these people who are now preparing to get into Parliament should have been brought before a Bribery Commission. What happened to the three thousand seven hundred odd petitions? How many of those fellows who were trying to get into Parliament should have been deprived of their Civic Rights? Let us call a spade a spade for the sake of our country and generations unborn. We are old, we are going, but these things must go on record.

Mr. Mendis -

In my paper I have provoked the Irrigation decision-makers. They are in the audience: please respond. There must be some point of view to be expressed. I hate to think that what I have studied and written and talked about, is all correct. I wish it was all wrong !

Mr. K.D.P. Perera - former Director of Irrigation

D.L.O. has directly provoked us to say something: actually, I didn't want to make any comments, after the excellent presentation; I did the construction of Lungugamvehera Scheme, of course at the time I started the construction the decision had been made to do it at this particular place; Mr. Mendis said that when wrote to an article in the paper, we were trying to justify the lower site. I don't know very much about the upper site, because at the

time, I took over, work on the present Lunugamvehera site had been started; so there was no occasion for me to look at the upper site; but of course, now which some of the facts presented by Mr. Mendis it looks to us that we really should have look at that place, before we took the decision to construct the Lunugamvehera at the present site. Of course, in fact once when I was discussing this subject with Mr. Mendis I asked this question; you were in the Planning Ministry; Why didn't you get the Irrigation Department to study this place and make a choice between the two sites. I don't know why the Planning Ministry was not able to do that because the planning of Lunugamvehera had gone on for a very very long time; so there was ample time and opportunity for other divergent views to have been expressed and investigated.

Commenting on the Southern area development, that is the diversion of water from Kalu Ganga basin; the ECI had prepared a report, way back about 20 years ago about the development of the 3 basis that is Kalu Ganga, Gin Ganga and Nilwala Ganga and more or less at the end of that study they had given a diversion plan for the southern area. Now recently, when there was another World Bank study on Kalu Ganga Project, this was highlighted, and in the terms of reference we gave this as one of the most important aspects of this particular study. The study was in 2 phases: the 1st phase is complete upto now. In phase 1 which was given to TAMS Consultants, and finally their recommendation was that the water at Kukule should be used for power rather than for diversion to the South-East Dry Zone. Now when this was presented, I strongly objected to this because I said that there are other ways of developing electricity, but there is no other way of bringing water to the South-East Dry Zone area; and of course, the UNDB, the World Bank, who were financing it a very much against my view, because they were looking purely at the economics of the proposal. But I said that we cannot look purely at economics, we have to look at our requirements of development. In fact I said that the UNDB has no mandate to tell us what is good for us, but they were doing exactly that. Anyway after that report had been presented, they were wanting to get on to Phase II within a very short time, which I refused. I said that it has to be looked into very closely, and still Phase II has not started. There has been lot of discussions, and a lot of contributions by many people, and I think the subject is still with the President or in the Presidential Secretariat. A decision regarding Phase II has not been taken so far. In the mean time when the UNDB found that we were resisting their proposal of not diverting water to South-East Dry Zone, they brought up a proposal to do an integrated study for the development of South-East Dry Zone; i.e. not only using water, but various other aspects. Then of course, I brought up the question what if by any chance, they want water, after that particular study which has not been started, at all so far? CECB is doing some work on that; UNDB had no answer to give. Anyway this is how it lies at the moment and I think before a decision is taken how it should be done, what sort of methodology we should adopt for developing the South-East Dry Zone, it is very necessary that we should look into all the aspects as Mr. D.L.O. Mendis has been telling.

Mr. D.L.O. Mendis -

Actually, Mr. K.D.P. Perera is a Secretary to the State Ministry of Irrigation. He is the former Director of Irrigation, and he just said that there was ample time to investigate the alternate proposal but it was not done. He asked me why when I was in the Planning Ministry I could not get it done. Now the answers to those questions are in the record; not in the record in the Ministry, but in the Transactions of this Institution. Please look up the history of the background to this. But I have to make another comment: what the consultants who recently worked on the Kalu Ganga, project did was to study hydraulic engineering; in fact their language reveals this; they talk of "target areas" in the South-East Dry Zone for development by diversion of water from reservoirs in the South-West Wet Zone; This is like pumping Mahaweli Ganga water into a water tank, and letting it out at the top. If this is our concept of irrigation, we are destroying our country; hydraulic engineering is a destructive force; we must understand, irrigation eco-systems. So I beg of you as the Secretary of the State Ministry for Irrigation, to ask your staff, (stating with yourself if you don't mind) to start understanding the ancient irrigation eco-systems of our country. Don't wait for foreign consultants to learn it and come and tell us about it. When we do that we will be in a position to build a stable eco-society in our country; not disrupted, disarticulated and flowing with blood as it is now.

Mr. G.T. Dharmasena - Irrigation Department

As Mr. Mendis wanted a response from the Irrigation Department, I thought instead of going for a postmortem, I will just make a few comments.

One thing is in 1935 Mr. Kennedy had presented a paper. I think what had happended was, if you

read that carefully, most of our irrigation engineers, who took over this work in the recent past, we misunderstood most of these. I will just quote one: he said "A good scientist will always respect traditions. You see, a man coming from an European country said this: "A good scientist will always respect tradition". Not only this, there were so many other things in that report, but we have not read it correctly, and we have not understood it properly. I cannot really talk of all 7these things, because there's no time.

Mr. Mendis mentioned about Mr. Manamperi who has done a great amount of work; actually even at the beginning Mr. Manamperi also misunderstood certain things. One example is, he also thought of breachi1ng these minor tanks and doing cultivation the tank beds, but before his death he realised the mistake, and he was convinced. As Mr. Mendis said really at a latter stage Mr. Manamperi himself really understood certain things; but he had some different opinions at the beginning.

Then coming back to the major reservoirs and minor tanks: in my opinion what I feel is a system of minor tanks is a descentralised system; a big reservoir is a centralised system; and you all will understood that it is easy to manage a descentralised system. Actually, major reservoirs are required for generation of power, but water distribution cannot be done without these minor tanks. Even in developed countries where the minor tanks are not existing, now they are thinking of creating minor tanks into their system. With these comments I think I will stop. I think what is necessary for us is to study; we have to read, and understand things properly; and in general, personally I feel that most of our irrigation engineers, misunderstood the paper presented by Mr. Kennedy.

Mr. A.D.S. Gunawardana -

Mr. Chairman, Ladies & Gentlemen; I am expressing the opinion of the large majority of irrigation engineers; Mr. Dharmasena referred to tradition which Kennedy has referred to in 1935, and Mr. Wickremasuriya is one of his 'golayas'; I must tell you that we respect some traditions at the Irrigation Department, even today.

Mr. Mendis has presented this paper on Destabilisation of Irrigation Systems in the Southern Part of the Country; but de-stabilisation of irrigation all told, in the whole country, started in 1978 when the new Secretary started dubbling in the Irrigation Department with the help of the Sinhala Brigade in the Irrigation Department. At least some of them helped that; with that they produced something called an IMD, an Irrigation Management Division; with that they have appointed complete outsiders who had no qualifications, no training, no experience to manage irrigation water; that is the other part; so that has happened and when this Minister took over, he had got a report from a couple of experts not in the Irrigation Department but from outside and, he decided to close it down. But then the other brigade which came back, who were running the Ministry all these years prevailed on the Minister, and somehow they are going to keep the IMD and keep these outsiders managing water.

Discussion following the paper on

"DAM INSTRUMENTATION"

by

Mr. D.G. Athukorala and Mr. S. Karunaratne

Mr. D.L.O. Mendis -

Walawe comes under your administration in the Mahaweli. There are cracks in the concrete on the gated spillway structure. You have not touched on this aspect in your paper. I would be most grateful if you could, not necessarily now, but even in a written response tell us what has been done about investigating the cracks in the gated spillway structure at Uda Walawe, and what could be done. I would also like to ask you please to refer to my paper of 1986 where we had cracks at Uda Walawe during construction, and I think is another example of using our own resources before we go running to outsiders.

The second point is that you have mentioned that Kalawewa was built in 40 BC, I wonder what that source is, because it is commonly accepted that Datusena built Kalawewa in the 5th century AD. I am indicating that there was a diversion system from Kalaoya to Malwatu oya which was built earlier and there was no reservoir there earlier than 5th century. As regard to the breaches may be you could have a different way of classifying breaches as man made and by natural causes and amongst man made breaches, you get multiple breaches. When an earth embankment breaches due to natural causes there is a simple breach, but man made breaches are multiple breaches very often.

Mr. D.G. Athukorala -

Regarding the first point you mentioned, we at the Mahaweli Headworks have been carrying out investigations of the cracks in the gated spillway structure at Uda Walawe since we took over this Headworks in 1986. You say there were cracks during construction. We have carried out through our Consultants certain measurements and find that there were no movements of the cracks for quite sometime. The design also shows that the dam is quite stable in spite of the cracks and there is no reason to worry. We have been advised to close up the cracks and that is what we are going to do.

Regarding the Kalawewa breaches we have taken gathered that information from Brohier's book on "Ancient Irrigation Works of Ceylon".

Mr. A.T.G.A. Wickremasuriya -

My first question is similar to the question on cracks by Mr. D.L.O. Mendis. Regarding the cracks on Nalanda dam, a dam built in 1956, it suddenly started cracking 2 years ago. Was any attempt been made to monitor and find out the reasons for that crack. We know that when people came down from India they were paid handsome consultation fees, others from Sri Lanka also went, I also went, but has any attempt been made to find out the reasons for that crack. We can learn a lot from failures.

Second question, Mr. D.L.O. Mendis made reference to that map. That was based on the watershed areas. As important as the watershed areas is the variation and mapping of the ground water tables. All this highly sophisticated instrumentation will be thrown out of gear if the ground water tables vary. Has any attempt been made to monitor and map out the existing ground water tables and its variations. Mahaweli ganga, the islands biggest natural drainage stream has now been converted into a totally different hydraulic system. We have taken the water and put it on a higher level. We know very little, almost nothing, about the geology of this area. So to my mind monitoring the ground water table is all important, otherwise all this highly elaborate instrumentation is out.

We must learn from past experiences also. When the Gal Oya dam was built I was there, at that time, a young engineer, these pore pressure instruments were put there. Is there follow up action to determine what has happened since that time, about the pore pressure in that area on the dam itself. Consequent to the construction of the Gal Oya dam the paddy fields that were earlier irrigated became water logged. Irrigation canals became drainage channels. So have you learnt from experience, at least from observations to try to see the geomorphology of this area. Now in the south eastern area we have the Badegiriya tank, before Walawe came into existance. The tank never filled up. Water that is let down dissappears half way and reappears towards the coast. These are connected with simple facts observed even by the farmers.

Mr. D.G. Athukorala -

Mr. Wickremasuriya mentioned one point about the cracks in the Nalanda dam. I am afraid this dam does not come within the operation and maintenance of the Headworks under the MASL. This dam belongs to the Irrigation Department. The monitoring of this dam has to be by that Department. I believe CECB is carrying out some investigations on the cracks.

With regard to the mapping of the water table and the variations of the water table, I have mentioned this aspect in the text of the paper under the sub heading of Reservoir rim. This aspect has to be monitored. I agree, but this subject falls outside the scope of this paper.

Mr. Abeypala - Environmental Federation

I would like to know whether there is supervision from the top. Whether this monitoring is done to coincide with a circuit or which will tally with the school holidays, because that is what has happened even with all these sophisticated equipment dams are failing every where because there is lack of supervision from top people from Colombo. Mr. Dolapihilla mentioned that engineers have been kept away from decision making. Even the same complaint comes from the public. There is no decision which effect the public where the public are consulted. Now whereas since of late with pressure to the World Bank any loans given by the World Bank, Asian Development Bank or any of the World Bank agencies has to be monitored with the consultation of the individuals. There is a World Bank operation paper. I would like to know whether these things have been implemented by the Mahaweli Authority and also whether there is any coordination between the Ministry of Power and Energy, Irrigation or State Ministry.

Mr. Athukorala -

Regarding the monitoring of the dams, as mentioned earlier, these are done at the site with the assistance of qualified engineers trained for the purpose. If there is any reason to think that the normal behaviour of any particular item that is monitored, whether it be vertical settlement, or horizontal movement or a piezometer reading, is behaving in a way that is different to previous readings and continues to do so without reason then this is brought to the notice of the Head Office authorities as early as possible. I have here with me some of the graphs which show that we have being carrying out the monitoring regularly. We see that the figures follow a uniform pattern as compared with previous readings. If there are any disturbing readings then they are brought to the notice of our Consultants and we follow the procedure shown in the chart before you. As I mentioned to you before the CECB also carries out an independent check on all the dams under the Headworks Division twice a year.

Mr. Karunaratne -

We select our trained personal from the construction agencies. CECB is the consultant for all the dams under the Accelerated Mahaweli Programme. We selected our trained personnel from these projects wherever possible. The senior and junior Engineers, the Technicians, the Engineering Assistants are all at the sites and not in Colombo. The Head Office is situated central to the sites at Digana and not at Colombo. Senior Engineers are monitoring the sites daily. If there are any adverse readings, that fact is brought to the notice of the Head Office who in-turn will inform the Consultants if necessary. Our staff has been trained in Sri Lanka as well as abroad. We are certain we have the required number of trained staff at present in the field.

Mr. Amerasuriya -

I would like to ask Mr. Karunaratne what is relevant to the present times about the Kotmale dam. By increasing the height of the dam whether investigations have been carried out or calculations have been done to try to find out whether it is feasible increasing the height of the dam without undermining the present foundation.

Mr. Karunaratne -

This is really a matter for the Consultants to answer. We know that plans are ready to raise the dam by 30 metres. There will be no problem of doing that. The dam will be raised. Please refer this matter to the CECB for any further clarification.

Mr. H.A. Wickremaratne - Mahaweli Economic Agency

Regarding the cracks in the Walawe dam, I would like to say that the cracks are not in the dam but in the spillway abutment. In fact we were maintaining the Walawe dam for some time before handing over to the Headworks. As Mr. Mendis mentioned McDonalds were employed as consultants for rehabilitation. We wanted a report on this and they submitted a preliminary report on the information available. We tried to go into the design, at that time design notes were not available but reinforced concrete beam details and the construction drawings were available. According to these drawings we see that the foundations were founded on solid rock, and it is very unlikely that it is a foundation failure.

Mr. S.M.B. Dolapihilla -

I would like to ask a question from Mr. Athukorala. Had you these instrumentation at the time that Walawe dam was built, would you have been able to notice and take corrective action to stop this kind of crack?

Mr. Athukorala -

Yes, if we had instruments to measure tension, like strainmeters, then we could have measured the strain, the increase in tension at that point, and from the observations we could see that the strain keeps increasing at the point where there is to be a crack. At that time action must be taken to see why this is happening and if possible to take corrective action.

We have seen from the drawings that the reinforcement laps are not staggered. It is possible that this is a weak area and if it is necessary to measure the strain at that point the strainmeter should be fixed at that point.

Mr. J.P. Senaratne -

I like to ask from Mr. Athukorala and Mr. Karunaratne now from the observations that you have had, I suppose it is 2 years, in Kotmale and Victoria dams in special, has the seepage of water increased during this time? You are talking of cracks, whether any of those have become widened and what has your general observation been. I think if I am not mistaken the original design of the Kotmale dam was to be 30 ft. higher than what it is now. There is now a proposal to lift it to the original design height and the present height is lower due to lack of funds.

The other thing I wish to take up about the failure of the Kalawewa dam. Kalawewa breached and caused terrible damage in December 1957. I was in the Railway at that time, the railway line was on the top of trees. A tidal wave from Kalawewa which was over 30 ft. high took down all the railway ambankments and bridges. This is not mentioned in your paper.

Mr. Athukorala -

I have mentioned in the paper on page 69 in detail about the seepage from measurements of seepage at Kotmale. The amount of seepage is between 10 to 15 litres per second and this has been steady from almost the inception and the graphs here show that. During the rainy period we get a higher reading, but that could be due to water coming from outside. Taking other dams of similar height and similar construction, from other parts of the world you can consider 20 litres per second as an average figure. So the Kotmale seepage is well within this.

Regards the second question, we have not mentioned the 1957 breach of the Kotmale dam. I have mentioned only those given in Brohier's book. We have taken action with UNDP assistance to work out a programme of action to be taken in the event of a breach in the dam. This is called Dam Breach Hassard Analysis. In the event of a breach what is the course of action we are to take. Dam Breach Hassard Analysis is a computer model that has been successfully carried out in most western countries where you feed in the necessary data to the programme including contour levels downstream, population figures downstream etc. and analyse the effect of a breach at different reservoir levels in the downstream areas. We can locate areas that will get flooded and can also locate safe areas at higher elevations.

We are introducing this first into Kalawewa in the Mahaweli set up. We have already started taking levels with the help of CECB of the areas around the Kalwewa bund. We have installed piezometers about 21 of them to determine the phearetic line and then determine the flow pattern within the bund.

UNDP has agreed to assist us on this very important task. From this information in the event of a breach we will know, unlike at Kantale, what exactly we should do to evacuate the population to higher reaches, and to see that there is no harm done to the people or their belongings, since from experience we know that we have a few hours or a day or two as the case may be to take necessary preventive action.

Discussion following the paper on

"INVESTIGATION AND ASSESSMENT OF THE CONDITION OF THE NEW KELANI BRIDGE"

by

Mr. M. Chandrasena

Mr. Dias -

First thank Mr.Chandrasena for his paper and for having kept fine records for future guidance in designing bridges of this nature. Of course one thing I would like to find out whether this bridge had been given any form of maintenance in the past 30 years regular maintenance, pay once in 5 years, someone went through and attended to any matters or was it allowed to carry on till it was opened up 2 years ago; and had it been maintained regularly would this same situation have arisen? So that in future we could lay down some guidelines for young people who are coming up look after these. Had it been a steel bridge would this position have been different? Would it be very much easier to maintain a steel bridge than reinforced concrete bridge? I remember that time this bridge was been awarded, there were steel bridges also forwarded in designs and they were turned down, to the best of my knowledge, saying the steel bridges were difficult to maintain in the tropics. But we still find quite a few steel bridges rafting; I have noted that in other countries, UK bridges at the Forth Bridge and large bridges, permanent maintenance gang moving from one end of the bridge to the other end. So I would like to know whether such things are possible in our work.

Mr. M. Chandrasena -

Thank you for the comments. Actually, I have also thought that concrete bridges don't need any maintenance and that it was the one of the advantages of a concrete bridge. I think if it is done well you need not look at it again, for may be 20-35 years. But in the design and construction if sufficient precautions have not been taken, maintenance has to carried out. I believe concrete bridges which are standing quite well; I think there is a bridge on the Galle Road in Hikkaduwa or Dodanduwa much older than this and still standing. I don't know if it is damaged. You are correct, t hat steel bridges have in Sri Lanka lasted 100 years or more. In fact that the present Victoria bridge is over 100 years old. It is not the fault of lack of maintenance. I think the fault is in the design and construction of the bridg As I said my own view that concrete bridge required hardly any maintenance. Of course you will have to inspect them occasionally.

Mr. B.M. de Soysa - Road Development Authority

We have thank Mr. Chandrasena for bringing his ideas together and recording in the Institution so that generations to come will benefit by this. He said it is a pity that we are banking only on the paper submitted at an Institution meeting to get the past records of this bridge. That itself showed how important it is that this sort of thing should be discussed here and put up for future reference.

As we know this bridge is a very important bridge and my only fear is that once we start the repairs, how we are too maintain the traffic that is going on this bridge. The Victoria bridge as you know had been restricted and only light traffic is allowed on that. So with repairs to this bridge, it will be very difficult to get the traffic on to Colombo in the rush hours. Anyway heartening to note that we have been able to complete the Kaduwela bridge. At least there is a crossing over there so that at least some of the heavy vehicles could be diverted.With all due respect to the people who administer the present concrete yard, I must say that it was quite a treat. He was a pioneer in prestressed concrete bridges. It was a treat to see that yard. He himself was there at 7 o'clock in the morning. He also manage to train some of the young engineers who were working with him and we in the RDA are proud that, one of his assistants Mr. E.F.M. Perera with us and he is a bridge consultant. As far as the bridges go now in the Road Development Authority, we have opened up a bridges investigation unit and all these bridges are being investigated and wherever possible they have been replaced. As you know the funds are limited. But we tell the powers what bridges have to be constructed so that they should pay more attention to that. I would like to ask Mr. Chandrasena for the benefit of the young engineers, really what went wrong with this bridge. It is not with the idea of putting the blame somebody. But I think for the guidance of our younger generation, it will be useful, if you could tell us who was really responsible for this, although right at the beginning he said that in England and elsewhere bridges, even the concrete bridges, last only about 30 years. But there, the conditions are different. As you know there

is snow and they have to use salt and all sorts of things to clear the snow. But in a place like this, we at least expect concrete bridges to stand at least 50 years; so there has been something wrong somewhere. So is it the fault of the contractors or is it the fault of the supervising officers. It is not with the view to blame anybody but it is for our own information and so that we may not repeat this sort of thing. As professional people, there is a lot of blame that will come up for a thing like this, because it is with difficulty that the government gives us money and most of these things are done under the loans scheme for which not only we, but future generations to come, will have to pay for. So it is as professional engineers we have to be very cautious in this sort of thing and so that this sort of damage should not occur in future.

Mr. Chandrasena -

As I mentioned I think the blame should go to the method of getting this work done, which was on a turnkey basis for design and construction. When tenders were invited on a turnkey basis there was a large number of tenders. Most of them were for steel bridges and they were not accepted because as Mr. Dias has pointed out we thought that, or rather the Department thought that, the steel will not last as long as concrete. When you invite tenders on a turnkey basis the designer cuts down his design to the barest of minimum and less than the minimum sometimes, with a view of getting the cost down; and he certainly has, like in this case considered the man who was going to construct this bridge. Imagine casting beams 12 ft deep which were only 12 inches wide with so much of steel congested. It must have been a very difficult task. So really one wouldn't blame the supervisors nor the contractors. I think the system of getting this work done. An important job of this nature, I think, for works like this we should never call for competitive design. It should engage a consultant of the RDA itself could carry out the design and get the construction done by contractors or by themselves. So I would not blame any particular party.

Mr. A.D.S. Gunawardana -

Mr. Chairman, Ladies & Gentlemen, I have no complaint against Mr. Chandrasena on bridges and Dr. Kulasinghe on nearly everything else. But now we are producing Engineers to the tune of something like 500 year for quite sometime from Peradeniya and Katubedda and some from this Institution and some from the London Institution as well. Now when we have trouble in a bridge something like Kelani Bridge, have our institutions, in the sense, in the sense the Highways Department, the Irrigation Department or the Authority or Boards been not producing people of that calibre; what are we doing? Are we calling consultants to do all the jobs. If I give an example from my Department, they call consultants local and foreign, they say the World Bank and the Asian Development Bank are imposing it on us. Is it the case with the RDA for that matter and isn't RDA geared to produce Chandrasenas or Kulasinghes. Because we are producing most of the brilliant Sri Lankans are Engineers today. Are we not producing Chandrasenas and Kulasinghes?

In your comments, you have said that if it was built to the current code there would be no problem with the bridge; but current code is current code; but bridges constructed elsewhere at that time there are standing and they are very well.

Mr. Chandrasena -

I would like to make comments on Mr. Gunawardana, what he mentioned; I don't think it is correct to say that the RDA not producing capable men, because I think I can tell you that I had very serious arguments with the RDA Engineers on this particular job on our recommendations. It has been a very good exercise for me as well as for them, and they are very keen. I don't think it is right to say that they are not trying to produce good engineers. There are various obstacles unlike those days. Those days we could take a bold step without fear and carry it out. That situation different now. You all know about it.

Mr. J.P. Senaratne -

I must thank Mr. Chandrasena for his very useful paper which he has submitted this time. Except for Mr. Chandrasena, myself and one or two others; I don't think any of you were here in this Institution at the time that this bridge was built. I can remember, we went to visit the bridge site when the filling work being done for the approaches. Then we also went and inspected the bridge on a number of occasions, when it was being built at different stages and I can still remember those, the amount of steel. We at that time itself wondered how the duce are they going to get this concrete into narrow beams and with so much of steel within that. Anyway now this damage, which has occurred during the last 30 years will we assume, be rectified; but I don't know and I am not aware of the processes they use for concrete bridge re-construction or repairing like this. But I presume there must be methods, but I know for steel bridges now,

in the Railway we had four miles of bridges, if you put one bridge next to the other; 4 miles of steel bridges on our railway, and specially on the coast line, and we have a special bridge section. There is continuous inspection of these bridges; on the coast line from Slave Island upto Matara. Those bridges are inspected every year; and every year those bridges were painted. We had a Bridge Commission that came out here 1949 or 1950 from England who came to inspect the bridges on the railway and to comment on them, now those people also brought their instruments out; they brought extensometers, they brought deflection meters, different things and all the bridges were tested under live load with the heaviest railway engines going up and down and these bridges are being maintained even upto date, I can't say very well; I retired 15 years ago; anyway upto that time they were be maintained as best as possible and at the time I left 15 years ago; our recommendations were, after having seen what is being done in other countries specially in France; the bridges have been replaced by prestressed concrete bridges. In 1964 I walked through a bridge between the girders in the prestressed concrete bridge; you could get down into a pit and in between the girders. One girder is like a huge box and that was a spanned of 250 ft., huge railway bridge built out of prestressed concrete and that was in 1964; and at that time and I presume the remedy is prestressed concrete and not reinforced concrete in the future. I think the modern trend is that, that you use more prestressed concrete where you use less steel and it is not crowded. What we saw on this, that Mr. Chandrasena showed and these bridges I know the railway one had to be cleaned, clean them upto the metal, then red lead and then what we called English tar that is the tar that you got to heat - heat tar; and this the English Consultant said had been the best, because we tried out; every person, when I was Chief Engineer used to come from abroad for all people; we all give them, they make so many claims; and tell them all right do this; then we give them a bridge for a test. The new rail corroses on our coast line sometimes in 5 or 6 years; corrosion is so heavy, In France I can remember the talking of corrosion I said you must come to Sri Lanka to see what corrosion is; I said that is not corrosion; what you find in places like on their Ports on the sea coast and the corrosion is very heavy and this one also I think has been directly due to corrosion and in sufficient cover as Mr. Chandrasena points out the difficulty to work the concrete to the bottom of the beams had been the cause and I do hope that before along the RDA will be able to repair this bridge, or I don't know whether they will have to wait till Victoria bridge is repaired and the new bridge put in there, before they start work on this. I think Mr. Chandrasena will be able to advice whether it can be done while traffic is going on now.

Mr. Chandrasena -

The RDA expects to repair this bridge before the new bridge is constructed and they expect the repairs to be done while traffic is moving all the time. Otherwise there is no way for heavy traffic coming to Colombo except through a devious road; and we have made provision for allowing traffic while the repairs are being done and even while the jacking is in operation. The most difficult task there will be the jacking up of the suspended spans weighing 500 tons. We may have to jack it by about 1/2 a meter, and to jack beams carrying different loading we have to keep the movement equal in all the beams otherwise there will be cracks due to a distortion. We are making provision for allowing traffic even while jacking. It may be possible that we could close the bridge for traffic for couple of hours, but in the jacked up position we still got to allow traffic and because of this extra loads coming in with the girders we are going to undersling at the cantilevers to jack up the suspended span and for other design reasons we will have to restrict traffic to just 4 lanes, out of the 6 lanes.

Mr. Priyal de Silva -

Let me thank Mr. Chandrasena for the very interesting and useful paper submitted by him. Approximately 20 years back, when I was an undergraduate I also had the opportunity of having a training under Mr. Chandrasena in the model bridge yard at Ratmalana. Regarding the loading when the bridge was first constructed in 1960's; I don't think we had such big axle loads on our roads; at so is it one reason that has caused the bridge to get damage so quickly.

No. 2 is that than any other bridge in the island this bridge has more traffic and hence the frequency of loading is more and even unloading is more, so because of the stress reversal, so it one cause for the bridge to get damaged so quickly?

Mr. Chandrasena -

Actually, this bridge has been designed according to the old code, but it was designed for the normal HA loading, in addition checked for the heavy loading, HB loading, which is quite sufficient for even the present loads. I don't think the heavy loading as carried by the bridge at present is responsible in anyway for the damage that has been caused No failure has taken place due to heavy loading.

Discussion following the paper on "USE OF THE DEFLECTION BEAM IN THE DETERMINATION OF REHABILITATION REQUIREMENTS OF ROAD PAVEMENTS IN SRI LANKA"

by

Mr. D.D. Senanayake, Mr. Susil Weeratunga and Mr. D.P. Mallawaratchie

Prof. D.S. Wijeyesekera -

We heard that there were different methods being used on this analysis, other than the deflection beam. What were the methods used before and have any comparative studies been made.

Mr. D.D. Senanayake -

The deflection beam came into being in 1953 after the AASHO road test in America. Prior to that there was no particular method for determination of road pavement conditions. However, by observing the surface deformations, surface irregularities and unevennesses, cracking patterns etc., roads had been categorised or indexed in several parts of the world. Such procedures, however, are subjective in nature.

Mr. B.M. Soysa -

As we know, even earlier our Research Organisation has been presenting various papers. These had been however, limited to the four walls of the organisation. The research now being done, one of which is presented in this paper, are of daily use particular because of the Foreign Aid received from World Bank and Asian Development Bank to our roads. The foreign Consultants are also able to make use of these findings. As such we should be thankful to these officers who were very hard working and who have saved not only local currency but also foreign currency for us. This sought of testing and research programmes are essential particularly, because of the increased traffic on our present day roads.

Mr. J.M. Chandradasa -

I have one sample question. Can we use these deflection beam results to determining the allowable axle loads of vehicles on our road.

Mr. Senanayake -

It is very difficult to say, as we normally go on a cumulative basis of traffic. It is the cumulative axle load that is considered. As such, I do not thick that we could make use of these results to determine the individual values of axle loads.

Brig. P.N.K. Dias -

I thank the authors for their paper. However, I would like to know as to why on most of our roads the surfaces are wavy on the curves and the edges and what could be done to reduce such failures on our roads.

Mr. Senanayake -

This problem of shift of surface materials particularly on curves has been observed in many places and even on places where we have laid asphaltic concrete. In other countries they use materials harder than asphaltic concrete and even in asphaltic concrete they use harder bitumens. Unfortunately, we are not in a position to treat such places with special materials particular because of the extra costs. However, we are carrying out experiments particularly with polymer modified bitumens and also with roller compacted concrete. We could lay roller compacted concrete in this kind of situation with advantage.

Mr. Senaratne -

Although you said that the deflection beam could be used to determine thickness of overlay required. I feel that this step alone is not sufficient since our pavements are not uniform across the cross section. As such further investigations are necessary.

Mr. Senanayake -

I fully agree with Mr. Senaratne. In fact we carry out for their investigations. But this is one of the non-destructive tests which gives a good idea of the existing pavement condition. Where there are problems we dig the road surface and in the layers benieth we carry out penetration tests with the use the Dynamic Core Phnetrometer (DCP). Also we collect samples from such pits and carry out CBR tests prior to determining the overlay requirements.

Discussion following the paper on

"THE RELIABILITY STUDY OF TWO BUS ROUTES WITH OVERLAPPING SECTIONS"

by

Mr. L. L. Ratnayaka

Mr. D.L.O. Mendis -

The Author has determined the expected waiting times during the evening peak only. Is there any special reasons for it?

Mr. L.L. Ratnayake -

The traffic surveys were done by the University students and it was possible to carryout these surveys during evening peaks only. Since evening delays are more than the morning, the results may indicate the higher bound values.

Mr. Mendis -

In the morning too there are lot of delays in these two routes and it is better to know the morning delays as well.

Mr. Ratnayake -

I too agree with Mr. Mendis. There are many delays in the morning as well. In this paper, I am trying to develop models to determine the reliability and delays. Once they are developed, it is possible to determine these two parameters irrespective of time.

Mr. Priyal de Silva -

Is it possible to increase the reliability and reduce delays by shortening the route 155. For example, if it runs from Bambalapitiya to Mattakkuliya, will there be an increase in reliability?

Mr. Ratnayake -

Since there are only a limited number of buses, certainly the reliability will be increased from Bambalapitiya to Mattakkuliya Strech, if the route length is reduced.

But the passengers travelling from and to Galle road may have to spend more time at the transfer stations. Since they have to travel in two buses travel costs too will go up for these passengers. Hence, an overall evaluation has to be done to determine the benefits and disbenefits of proposal of this nature.

Mr. Adhikaram -

What will be the change in reliability if the private bus operators too requested to operate large buses?

There will be a sharp increase in the reliability during the peak times. However, the reliability may be less during off-peak times with more number of smaller buses operating at frequent intervals when the passengers demand is less.

Discussion following the paper on

"AN ANALYSIS OF FACTORS CONTRIBUTING TO CONSTRUCTION CONTRACTORS' MANAGEMENT PROBLEMS AND POSSIBLE APPROACHES TO EFFECTIVE CONSTRUCTION MANAGEMENT"

by

Mrs. Geethi Karunaratne & Mr. Mervyn Gunasekera

Mr. Sunil Perera -

First I congratulate my very good friends Mr. Mervyn Gunasekera and Mrs. G. Karunaratne for a job well done and I would like to ask this question from Mr. Gunasekera. Out of 39 projects analysed, you mentioned that there was no planning done at all in 14 projects, ie. about 36%, and there was good planning in 3 projects, ie. about 8% of the total projects studied. Also you mentioned that the majority of projects went behind schedule and quite a number of them were extended; only about 7 of the 39 projects were completed on time. I am very interested in knowing how many of the 3 projects which were well planned were completed on time.

Mr. Mervyn Gunasekera -

At this moment I am unable to give an answer to that question as in the last 2 months we could not do not much in our research work. But one thing I must mention is that good planning definitely helps contractors to complete a project on schedule. On the same token if the consultant does not co-operate or if he is not a professionally qualified consultant, and at the same time if the client also does not support them, then there is very little a contractor can do, even with good planning. The only thing is that a contractor can contractually cover himself if he has done his planning properly.

Brig. P.N.K. Dias -

I will first thank the authors for their paper. We have had so many problems regarding the short comings of Architects, Consultants, Engineers, Contractors and the whole lot. Now for the future, can we not sit down and prepare a set of guide lines for each of these different parties, so that they will know their responsibilities and so that in future we could fix responsibility on each group; and also organise a forum where all these parties could be brought to one place to discuss these and lay down these guide lines.

Mr. Gunasekera -

Thank you very much Mr. Dias. One of the objectives of our Research Project which we hope to complete by the end of next year or so, is to prepare some guide lines in the form of a hand book for use by clients, consultants and contractors who will benefit from it.

Mr. D.L.O. Mendis -

I was a contractor in Sri Lanka about 5 years ago. So really I should give way to the contractors who are in the audience. I want to ask a couple of pertinent questions. Did the authors find a difference between aid projects and the treasury financed projects or are they all treasury financed projects that you investigated? I get the impression that as the size of the projects was this small, they were all government projects and may be you will have to run inquiry for so-called aid projects. But then aid projects you have a large number of foreign contractors, and local sub contractors; so here we have a situation where the sub contractors role has to be investigated separately. In the classical situation of client, consultant and contractor previously contractors used to employ labour contractors, where as now, as you also have recommended at the conclusion of your paper, there is a need to employ professional project consultants. So you get another skill involved in project planning and execution, ie. contractors' consultant. I know that in CDE Company Dr. Melva Perera perhaps was the first to employ contractors' consultants about 20 years ago. May be their experience at that time would be relevant to what you are inquiring into now. The situation of the construction industry today is such that, if we generalise you can say that the local construction industry has been driven to wall. Some firms have had to change and diversify. Long ago, when there was the first devaluation of the dollar in 1971 construction companies in United States faced this critical situation; and they diversified. So may be the leading companies in our country have also survived by diversifying in this manner; and this is the way that they have to survive the cyclic slump of capitalism. But at the moment we are going through this, quite apart from the political chaos, we are also going through the lower part of the financial cycle. So that when you look at a study like this, which is a very detailed study of a small aspect of a very large problem, it would be some times useful to get this into perspective. I appeal to the experienced local contractors here, please contribute to this as it is extremely important for their

wisdom and their experience to be brought to bear on this.

Mr. Gunasekera -

In this study, we have selected some treasury funded projects, but in the future work of our study, we have included some foreign aided projects also. At the same time we have included some foreign contractors also to see how they perform.

Mr. Wijesundera -

While congratulating the authors on this very useful paper, I would like to pose two questions to them.One is in the analysis of the data I wonder whether you could analyse the data for civil engineering work and the building construction projects separately. I have a hunch that you will get completely different results. Then going to the last para of your paper to commitment and dedication, I wonder whether you had the opportunity or any way of examining, how many of these construction managers try to manage their sites out in the field from head office in Colombo and how many really go in identifying themselves with the people in the field, the engineers, the technical officers and the workmen and work together getting a first hand experience of the problems in the field and solving them then and there, without allowing the problems to come to the Head Office and waste so much of time.

Mr. Gunasekera -

To answer the first question - actually out of the total number of 39 projects, 28 were building projects and 11 were civil engineering construction projects. But we have not analysed how many of the civil engineering projects are behind schedule or how many of the building projects are behind schedule.

Regarding the next question - we cannot tell you the quantitative figures. But we have found out during the discussions, when the contract is away from Colombo very rarely they have regular visits, to see. under what conditions the contractors' staff is performing, what are the problems they have at the site, etc. This is also one of the factors contributing to some of the problems which we have come across during this study. So what you mentioned is probably correct.

Mr. S.A.D.A. Subasinghe -

I think this subject is very very timely because at the moment most of our problems in this country as it has been mentioned, is the lack of committment and dedication and hardwork. Of course all these things, commitment and dedication all come under hardwork.

My question really is this. It was mentioned that the 39 projects studied had been from the public sector. I wonder whether the authors had any opportunity to study, even superficially, any private sector projects, where the conditions would be very different and the actual results would have been the main idea behind the whole thing. And also it was mentioned that 26 projects were behind schedule and that 14 projects had no planning at all. If that was the situation, how could we say these projects were behind schedule if they were not planned.

Mr. Gunasekera -

The first question - Yes, eventhough we studied some projects in private sector we have not included that in this report. All the projects included in the report were public sector projects. The 2nd question - 26 projects were behind schedule and in 14 projects there was no planning at all. We cannot tell you the names of those projects, in some projects, we have realised that the client has employed a lot of professionally qualified staff which should have been done by the contractor or the consultant, to ensure that the project is on schedule. For example, we have observed that in some of the projects the client himself has prepared the contractor's bill; client himself has prepared the contractor's construction programme. So eventhough the contractor did not have planning at the site, because of the support and also the work done by the client and the consultant from the other end, it has resulted in the completion of these projects on time. That was the main reason we can tell you for the difference between those two figures.

Mr. Kulatunga -

Regarding the competency of the contractors that you have taken into your study, were they prequalified or have they had any formal training either in engineering or in project management; some sort of background information. It is apalling to here the figures you gave. I have a feeling that most of them may not be competent contractors. Am I correct in saying that?

Mr. Gunasekera -

You are correct. What we have analysed in this study was - when we went to a project, we have checked what sort of qualifications those people have, because

we do not expect for a one or two million rupees housing project, a Chartered Engineer with two Assistant Project Engineers, a Quantity Surveyor and a Manager at the site to be employed. So depending on the project one must use one's experience and engage the minimum required staff for the work. For eg. if you are constructing a building like ICTAD headquarters, we cannot expect the contractor to employ a site engineer, who has only done the supervisory course or who has only 4 or 5 years experience. That would be inadequate. In our study it was a very difficult thing to consider each and every contractor's staff and analyse all these things. It is difficult but it can be done. However, we have not done it like what you mentioned. We have used our experience and our judgement.

Mr. G. Weerasekera -

As a small time contractor the problem that we are facing is that we find it difficult to employ qualified or trained people continuously, due to lack of work. We can't keep them in a continuous pay role. So what we do is when we get the contract we get the best available people there is at that time and employ them. So most of the time we find it difficult to get good people. Then they ask for not only a higher salary but they ask for continuous work. So this is one of the problems that we have. So because of this, although planning, controlling and all these techniques are important in any p1roject, do you think lack of minute detailed planning 7will very badly affect the completion of project on schedule and the profit, and that sort of thing.

Mr. Gunasekera -

Actually that is true. It is very difficult for contractors, even a very big contractor to employ very professionally qualified people to continue to provide this management support. I know I have worked in association with world's largest engineering contractors like Bactel and Parsons when I was away from the country. Even those companies do not have continuous staff sometimes. From contract to contract they employ the required staff. So therefore the option available to the contractor is to get services from a consultant who has the required competency, on a contract basis for that particular project.

The next question Mr. Weerasekera asked was whether it is really important to go to this type of planning. In early 1960s one of the American Universities did a research work. They got 3 groups, each group consisting of 20 students, all in the same grade. Each group was given a task in similar workshop conditions, given a time of 60 minutes to produce some articles to a given quality. They wanted to check the productivity rate during the given 60 min. Before starting, each group was called separately and the 1st group was given the materials and was told to produce the articles to the given quality. The 2nd group was instructed similarly but they were told that planning is important before doing any work. The 3rd group was briefed similarly but it was indicated to them that out of the 60 minutes the first 15 minutes they have to devote for planning. Only 45 minutes they can use for production. At the 60th min. all the groups were checked for their production. The results were not surprising. Highest production was from the 3rd group who devoted 15 min. for planning. The next highest production was from the 2nd group and lowest was the first group who did not do any planning. This shows the importance of planning. It is up to us to decide to what details we should go.

From the audience -

Specially, one worksheet is containing about 2000 cells, some thing like that, and I use a 4.77 mega hertz machine; I don't know whether it is due to that, or whether due to something else; and someone suggested to use a math co-processor which I did and by doing that I manage to cut down the time in a certain development process by about say 60%, but still it is very slow; I don't know how this kind of big programme in sort of get executed fast enough for us to utilise it.

Mr. Kamaladasa -

Actually, if we are using a floppy disk system, sometimes programme take a quite along time to access; even goes into minutes; but with the hard disk it can be upto 5 - 10 times faster; of course the maths coprocessor help during the calculation process, but not so much during the access of the diskette and of course there are other problems connected specially accessing the floppy is very slow; but if we use a hard disk it will be faster; there again the new computers with higher speed definitely help a lot; but sometimes those few minutes does not matter really compare to the number of hours or days you may have to do these calculations manually.

Mr. D.L.O. Mendis -

With all these computer literate bright young people in the audience, I was interested to touch on the other aspects which was the water management aspects.

What I want to ask is, whether this scheme, whether it was possible in this scheme, to measure soil moisture because with this a level of sophistication in the theoretical programme using your basic formula of rainfall and effective rainfall and the evapotransporation and so on; takes us to a low degree of accuracy in the inputs because what you are trying to do give moisture to the plant rootes; and if you have - what can I understand being rarely computer literate very effective programme here, I wonder whether it should be matched with direct soil moisture measurements.

Then regarding the observations you made I think that should be very boldly presented may be as a subject of a seminar in this Institution, because all people like myself, who constantly appear before you, ask that the younger people should participate, contribute and ask questions; now here questions has been asked which is tremendously important; when will this country take note of the resources of our own children; I think this should be the subject of an open discussion seminar what have you, we should invite for example Mr. Dayaratne, Hony. Fellow of this Institution; about 15 years ago we had a Minister, who was an engineer, name of Kumarasuriya, and he said, when I walking here, I said my ministerial role and I come here as a member of the Institution; I think we should invite Hon. Dayaratne to come in here as an Hony. Fellow and few other important people whom we meet and discuss this question.

One minor question - you use the word user friendly in your Introduction; Could you please tell me what you meant.

Discussion following the paper on

"APPLICATION OF LOTUS 123 IN WATER MANAGEMENT IN KIRINDI OYA IRRIGATION & SETTLEMENT PROJECT"

by

Mr. B.K. Jayasundera

Mr. Kamaladasa -

Really, what I mean is - there are computer languages, and those computer programmes written in some languages can be used only by persons competent or the persons who have studied those languages; but when I said user friendly I wanted to indicate that it is a programme that can be used by a person who has only a very little amount of knowledge in computer.

Mr. N. Madusuthanan -

Usually we use the word "user friendly" for programmes which gives you sufficient interaction from specially the screen, which enables you to know what to do next. eg. Programs in Basic Languages, can be user friendly if you have inputs saying "What is your name?" or "What is your age?". So that even a beginner can input these data.

On the other hand I would consider Lotus as a fairly dangerous program in the hands of a beginner. You can input a label instead of a value and all calculations will go out. It is user friendly only after you are familiar with its basic operations or if a clever macro is written by an expert as in this case by Mr. Jayasundera, but wrong key entries can make the program jump out of the macro. I would sum up that lotus has to be properly understood before doing serious work.

Mr. D.B.J. Ranatunga -

I would like to make few comments about his last questions; when are we going to appreciate our own people; well I want be able to talk very much about the entire engineering field, but I must say something about the use of computers by engineers we have set up a Specialist Study Group on Computers at the Institution of Engineers, Sri Lanka which I chaired last year; so we try to encourage as much as possible the engineers who are involve computers to come and share their knowledge with the other engineers, and at least this should be a quorum where they should come and say this kind of things can be done; now today's exercise that his presentation I am sure would have given lot of confidents to other engineers to this kind of user friendly programmes; you don't have to be computer literate to use these programmes; so called computer literacy is not required; if you know your mathematics and you know how to manipulate forms little bit of calculations within about one day any competent engineer can get on to a lotus 123 package; within about one day you can get onto it; after as you go on, you will keep on improve in your skills in the use of that; that do not think that puts you a lot of confidents in yourselves, that you can get onto this and start on it. A similar thing, experience in LECO you would know that when we wanted to start for instant a programme for electricity billing in this country we employed a team of consultants from Newzealand which we paid in the order of 6 Million Rupees for them to come and develop programme first; may be in that order, so they have written a programme; we have paid for it; we found that one of the engineers in the CEB who have already done it; and no one in the CEB, new such exercise had been done and its available and in fact thats much more powerful than what the foreign consultants did; and there are so many of those things; ther are many colleagues who are in the audience today; who use that they are use this computer packages in there every day to day work; today, but unfortunately it's not known to our engineers; in fact when you go and talk about computers in a non-engineering organisation; they say why not you get the Accountant to use the computer; don't blame the Accountant for it; because in the minds of the ordinary people they have created image that the computers are use by the Accountants; not by the engineers, the engineers should be telling the public that we ourselves also can use it; I would like to invite you all to come and join this SSG and we would more organise this kind of seminar where you can come and share your knowledge with the other engineers for already doing similar work.

Mr. G.T. Dharmasena -

I am here not to ask questions, but to make few comments; I think as Mr. Kamaladasa mentioned this programme is really prepared by one of our engineers and according to my memory, this may be the second of this kind; I think one programme was prepared sometimes back by Mr. Godaliadda in this particular field in the field of water management; so according to my memory this seems to be the sec-

ond; Mr. Kamaladasa mentioned about the work done by foreign consultant at Kirindi Oya; I can tell you I am personally aware, eventhough it is not my direct work. Constantly, I was in touch with these foreign consultant, as he said, actually the work done by them, really no use, because from the time they came I myself mentioned that if you are preparing a programme; there should be a manual; actually they brought a programme from some where and they were trying to calibrate it; so ultimately they left the programme when no body can operate,. if I use the same word that programme was not user friendly; so only those people could operate the programme; and also they went without a manual; I don't think anybody in the Irrigation Department with I myself brought a copy for my interest; can operate from that without a manual, only thing is when the work is done by a local man it is not appreciated; I can true that point if you see the audience today; now this was done by a young engineer from the Irrigation Department even those who are involving with water management, most of the people are not here.

Then coming back to the point mentioned by Mr. D.L.O. Mendis, I think what he said is to prepare a water management programme based on the soil moisture; in other words, now when to irrigate we should decide on the basis of soil moisture, actually the concept is really good and also the technology is available; now just to explain we can have censors in the field to get the soil moisture and it can be translated into a central computer; and from the computer we can find out different space in the field; how is the soil moisture; based on the soil moisture, we could decide the required amount of irrigation; of course when we come to this point most of these items, we have to buy from outside; so when you get down these things and if it becomes out of order may be after one year either we had to purchase it abroad or we should be able to repair; but to repair these things, we must train our local people to do that; so in developing country if you try to do that types of thing you know what is happening at Air Lanka will happen; so because as we are in a developing country that trained technicians; will not stay the moment the training is given they will find a new job; that is a problem in any developing country, so if you want to do the correct thing, we must follow India; India what they do is; they manufacture most of their items; they know how to manipulate that; they can do it; because it's a large country; this is the problem, we are having, but the technology is available if we went to do it; we can have the instruments, if possible for us to have a water management programme, based on the soil moisture.

Mr. N. Madusuthanan -

The basic formulaes whether we are using the correct theory behind water management or for that matter on any other subject, whether we should use proper soil moisture so that when moisture decrease to the wilting point to start irrigating are in the (human) hands. The computer is only what they called a GIGO machine or Garbage in and Garbage out machine. So the output is no better than the quality of what you input.

There are two aspects computer provides a fast calculating medium; it will repeat calculations fast. Still we should be very strong in our fundamentals and willing to change the fundamentals whenever required and our complete thinking should be charged whenever it is necessary; I think having a one day seminar for the whole concept of water management with free discussions will be a very useful exercise; It will be useful to the country as a whole and to each one of us as individuals.

About the local and foreign consultants I also agree; but when we talk of the foreign and local main problem is amongst both parties there is the good and the bad. But we are paying for foreign experts; When we want the foreign experts, we don't want the bad experts to come in. We want them who are good in their work; There is a saying that they come as experts for rice and see rice plants first time in Sri Lanka. But not all of them. We should be in a position to see who is good and who can transfer their technology or use their technology. And we should also appreciate the talents we have. When local expert is available he will be paid only the normal local salaries. The foreign experts with less experience is paid very high and taken in. Local experts like Mr. Jayasundera spend their valuable private time not only to produce an excellent programme but to fully document it; This is one of the very important things; As Mr. Dharmasena pointed out, the programme foreign expert had done, had no manual or documentation and it is safer for the experts and that may be why they avoid any documentation.

However, here we have a programme documented so fully, I think its highly appreciated; because anybody can reproduce it, of course with copy rights and we should properly acknowledge in kinds or in proper tangible terms; I am very happy to see that this may be one of the very few progammes which are properly documented; others say what a programme can do; but we don't know how it does; all the secrets of the programme is in the paper for which our thanks again.

Mr. A.D.S. Gunawardana -

I might be saying the wrong thing, in the sense, that it might be against the impressions that the accomplishment of the author Mr. Jayasundera had on you; but please don't take it that way; I hope I will be sufficiently clear; now for water management they have developed a computer programme and its been used, probably at Kirindi Oya and they are trying to use this kind of thing elsewhere as well.

I am not trying to tell you about myself, for that matter, when we manage water in Parakrama Samudra something like 10 years ago; about 10 years ago with no water, we had only 1/2 tank full for 3 seasons we carried on like that; we had no computers, no extra Engineers, no Technical Assistants; but still we manage to do it with no water; I don't think with all the computers you can still do what engineers themselves could do you using their own brains; of course their challenges made or at this request made by couple of engineers for people of our generation to take into computing.

Just to give another example - when man landed on the moon probably at least people of my generation and the senior people will remember man landed on the moon, sometimes around mid night local time and they were going down and they were supposed to land on a plain area; and it was a computer programme and it was all auto manage; about 500 ft. away from the lunar surface, Neil Armstrong saw that they were going to land on a slope and if they did land on the slope they would have never come back; so he took off the computer controller and took over the manual controller and landed elsewhere; that's what the human being could do against the computer.

Mr. Ranatunga -

Human brain is a very good analytical tool. But it is very bad at repetitive calculations. The computer can do million times faster what you could do. I always come across this problem how many of us have been saying what is the use of mathematics we learnt in the University - Laplace transform Courier series, matrices. How many of us have used those - why? Is it because those mathematical tools are bad. No. Because we did not have the capability of using them. But I must tell you now, can you ever think of the time you take to invert a six by six matrix. Because of the difficulty we never do it. We allow human intution to go thro' that and give whatever closest answer. But we never do it. If we have a computer even a hand held programable calculator can invert a six by six matrix within couple of minutes. If you have that kind of powerful tool why not we use it. If we don't use it we will be behind the foreign experts. That is where the difference is. The foreign experts have access to these tools. They do not know half what we know. But they put things in refine way and he gets the job. Now for instance I have in my office a mathematical model where I put in a very small operation about Eppawala phosphate. If you tell me tomorrow that dollar is going to be Rs.42/- within about half a minute; I can tell you the profitability and i can generate a profit and loss statement, a balance sheet, taking the change into account. Or else if the electricity prices go up by a 20% I can give you relevant figures based on that. But how long will it take for a bright Engineer to work it out mentally. You can get it fairly close but it is difficult. So what is required is to use these tools to enhance your inherent human capability. I think I am qualified to say I am an old Engineer and being an old Engineer when I say this kind of thing please accept, because what had happened is most of old Engineer have a feeling that this kind of gimmicks are for the younger people. Not for us. But it's not true. That is because some of us things that we have already passed the age. No I can take any one of you to lotus 1-2-3 program in half a day. I take this as a challenge. After going through a half day course you will be using lotus 1-2-3 of course not in a very sophisticated way, but you can; why not you try it.

Mr. Gunawardana -

Minutes after the man landed on the moon the Voice of America correspondent interviewed another Scientist. Of course a person nothing to do with moon program. The first sentence he said was if not for the computer man never would have landed on the moon. If reinforces what you were saying and also to give an example from the Irrigation Department what I referred to you earlier this particular Engineer was not given the scholarship for some reasons including not knowing English and the person who decided not to give it is very old now around 60 and now begun to learn computer.

Mr. Madusuthanan -

I think I will make a few concluding remarks; my friend A.D.S. who spoke earlier may benefit further. As I told earlier computer is only a GIGO machine. As we are not anyway loosing our thinking ability surprise to find that thinking ability really is sharpened. "Libxitz" in the 16th or 17th century told that it is a pitty to see intelligent bright young men wasting their time doing calculations. We are only

saying that using a computer will be to get out of using labour by the way of may be using the slide ruler or calculator whatever upto a certain level you can think of problem and solve it using your intelligence to a maximum, without getting involve in deciding whether one plus two is three or four. Let the computer attend to it. But your ability to think straight or to reason out still remains and man is supreme. Let us not forget it. Whatever the computer is computer is a tool. After all if you want to dig the ground do we use the hand or do we use a memory. Similarly, if we want to do a complex calculation repeatedly, use a computer. If you use a calculator it will take three days or may be more. With a computer you can do it within minutes. With all told, we can conclude that water management is a subject which needs very prime human brain thinking. Let the computer to do the slave work for us, of doing all computations whether it is lotus or any other program the computer can do the work for us. And as Mr. Ranatunga pointed out as Chairman SSG of computer application we are holding seminars and workshops on computer applications and all are welcome to take part in those. Also that thinking of computer something either superior or inferrior should go out. It is within our control or within our hands, to use a tool and nothing more. With that let me also now pay tribute to Mr. Jayasundera for his work. He has done a very good, excellent work and also Mr. Kamaladasa has done a very good job and I think the discussion credit should go to him, because the whole disussions was on the question when will local experts be recognised so ready the discussion was based on that and not on the subject so much. So thank you for a very good job done also.

SEMINAR

ON

"THE ROLE OF THE ENGINEER IN THE PLANTATION INDUSTRY"

Held on 26th October, 1989 at 9.00 a.m. at the Institution Auditorium.

Following papers were presented :

1. 'Engineering Aspects in the Tea Industry' by Dr. S.A. Samaraweera, Tea Research Institute
2. 'Engineering Aspects in the Coconut Industry' by Mr. P.G. Joseph, Coconut Development Authority
3. 'Local Manufacture of Machinery for the Plantation' by Dr. A.N.S. Kulasinghe, Chairman, National Engineering Research & Development Centre
4. 'Need for Research in Agricultural Engineering' by J.A. Lewis

THE GUEST LECTURE

The Guest Lecture was delivered by Prof. Boris Zhivotovsky, Professor of Hydraulics & Hydro-technical Construction at the Peoples Friendship University, Moscow on 'Design & Construction of Hydro Power Stations and Hydraulics Structures.

* * *

MINUTES OF THE 83RD ANNUAL GENERAL MEETING

The 83rd Annual General Meeting of the Institution of Engineers, Sri Lanka commenced at 0900 hours on 31st October, 1989 in the Institution Auditorium. The meeting was chaired by the President, Mr. S.M.B. Dolapihilla. 92 members were present.

1. NOTICE CONVENING THE MEETING

As requested by the President, the notice dated 22nd August 1989 which had been already circulated among all Corporate Members was read by the Honorary Secretary, Mr. E.J. Sunil Perera.

2. OBSERVING A MINUTE'S SILENCE IN MEMORY OF MEMBERS WHO PASSED AWAY DURING THE YEAR

A minute's silence was then observed on the demise of the following members :

Mr. J. Bala Gunasekeram	-	Fellow
Mr. C. Rasiah	-	Fellow
Mr. N.W. Suraweera	-	Fellow
Col. C.M. Perera	-	Fellow
Prof. C. Patuwathavithana	-	Fellow
Mr. S.C. Weerasinghe	-	Fellow
Prof. H.B. de Silva	-	Fellow
Mr. F.F.A. Wilkie	-	Fellow
Mr. S. Vinayagamoorthy	-	Member
Mr. G. Ambrose	-	Member
Mr. S. Mohanaraj	-	Member

3. MINUTES OF THE 82ND ANNUAL GENERAL MEETING

The Minutes of the 82nd Annual General Meeting held on 28th October 1988 which were circulated amongst the members in Transactions 1988 Vol. II were taken up for discussion. The Minutes were confirmed as correct without any amendments, being proposed by Mr. S. Panchacharavel and seconded by Mr. Priyal de Silva.

4. REPORT OF COUNCIL FOR 1988/89

The Report of the Council for the Session 1988/89 which was circulated in Transactions 1989 Vol. I pages 27-36, was taken up for discussion.

* As pointed out by Mr. D.D.S. Jayawardena, Executive Secretary, in page 30 - 'Elections to Council for 1989/90' - Cdr.(E) D.A.P.S. Daranagama's name should appear as Representatives members under 40 years (and not over 40 years).

* Mr. T. Aravindan, Student Member, referred to pages 29 (Examinations) and 36 (Membership figures) wherein the Student membership has decreased by 98 during the outgoing session. He highlighted the inability of engineering undergraduates appearing for IESL Examinations and the consequent disincentive it has turned out to be from becoming Student Members. President thanked Mr. Aravindan for the issues raised by him, including publicising the Institution among engineering undergraduates, and assured that the Council would be making note of the suggestions.

The Report of Council was then adopted with Mr. Peter Samuel proposing and Mr.George Samarawickrema seconding.

5. STATEMENT OF ACCOUNTS FOR THE PERIOD 01.01.1988 TO 31.12.1988 & REPORT OF AUDITORS THEREIN

The Annual Statements of Accounts for the period 1st January 1988 to 31st December 1988 was then taken up for discussion.

* Mr. D.B.J. Ranatunge, Hony. Treasurer, outlined the improved asset base of the Institution which had appreciated by Rs.770,000/- during 1988 and having assets of Rs. 3.1 million which are readily convertible to cash. He strongly advocated that the Council should proceed with the building programme. He stressed on the three major items of expenditure of the Institution as follows :-

Cost of Employment - Rs. 612,000/-
Cost of Publications, publicity etc. - Rs. 520,000/-
Cost of Conferences, Seminars etc. - Rs.200,000/-

Mr. Ranatunge stated that the theory classes are being conducted just at break even cost.

* Mr. L.C.R. de Silva enquired whether the nearly Rs. 1 million in current accounts could not be invested more lucratively to obtain the best return, even if operations have to be carried out on overdraft.

* Mr. D.D.S. Jayawardena explained the need to maintain Rs.400,000/- in current accounts at any given time and why it went up to nearly Rs.700,000/- at end of December, 1988 (due to theory classes and professional review fees). In January 1989 a fixed deposit of Rs.300,000 was opened. According to By-laws, fixed deposits could not be opened in Commercial Banks.

* Mr. D.B.J. Ranatunge added that the Institution, being not a business venture, is exempt from tax as it is a non-profit making organisation. The By-laws have been enacted for prudent financial management. As such the Institution needs to be careful when getting involved in profit making activities, lest they may lose favour with the government.

* Mr. J. Varnakulasinghe commented that if money is placed in a current account, only 1% more interest needs to be paid to obtain an overdraft, when compared to money in call deposit. He suggested that the income from Techno Exhibitions be deposited into a separate account so that the interest earned on it could be made available for publicising the Institution. He also referred to the need for indicating the dates on which the various fixed deposits were opened, in the Statement of Accounts. He pointed out the desirability of re-assessing the assets, including the Headquarters building, to ascertain their true market values. He concluded his comments by proposing that a separate fund be maintained for life membership to ensure its viability.

* Mr. D.L.O. Mendis responded to Mr. Varnakulasinghe's observations on life membership by proposing that provision be made in the By-laws for every life member to introduce another member. This would ensure that the Institution would not lose on account of current amortised life membership fees in the face of future inflation. He also highlighted the necessity of maintaining an account for the History of Engineering Project and mentioning in the Report of the Council of his appointment as the Honorary Editor of this series of publications.

* Mr. D.B.J. Ranatunge further added that since the format for presentation of Annual Statement of Accounts as presently determined by the Auditors is not satisfactory, he proposed that in the future the Council should prepare the presentation.

Subsequently the Annual Statement of Accounts was adopted being proposed by Mr. A.N.P. Wickremasuriya and seconded by Mr. D.L. Taldena.

6. ELECTIONS TO COUNCIL FOR 1989/90

As given in page 30 of Transactions '89 Vol. I, the report of Mr. V.C. de Silva, Chief Returning Officer for the 1989/90 Elections to Council, was noted as follows :

President:		
Prof. C. Patuwathavithana	-	elected uncontested
Past President :		
Mr. W. Premaratne	-	- do -
Hony. Secretary:		
Mr. E.J. Sunil Perera	-	- do -
Chairman, Mechanical Engineering Sectional Committee :		
Mr. A.N.P.Wickremasuriya	-	- do -
Chairman, Electrical Engineering Sectional Committee :		
Mr. B.R.O. Fernando	-	- do -
Representatives Fellows :		
Mr. L.J. Weeraratne	-	- do -
Mr. H.A.D.P.M. Gunasekera	-	- do -
Mr. K.S. Senanayake	-	- do -
Mr. D.L. Taldena	-	- do -
Representatives Members :		
Mr. M.S. Fernando	-	elected uncontested
Mr. L. Tilakaratna	-	- do -
Cdr (E) D.A.P.S. Daranagama	-	- do -
Vice Presidents :		
Prof. A. Thurairajah	-	445 votes - elected
Prof. D.S. Wijeyesekera	-	389 votes - elected
Prof. S. Karunaratne	-	353 votes - elected
Mr. D.G. Senadhipathy	-	306 votes - elected
Mr. S.A.D.A. Subasinghe	-	281 votes

7. APPOINTMENT OF AUDITOR

Mr. S. Panchacharavel proposed and Mr. D.L. Taldena seconded that Tudor V. Perera and Company who have been auditors of the Institution since 1983, continue for the next session too.

8. RESOLUTIONS

(Vide pages 37 to 45 of Transactions 1989 Vol. I)

Resolution 1 - from Council to add a By-law to bring in a By-laws Revision Committee. The following members expressed their views :

Messrs. L.R.L. Perera, S. Panchacharavel, D.L.O. Mendis and J. Varnakulasinghe.

The resolution was carried in its original form.

Voting :	for	- 69
	against	- 02

Accordingly the following 6 Corporate Members were elected by the AGM to serve in the By-laws Revision Committee :

Mr. Priyal de Silva
Mr. G. Kulatunga
Mr. J. Varnakulasinghe
Mr. S.A.D.A. Subasinghe
Mr. D.L.O. Mendis
Mr. R.S.C. George

Six posts will be filled by the Council.

Resolution 2 - from Council to amend By-laws 28, 30 & 32 on Professional conduct and delete By-laws 33 & 34. The following members expressed their views :

Prof. S. Karunaratne, Rear Admiral K.R.L. Perera, Prof. D.C.H. Senarath, Messrs. L.R.L. Perera, S.A.D.A. Subasinghe, S. Panchacharavel, V.C.R. de Silva, Saravanapavanathan, G. Kulatunge, D.L.O. Mendis.

The Resolution was carried as follows :

Amended By-law	Voting for	Voting against	Total present
28 (ii) (With the addition of words "as Appendix 1" after "the Code of Ethics"	unanimous	-	62
30 (with the addition of words "but none of whom is a sitting member of the Council in session" after "set up a Disciplinary Committee comprising of three Fellows, at least one of whom shall be a Past President"	43	03	62
32 (with the deletion of last sentence of para 3)	49	09	64
33 (to delete)	46	03	62
34 (deleted automatically in view of 33)	unanimous	-	62

Resolution 3 - Proposed by Prof. H. Sriyananda, seconded by Prof. N.R. Arthenayake and supported by 3 Corporate Members.

After the Executive Secretary read out the alternative resolution in this regard, as proposed by the Council, Prof. Sriyananda and Mr. D.L.O. Mendis expressed their views strongly in favour of passing the original resolution. It was unanimously carried.

Resolutions 4 to 9 - Proposed by Mr. S.A.D.A. Subasinghe, seconded by Mr. K.K.A.C. Samarasinghe and supported by 12 Corporate Members.

Resolution 4

The following members expressed their views :

Rear Admiral K.R.L. Perera, Prof. S. Karunaratne, Messrs. S.A.D.A. Subasinghe, J.P. Senaratne, T.D.M.A. de Silva.

Voting : for - 22
against - 23

Resolution 4 was defeated.

Resolution 5

Voting : for - 40
against - 06

Resolution 5 was carried.

Resolution 6

The following members expressed their views :

Prof. D.C.H.Senarath, Prof. S. Karunaratne, Messrs. S.A.D.A. Subasinghe, D.B.J. Ranatunge, R. Lokubalasooriya.

Subsequently the following amended proposal was placed before the house instead of the original resolution :

Amended proposal No. 1 (proposed by Mr. L.J. Weeraratne and seconded by Mr. D.B.J. Ranatunga) -

"This house resolves that deliberations of the Council be reported in greater detail in 'IESL News'"

Voting : for - 16
against - 03

Amendment No. 1 was passed.

Amended proposal No. 2 (proposed by Mr. R. Lokubalasooriya and seconded by Mr. S. Kirupananther).

"This house resolves that in view of the lack of adequate information to the general membership on the performance of their representatives they elect to Council and Committees, proceedings of such meetings should be adequately reported in the 'IESL News' regularly in a manner that enables the general membership to ascertain the contribution and participation of such representatives".

Voting : for - 10
against - 31

Amendment No. 2 was defeated.

Resolution 7

The following members expressed their views :

Mr. S. Panchacharavel, Prof. D.S. Wijeyesekera, Mr. D.L.O. Mendis & Prof. D.C.H. Senarath, besides the Executive Secretary.

Accordingly, the following amended resolution was placed before the house as proposed by Prof. D.S. Wijeyesekera and seconded by Prof. S. Karunaratne, in place of the original resolution :

"This house urges that the President, in consultation with other officers of the Institution and the Chairmen of the Sectional Committees, shall present at the second Council meeting of a session, a Work Programme for the year and this programme to be published in the Newsletter for the benefit of the general membership".

Voting : for - 44
against - 01

total number of Corporate Members present at time of voting - 62

The amended resolution was carried.

Resolution 8

The following members expressed their views :

Mr. D.B.J. Ranatunge and Mr. S. Panchacharavel.

Voting : for - 27
against - 14

Resolution was carried.

Resolution 9

The following members expressed their views :

Messrs. D.L.O. Mendis, Priyal de Silva, S.A.D.A. Subasinghe and M.C.A. Rahuman.

Accordingly the question of considering all the amendments to By-laws referred to in the resolution as one package and placing before the house for voting was taken, with the item 45 suitably amended.

This was carried with 42 for and 07 against.

Thereafter the entire package was taken up.

Voting : for - 18
against - 27

Thus the entire package of the Resolution was defeated.

9. ADDRESS BY THE OUTGOING PRESIDENT

Mr. S.M.B. Dolapihilla in his address thanked the Council, Committees, Office Staff and everyone else who contributed to the activities of the Institution during the outgoing session.

Among the achievements he highlighted the progress made in the Registration of Engineers proposal, Technician Engineers class of membership, Benevolent Fund and preliminary activities of building the Multi-purpose Hall.

He paid a glowing tribute to the late Prof. C. Patuwathavithana for the advice and guidance given to him. In view of the tragic and untimely demise of Prof. Patuwathavithana, he proposed that the most senior of the Vice Presidents be elected as the President for the forthcoming session, to continue a healthy tradition. Accordingly he proposed that the name of Prof. A. Thurairajah be nominated as President for the session 1989/90, subject to formal election by the Council.

The house endorsed this.

10. INDUCTION OF PRESIDENT FOR 1989/90

The cloak of office and the chain of office was then handed over to Prof. A. Thurairajah.

Prof. A. Thurairajah in his address acknowledged the honour bestowed on him in nominating him as the new President. He solicited the cooperation of the Council, Office Bearers, Executive Secretary, Office Staff and all members to enable him to fulfil his duties effectively.

11. TERMINATION

The Annual General Meeting was terminated at 1.00 p.m.

E.J. SUNIL PERERA
HONORARY SECRETARY