

CCI
SRI LANKA

Bulletin

THE NEWSPAPER OF THE CONSTRUCTION INDUSTRY SRI LANKA
CHAMBER OF CONSTRUCTION INDUSTRY SRI LANKA, 65, Walukarama Road, Colombo 03, Tel: 577811, 577812, 577815 Fax: 577816 E-mail: cci@sri.lanka.net

Page 4 Towards sustainable development in Sri Lanka an Architectural overview

Page 7 The new SLIA President pronounces his vision 'Architecture to the People'

Page 13 Women in Construction

Page 17 Gabion Walls

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Is the private sector the engine of growth? - CCI President

The Construction Industry is yet to take off from the lull which prevailed over the past few years. Despite this crisis the Government continues to give a major part of the government work directly on agreed 'turnkey' terms to Public Sector Construction Agencies. This is at a time when the Donor Agencies have excluded the prequalification of Public Sector Construction Organisations tendering for Donor funded projects. At least if the government obtains competitive bids for the same work given to the Public Sector Agencies from their local counterpart in the Private Sector there is a level playing field. The Government on the other hand claims that the



A 9 Road Construction in progress in the North.

engine of growth is the Private Sector and at the same time is comfortable giving work to the Public Sector Agencies even at a higher price.

One other serious set back to the Construction Industry is the bureaucratic bottle necks which

Contd. page 6...

Chamber Meets Multi Lateral Agencies

Chamber Delegation led by their President, Deshabandu' Surath Wickramasinghe which consisted of Eng. D.D. Wijemanna, Mr. Jayasiri Samarathunge, Archt. Rukshan Widyalkara, Mr. Eddie De Zylva, Eng. Tudor Munasinghe and Mr. Dakshitha Thalagodapitiya met with Mr. Peter Harrold - Country Director, World Bank Resident Mission on 7th July 2003 and Mr. John Cooney Country Director, Asian Development Bank on 8th July 2003 to discuss the modalities of ensuring the speedy implementation of the Reconstruction / Rehabilitation of the Projects in North and East and other construction related projects.

The consensus arrived was for the Chamber to act as the implementing agency using their members, subject to Donor Agencies being satisfied that acceptable procurement procedures are followed. At these meetings the Chamber

pointed out the need to adopt new procurement procedures, for expeditious implementation of construction related projects, the major component of the programme for which US \$ 4.5 Billion has been pledged at the Tokyo Donor Meeting.

Chamber also stressed the urgent need to undertake a contracting capacity building exercise - skills development, adopting competency based training techniques, and volunteered to extend its support using the contracting community to provide 'on the job training' facilities. The Donor Agencies noted this proposition with keen interest.

The CEO had a meeting on 10th July with Mr. Russell Sunshine, Project Manager - 'Invest-In-Peace' Project, of the UNDP and Mr. S. Sivananthan, Commissioner - Strategic Planning & Resource Mobilization Office of the Commissioner General for Coordination of Relief,

Rehabilitation and Reconciliation. The meeting was focused on an in-depth assessment of the training needs and Chambers ability to meet the demand.

At the Roundtable Conference on "Mobilizing the Local Private Sector to Participate in North and East Reconstruction Programme" held under the auspices of the UNDP and attended by Representatives of Multi-lateral Donor Agencies such as World Bank, Asian Development Bank, Japan Bank for International Cooperation among others, Deshabandu' Surath Wickramasinghe emphasized the Chambers role in facilitating Public/Private Partnerships and iterated its ability to find solutions for constraints such as Obsolete Unrealistic Government Estimates of Project Construction, Shortage of Skilled Labour, Management Practices (including, inadequate financial disciplines), and Lack of domestic procurement expertise.

Minister Thondaman to Attend as Chief Guest

The Minister of Housing and Plantation Infrastructure **Hon. S.Rm. A. Thondaman** will attend the function associated with the signing of Memoranda Of Understanding between the Chamber and the Construction Industry Development Council (CIDC) of India and the Indian Society for Trenchless Technology (INDSTT). His Excellency the High Commissioner for India in Sri Lanka has been invited as the Guest of Honour. The event is scheduled for Friday the 25th July 2003 at 5.30 p.m at The Colombo Plaza.

The day's proceedings are sponsored by **International Construction Consortium Ltd.** a leading multi-disciplinary engineering contracting company as a reflection of their commitment to promote Trenchless Technology in Sri Lanka.

A Sri Lankan Society for Trenchless Technology will be formed under the guidance of the International Society for Trenchless Technology (ISTT) located in the United Kingdom.

Representatives from all sectors, which would benefit from the application of Trenchless Technology have been invited to attend the function. (see detail report on page 3).

A USAID Delegation led by a Senior Education/Gender Advisor Dr. Vijitha M. Eyango visited the Chamber on the 10th July to explore the possibilities of obtaining Chambers participation in the Management of a Vocational Training Project. This meeting with the chamber was arranged by Mr. Ken Balendra.



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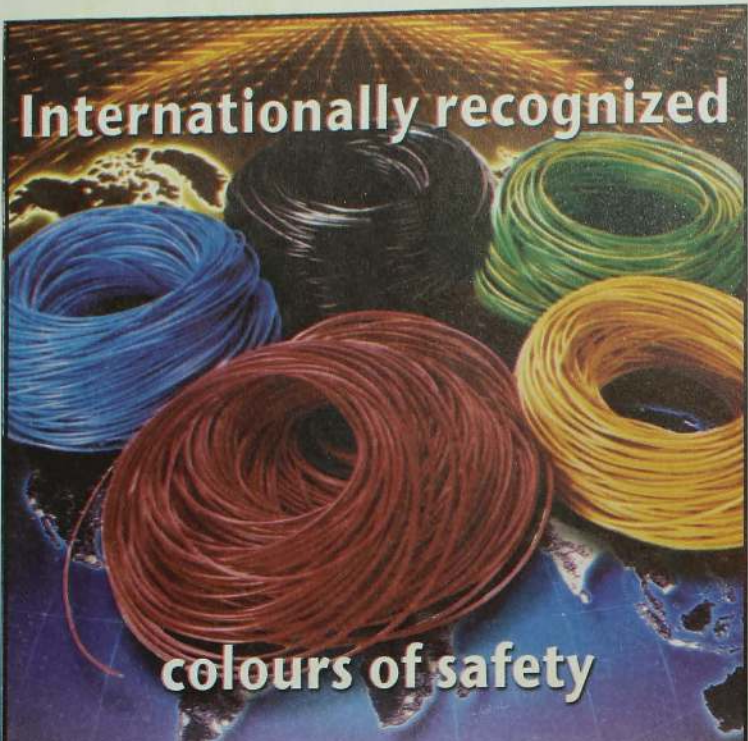
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Editorial

Our Commitment to 'Regaining Sri Lanka'

The CCI President in the inaugural issue of the Bulletin stressed the need to undertake Mega projects to kick-start the construction industry. The solid infrastructure, super highway construction are considered as priorities for rapid economic development of the island. This Chamber has also emphasized the need to facilitate public, private partnerships undertaking development-oriented projects. The Hon. Minister, Tilak Marapana at a meeting held with CCI at the Ministry of Highways stressed the need to involve this Chamber in planning, designing and construction of the national road network. In a subsequent issue we iterated the need to involve the local consultancy professionals in the planning of major development projects. Today we reiterate that projects that are within the executing capabilities of the Sri Lankan Consultants and Contractors should be handed over to the local fraternity. We are continuously making representations to both the Government and the multi lateral agencies that the most expedient method of implementation lies ahead with this Chamber undertaking such assignments.

The Chamber of Construction Industry, Sri Lanka being the umbrella organization of all construction related professionals and the contracting community is the ideal vehicle for the Government and the Donor Agencies to have their projects expeditiously executed.

"Regaining Sri Lanka" the policy document identifies that restoration of economic growth in the island and reconstruction and rehabilitation of the North East are prioritised strategies available for reduction of poverty. It further stresses the need to reduce transport costs and delays posed by the road transportation system rendering large number of rural households being trapped in poverty making it uneconomical for them to market rural produce in the more affluent urban market.

Chamber sponsors an inter-professional consultative committee for the construction industry.

With the aim of having a fully co-ordinated and integrated Construction Industry with a high degree of professionalism, comparable with countries in the region, the concept of forming an Inter-Professional Consultative Committee under the auspices of the Chamber has been mooted.

Such a Committee is expected to identify problems, analyse the causes and recommend solutions facilitating improvement in the quality, standards, practices, performance and cost effectiveness. This will also facilitate better understanding among the professionals and others associated with the domestic construction industry and will minimize disputes between associated parties.

Eng. Rohan Tudawe has been requested to convene the Inter Professional Consultative Committee

Chamber to Set up a Research Centre

The Council decided to establish a Research Unit and a data-base for provision of all construction related information and data. With the continuous increase in the cost of inputs like sand, aggregate, steel etc. the need to have a reliable and an updated data base with regular monitoring is greater than ever before.

The Chamber will obtain assistance of the University of Moratuwa.

CCI enters in to Memoranda Of Understanding with CIDC and INDSTT of India

for Regional co-operation and Technology upgrading.

A Memorandum Of Understanding will be entered into on the 25th day of July 2003 between the Construction Industry Development Council of India and the Chamber of Construction Industry Sri Lanka. CIDC was established by the Planning Commission, the Government of India along with the Construction Industry in 1996 to bring about an all-round improvement in the Indian Construction Sector.

This arrangement will facilitate working in collaboration in the following areas for the benefit of the Indian and Sri Lankan Construction Sectors.

- Management Training and Skills Development
- Trade Testing and Certification
- Manpower Recruitment
- Construction Financing
- Quality Management and Assurances Services
- Risk profiling and assessment initiatives
- Facilities for Arbitration, Mediation and Conflict Resolutions
- Development of Export Market for Manufactured Construction Material and Overseas Contracting / Sub-contracting operations.
- Promotion of foreign investment in infrastructure projects, Joint Ventures / Foreign Collaborations
- Networking with other National Organization and dissemination of information regarding good practices.

At the same occasion the Chamber of Construction Industry (CCI) will promote Trenchless Technology in Sri Lanka for which purpose a Memorandum Of Understanding will be entered into with the Indian Society for Trenchless Technology (INDSTT).

INDSTT is affiliated to the International Society for Trenchless Technology (ISTT) and is committed to promote Trenchless Technology as the science of installing and rehabilitating under ground utilities without digging open trenches. This No-Dig method is used for laying water, sewage and gas pipelines, electricity and communication cables and other under ground utilities.

The rapid development of capital cities warrant immediate rehabilitation, renovation, augmentation of existing old sewerage and water pipelines and also new installation such as Optic Fiber Cables, Communication Cables, Power Cables, Television Cables etc. The application of this new technology will result in no inconvenience being caused to the general public and no interruption to common amenities. Most Mega cities in the developed world today have committed themselves to the application of Trenchless Technology. This co-operate initiative is expected to facilitate the adoption of Trenchless Technology in Sri Lanka.

Mr. P.R. Swarup the Director General of the Construction Industry Development Council and member of the Governing Council of the Indian Society for Trenchless Technology will attend this function to sign the memoranda. Minister of Housing & Plantation Infrastructure will grace the occasion as the Chief Guest with the High Commissioner for India in attendance.

International Construction Consortium Ltd. who have been in the forefront of promoting Trenchless Technology in Sri Lanka will sponsor this important event.

Diary of CCI Events.

5th June 2003 :

Visit of the Malaysian Delegation consisting of Mr. Tan Sri Tee Hock Seng, and Mr. Datuk Ayob Hj Ketot of Master Builders Association of Malaysia to the Chamber Secretariat to meet Council Members and Corporate Members.

13th June 2003 :

Meeting with VTA, NAITA, ICTAD, NCA on the Skills Development and Trade Certification for Construction Workers at ICTAD CCI was represented by Mr. Dakshitha Thalagodapitiya C.E.O.

20th June 2003 :

Presentation on Tharuna Aruna Programme by Mr. Nimal Samarakkody Chairman of the Taruna Aruna Institute at the Ceylon Chamber of Commerce. CCI was represented by Mr. Dakshitha Thalagodapitiya, C.E.O.

23rd June 2003 :

Roundtable discussion on Mobilizing the Local Private Sector in the North and East Reconstruction Programme, organized by the Coordination of Relief, Rehabilitation and Reconstruction. CCI was represented by Deshabandu Surath Wickramasinghe – President

24th June 2003:

Meeting with NAITA, NCA, ICTAD on Skills Development and Trade Certification for Construction Industry workers at CCI Auditorium.

30th June 2003:

CEO's Roundtable Meeting with visiting US Congressmen and their team to discuss the proposed TIFA Agreement and the Prospects for US Investment organized by the Ceylon Chamber of Commerce. CCI was represented by Deshabandu Surath Wickramasinghe, President

30th June 2003:

Meeting with Chairman and Vice Chairman of Vocational Training Institute regarding collaboration arrangement to undertake Vocational Training in Construction Skills.

Chamber Of
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Sri Lanka



we strive to

- Be the voice of the Construction Industry
- Provide Management and skills education and training for the construction industry
- Be the promoter of services and business opportunities for the Chamber Members
- Catalize the formation of construction consortia
- Disseminate information for the Chamber Membership
- Facilitate market research and promote foreign collaboration
- Promote public / Private partnership for Infrastructure and related projects
- Initiate the pension, health and retirement benefit plan for the construction industry

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Towards sustainable development in Sri Lanka

an architectural overview by Prof. Chitra Wedikara.

Mrs. Chitra Wedikara, is the Professor of Building Economics in the University of Moratuwa, & the President of the Institute of Quantity Surveyors, Sri Lanka. She has a Doctorate in Dispute Resolution of the College of Law, Murdoch University, Western Australia & she is also a Chartered Architect, a Chartered Quantity Surveyor & a Mediator.



Introduction.

The concept of sustainability has been discussed as early as the 1980s and the term sustainability was finally recognised by the world community in 1992 during the Rio Earth summit when sustainable development was incorporated in the official documents as a common aim to be achieved by the world. Two years later the first world conference that was held in Tampa, Florida, discussed construction in the context of sustainability and hence 'sustainable construction' as a new concept denoting its share of responsibilities came into being the world over. (Miyatake 1996, pg 23).

Towards the end of 1990s there was an increased awareness through out the world of the problems associated with the environment such as global warming, air pollution, rain forest destruction, acid rain or the widening of the opening in the ozone layer. It is known today that 50% of the CFC (Chloro-Fluro Carbon) produced throughout the world causes the depletion of the ozone layer, while 50% of the world fossil fuel combustion is related to servicing of buildings. It is also known that water pollution and building industry are interconnected and acid rain due to polluted air affects building materials and that the buildings are partly responsible for the environmental degradation that is progressing rapidly. Therefore governments, both public sector and private sector organisations, academics and non-governmental organisations world over have been interested in the issues of sustainability.

In developing countries like Sri Lanka too, these issues have been discussed at various levels. However sustainable development remained in its embryonic stage, with attempts made to address these issues at various forums and in various parts of the country by various sectors. This article attempts to give an overview by analysing the past and discuss how some of these issues have been addressed by the built environment professionals such as architects and the sustainability issues undertaken by some sectors of the construction industry on the concept of sustainable construction. Further it will also discuss some of the best practices undertaken by the private sector towards achieving sustainability.

The Government.

The principle guidelines that have been formulated by the government is the present

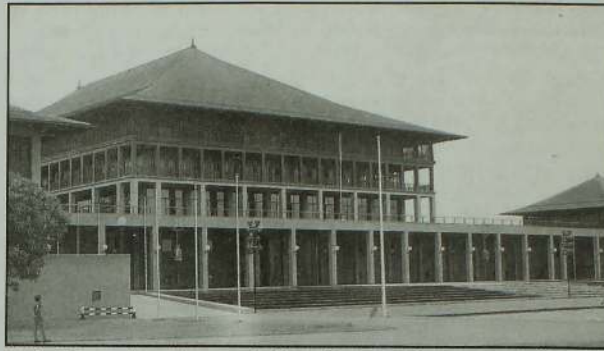
environmental policy for Sri Lanka. This is determined by the National Environmental Action Plan (NEAP), focusing on the nine areas of water, land, forest and bio-diversity, coastal and marine, built environment, health, energy and minerals, industrial pollution, poverty and the environment. In addition to NEAP there are policy documents formulated by the government for specific sectors. These policies are embodied in various regulations which in turn regulates to some extent the resource input to the various sectors.

Built environment and sustainability.

Shelter is a primary need of man as well as animals. But the structures built by animals are identified as natural while the structures constructed by man are not considered natural. The natural structures are part of a sustainable system while human settlements do not positively contribute to the sustainable growth pattern, (Chandrasekera 1994, pg.13). Gradually as man became more developed he created buildings ranging from small to large in varying degrees of complexities thus developing new technologies new materials and methods. Thus activities in the earth created an imbalance on the natural systems of the earth creating ecological imbalances. The over riding concern today is whether the resources of this planet and its ability to absorb wastes can sustain the pressures of the large human population. Sri Lanka has an extremely low figure [0.38ha (1acre) pp]. Thus the land for the large number of structures required is accordingly reduced, leaving aside agricultural, plantation and forestry lands all of which are required for Sri-Lankas sustenance. (Amendra 1993, pg 21).

In the recent years the built environment professionals in Sri Lanka have commenced addressing these issues both academically as well as in practice. Many papers have been presented at forums such as the public affair forums of the annual sessions of the Sri-Lanka institute of Architects on the theme of 'An Architecture in Harmony with Nature'. Studies have been undertaken by the academics and the students of architecture in the department of Architecture at the University of Moratuwa. Some of the research taken under was the use of appropriate materials for construction, use of energy during construction, the response of the built structures to the existing social order. Further studies were undertaken on comfort levels in different types of Sri-Lankan dwellings, so as to evaluate the most comfortable levels of humidity and ventilation. It was found that the traditional house with porous mud walls and steep side opened thatch roof to be the most thermally comfortable dwelling. The knowledge gained from these various studies have been used in the teaching of the

undergraduates of the built environment in the faculty of Architecture to make the students aware of sustainability issues. Some of the research undertaken also led to analysing the traditional or vernacular architecture that existed in the past, what happened to these traditions, what is the present and what would be the future, so that these best practices could be



used by the future built environment professionals.

Sri-Lanka's traditional architecture.

Sri-Lanka has had long architectural traditions dating back, from the ancient kings, to Portuguese, Dutch and the British period. The architectural traditions in Sri-Lanka was an amalgamation of various influences such as influence of Buddhism from India, building methods from the Mediterranean brought by Arab traders, with modifications by Dutch and the British. With this co-existed the indigenous building structures constructed from mud or wattle and daub, brick, coconut and thatch.

This indigenous tradition was motivated and determined by the internal conditions within the country from factors such as culture and religion. Few major elements of this architectural tradition were the roof which was a great umbrella roof that had number of variations. The other elements were the human scale and the basal platform the use of site selection, material selection, use of natural light and ventilation and climatic responsibility were some of the characteristics of this traditional or vernacular architecture in Sri-Lanka. In short, the traditional Sri-Lankan architecture was an eco-sensitive architecture following the green architecture principles.

However these traditional principles were abandoned due to various influences such as complex needs of people, attitudes of people etc., thus influencing the contemporary architecture existing today posing much problems in the built environment. Today the demand is in for the use of modern materials such as glass, aluminium, air conditioning instead of natural ventilation. Therefore the contemporary trends in Sri-Lanka have changed from the traditional solutions thus affecting the built environment of the country continuously increasing its effect with time.

This effect was mainly seen after British occupation, mostly influenced by the colonial education, economic and administrative back ground, technologies and material being introduced during this era. Therefore the traditional Architecture that served the peoples needs at that time changed and the contemporary architectural practices sustained

these needs.

Green Architecture and design practice.

Today many young architectural practices are moving towards green architecture, following the green principles such as energy conservation, working with climate, minimising new resources, respect for uses, respect for site, waste management, including green thinking into building regulations and most importantly a holistic approach to design. Some of the examples where elements of green principles have been used in Sri Lankan buildings have been identified below.

The national library building, Colombo.

This building is designed as a series of open trays under a large umbrella. The projecting roofs in each floor giving the umbrella effect. By this arrangement each floor was protected by the overhanging roof above also giving the possibility of natural ventilation. This building design in some ways addressed the issue of natural ventilation. This is a primary requirement in a hot and humid country, thus allowing only minimum requirements for artificial ventilation.

Parliament building in Sri-Jayawardanapura, Kotte

This building used the traditional forms of roofs, local material, and relied on natural ventilation and shading for comfort conditions in the building.

Audience hall in Kandyan Art Association, Kandy

This building too used the principle of naturally ventilating the building rather than the use of artificial ventilation. The roof was constructed using timber frame work and the roof covering with clay tiles harmonising with the external lake surroundings where the building was situated.

Union assurance building, Colpetty

This building situated within the city though an artificial ventilated modern one, attempts to use the land form to reduce the area of

curtain walls facing the sun directly, thereby reducing the amount of energy used in air conditioning. Further reflective glass was used for curtain walls to further enhance this effect.

Kandalama Hotel, Kandalama.

One of the Architects that have played a major role in eco-sensitive Architecture in Sri-Lanka is Mr. Geoffrey Bawa. He has shown how buildings could be responsive to the very fragile ecology and be sensitive and meaningful. Such a project is the Kandalama hotel. While its location overlooking the ancient Kandalama reservoir is contestable. (Daswatta1995, pg35). This building is a flat roofed building several stories high and has been concentrated on the least possible ground area, with natural landscape, without disturbing the natural flow of rain water and the growth of vegetation. The flat roofs with natural endemic vegetation attempts to maintain the thermal balance of the building. The existing rock formations have dictated the shape of the cave like entrance and the rock walled tunnel leads to the reception and to the main public lounges. The elemental forms such as the structural elements, maintains the natural lines of the rocky outcrop. Any building is essentially an intrusion on the environment. However Bawa overcomes this paradox by creating an architecture that rises seamlessly from the environment, hold its own and stands back to let the environment in. (Daswatta 1995, pg.37).

Low energy Architecture

Energy efficient buildings and sustainability are inter related. Both safeguard the environment and the process of exploitation of resources and attempts to be in harmony with the technological change so as to be able to maintain the current and the future potential to meet the human needs. (Barde 1990, pg.33). In Sri-Lanka according to the reports published by the Ceylon electricity board, the lighting in commercial buildings account for 20% of the total electricity consumption while the residential accounts for 35%. (Wijeratne 1994, pg.118).

It has been estimated that the use of energy is 20% - 60% in the annual operations and maintenance cost of commercial building. Therefore improving energy usage of such buildings could provide the user savings in the annual expenditure. The demand for electricity for lighting is expected to grow in Sri-Lanka, with the expected increase in the population growth. In this process the use of energy efficient building systems harnessing maximum natural light will lead to energy savings each year. In Sri-Lanka, day lighting is available in abundance with approximately 250 -300 clear

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Towards sustainable....

sunny days receiving 4-7kwh of solar radiation per sq.m. The efficient planning to accommodate this would result in considerable savings in energy.

Day-lighting is considered a renewable non polluting source of light and this should be desired in Sri-Lankan buildings. The use of artificial energy in the housing and commercial sector in Sri-Lanka is still on the increase. However in the last few years there has been a conscious effort by most architectural practitioners at attempting in providing natural lighting and ventilation, mostly in the housing sector, but in the commercial sector this has been a slow process. The initiative taken by the Sri-Lanka Energy Managers Association to make an award for the best designed energy efficient building is an incentive.

Alternate energy sources.

There has been an increased interest in Sri-Lanka in the areas of alternative energy sources. Some of these can be identified as wind power project in the southern province of Sri-Lanka by the Ceylon Electricity Board. Beyond there are the Micro-hydropower plants where there is a tax incentive given by the government of Sri Lanka in utilising the World Bank grant to the private sector if they produce their own electricity and add to the national grid.

Another is the production of bio-gas by non-governmental organisations such as the Intermediate Technology Development Group (ITDG) providing the technical support to local farmers to convert farm waste into methane gas. Bio-gas from garbage is another project under construction in the Colombo metropolitan region to convert vegetable waste from the vegetable markets in the area into bio-gas to run a turbine to generate electricity.

Energy efficient practices in Sri-Lanka

The Ceylon Electricity Board in association with private electric company namely (LECO) the Light and Energy Company has jointly promoted the reduced consumption of energy by providing upto four (4) compact fluorescent lamps (CFL) per household. Ceylon electricity board pays the supplier upfront, and recovers the cost of the bulbs from the consumers in 12 monthly instalments. This way the capital cost burden to a small house hold is minimised. Lack of tax concessions to the local manufacturers to make these bulbs locally appears to check the progress of this scheme.

The generation of electricity by using photo-voltaic has been discussed. However the initial capital cost is still prohibitive for the private sector. At present the emphasis is only on generation of electricity rather than conservation and there are still little incentives for conservation. If energy efficient practices are to

be sustained it is important that the relevant authorities be interested in the conservation of energy as well as generation.

Approach to public housing

The housing developments in Sri-Lanka in the past have had both positive and negative impacts on our eco-systems. The major housing programmes in Sri-Lanka fell under three categories. Namely the programmes with direct intervention by state in planning and construction, the programmes implemented by the state with user participation and the housing loan programmes with minimum intervention in planning and construction of same.

Under the first two categories the government had the opportunity to do the overall planning both at programme level and at the project level and there was scope for the state to look at the aspects of eco-sensitive housing development. However most of the large housing projects that came under the first category were located closer to the Colombo's municipal limits or suburban areas within Colombo. Some were located in the low lying areas due to political interventions. Even though some aspects of eco-sensitiveness were looked into, one of the main adverse effects of these projects were flooding of the areas due to filling of these low lying areas and blocking the natural drainage patterns, causing irreparable damage to the ecosystem. While there were some ill effects of the unplanned and over ambitious housing programmes, some positive efforts were made by the state sector towards public housing. In order to encourage building of houses using traditional materials and technology indigenous to different regions in the country, a national low cost housing competition was conducted annually to increase the awareness and interest within the communities. The efforts have been successful and the results have been well planned houses using locally available materials such as wattle and daub, sun dried brick, stabilised mud walls, stone walling and for the roof the use of thatch, straw, and country tiles with a conscientious effort to plan out home gardens with proper surface water drainage. This has encouraged the communities to revert to traditional solutions. The houses constructed country wide under this programme have had the least damage to the eco-system. (Domingo, 1995, Pg 43-44).

Sustainable construction

The word 'Sustainable' implies continuity when used with another word. Sustainable construction therefore involves management of the environment during the life cycle of the product, that is from its conceptual stage to the ultimate demolition stage. In the case of construction, the product could be a building, civil engineering project or infrastructure

development work. Construction brings along effects which interfere or pollute the environment.

Trends in sustainable construction is still in its embryonic stage in Sri-Lanka and the problems associated with it are being identified and studied. These trends in sustainable construction can be grouped under energy resources and land use issues. Where operation energy is concerned there are trends to move towards greater use of natural ventilation and lighting to supplement energy intensive artificial method by the built environment professionals as mentioned earlier. Where embodied energy is concerned studies are under way to compare materials on the basis of energy inputs. The use of non-renewable bio-mass energy in brick and tile production is of particular concern. The extraction of river sand and coral lime used in construction has had severe environmental impacts, especially in the coastal zone; substitutes for these such as offshore sand and dolomite lime are being either considered or encouraged. The use of timber in construction has severely reduced the country's forest cover; some efforts have been made to replace timber elements in building with precast concrete. Studies have also been undertaken on the extent of waste on building construction sites by academics in the civil engineering department of the University of Moratuwa. Land use planning is rather haphazard at present and unplanned development has reduced agricultural productivity and affected natural drainage in the marshes. However a mechanism for ensuring the restoration of borrow pits resulting from clay mining has been introduced recently. Bodies such as the Urban Development Authority are in the process of implementing land use planning regulations, such as the prevention of filling of critical wetland and flood retention areas.

In general, the best practices in sustainable construction have been in the low cost housing sector. The use of virtually zero energy compressed soil blocks and boron treated round wood for roofs. The hotel sector too has adopted some good practices such as recycling of waste and the use of solar water heating in their operations.

In terms of inputs to the construction process regulations are under way to maintain the quality standards when these materials are supplied to site as well as when the process is taking place to achieve the final product. Sri-Lankan contractors particularly those belonging to the higher registration categories have become more and more conscious about maintaining quality levels in construction and has commenced applying for ISO standards. A statistical analysis is under way to see how health, safety rules, material storage and handling, usage of material and

wastage are being done so that improvements could be made to be in line with the international standards. Constraints to Sri-Lankan contract practices in achieving sustainable construction is being enumerated and suggestions are being given by relevant regulatory authorities at government level towards solving such problems.

Towards Sustainable development by the private sector/corporate businesses

One of the leading private sector companies that have played a major role in the introduction of sustainable farming technology to the farming community is the Ceylon Tobacco Company in Sri-Lanka. They were the recipients of the prestigious World Aware award for sustainable development in 1997. The concept behind their role was to increase significantly the ability of the farming community to develop its own resources. The following are some of the techniques they have introduced to a sustainable farming technology.

New farming ideas to replenish the land and stop erosion

Dadyanmpola, Walapane located in the central highlands of Sri-Lanka was an improvised farming hamlet in 1989. The farming was at subsistence level, the land was scarce and made almost completely infertile by years of 'chena' or 'slash and burn' cultivation. In 1989, the Ceylon Tobacco Company convinced farmers in Dadyanmpola to plant Glyricidia [glyricidia sepium] on 125 acres of sloping land, interspersed with cash crops. The objective was to prevent soil erosion across the steep gradients of the hill country and rejuvenate barren land. This farming technique is known as Sloping Agricultural Land Technology [SALT]. This technique used by Philippines and in other parts of the world was implemented in Sri-Lanka. The use of the Glyricidia along with the hardy vetiver grass [vetiveria zizanoides] stopped the crumbling of the soil with its extensive root system. It also revitalised the top soil through nitrogen fixation. When the hedges reached a certain height they were pruned and the branches used as mulch which helped to retain the moisture and rejuvenate and build the soil. The vetiver grass planted alongside helped in the binding of the soil. The SALT technique used by these farmers in Dadyanmpola who grew coffee, pepper, chillies bananas, and maize was an unqualified success. Today The Ceylon Tobacco Company has spent about 9 million rupees in the past five years on 2200 hectares to propagate this technique and it is estimated that the bio-mass that has been added to the soil has been 14 metric tonnes per hectare.

Paddy husk; a new form of energy

This originated due to the use of wood in the curing process of green tobacco leaves. There was a necessity to search for more

environmental friendly source of energy and research found an ally in paddy husk as a by-product of rice processing. The husk or the chaff that remained after winnowing and threshing the rice grain was previously an environmental hazard. This has now metamorphosed into potent, cheap and clean source of energy for the tobacco industry. 100% of all tobacco farmers use paddy husk to fire their curing barns and as a result the energy costs have dropped by almost 40%. Ceylon Tobacco Company has patented an easy to assemble 'brick and clay paddy husk furnace' which can be used for other agricultural products such as chilli, pepper, cardamoms and cloves which also need gradual evaporation process for drying. The residue that remained after the husk was burnt was used as a substitute for dolomite and helped in the neutralising of the soil acidity.

Coir dust trays & paper pots

Bio-degradable paper pots have been used instead of the poly pots and making them have provided a source of income to disabled soldiers who suffered injury at the ongoing civil war. Use of wooden trays to propagate the seed in a mix of coir fibre dust and soil allowed much smaller areas to be maintained and helped to retain moisture and the agricultural waste. The fibre dust which, polluted the environment otherwise was put into more productive use.

These were some of the best practices used by large businesses such as Ceylon Tobacco Company where corporate excellence and attitude of continuous improvement led to imaginative and inexpensive solutions to address issues of sustainable development.

Conclusion

This article has attempted at identifying some of the conscientious efforts made by various sectors in Sri Lanka towards sustainable development. However if it is to continue it is important that the development of indigenous and inexpensive technologies be an important objective of any large corporate client in addressing the issues of sustainable development. Further built environment professionals must take responsible decisions towards conservation of the ecology through eco-sensitive architecture, while having a clear look at the process of construction thereby changing the linear process of construction to that of cyclical process leading to significant use of recycled, renewed and reused resources with a significant decrease in the consumption of energy and resources. This would enable the co-existence and interdependence leading to a positive relationship with the environment if it is to sustain itself. In short all man's activities including building activity should conserve the environment so that it depends and exist and contribute positively towards sustainable development.

Contd. from page 1...

Is the private sector the engine of growth?

withholds large payment due to Consultant Contractors by the client Ministries not always due to lack of funds but due to other reasons. Consequently, overdraft payments to Banks with accumulate interest, the Consultants and Contractors are faced with severe cash flow problems. If the Construction Industry is to survive in Sri Lanka, drastic reforms must be introduced to streamline the contractual obligations of the Government. In addition it is equally critical that the mindset of the Bureaucracy must be simultaneously transformed.

Another anomaly is that the Government is awarding Projects to Consultants and Contractors from Singapore and Malaysia without calling for competitive bids according to the news media. These projects are funded locally and could be handled by the local Construction Industry. We understand from these reports that the Master Plan for the Western Region has been awarded to CESMA a subsidiary of the Housing Development Board, Singapore specializing in public housing and the Wellawatte Mixed Development Project and the reclamation of the Marshes in the Western Region to the same Consultants and to be paid directly by using Sri Lanka funds. The Colombo Kandy Expressway Project and the Housing for the Public Servants are to be funded by the Malaysian promoters on the basis that the government guarantees to pay them back. If this is the case why cannot the government give similar terms to the Chamber of Construction Industry, Sri Lanka whose Member Associations could undertake the same work competitively. It is not correct for the Government not to give guarantees for Sri Lankan entrepreneurs in the Construction Industry to venture on Projects while at the same time agreeing to give their foreign counterparts.

In countries like South Korea, Taiwan, China Singapore and Malaysia from the South East Asia, in the East Asia and in India and Pakistan particularly from the South Asia all Construction Industry projects are handled strictly by their Consultants and Contractors. Consequently, the Consultants and Contractors gain enormous experience and have the confidence working on projects in their own country and thereafter venture overseas and obtain work in the Middle East, Sri Lanka and other countries. In addition to employing professionals and skilled labour from their country the repatriation of their profits and income to the respective countries is a boost to their national economies. Sri Lanka should follow the same example in developing its own Construction Industry.

Our situation is that the Construction Industry has no one to appeal to, and explain our grievances. Since there is no specific Ministry responsible for the Construction Industry,

The Rehabilitation and Reconstruction of the North and East as well as other parts of Sri Lanka needs to be viewed in a proactive manner if the US\$ 4.5 Billion pledged in June 2003 at the Tokyo Conference is to be speedily and efficiently disbursed. Other than the Road sector and emergency projects in the North & East, carried out by a few agencies and work of a similar nature, no substantial physical development is taking place. This situation is critical to the Private Sector.

This is the time to plan, design and get ready for the implementation of the projects identified in the 'Regaining Sri Lanka' document and the Post Conflict Needs Assessment survey carried out by the Multi lateral group. At least the priority projects should be finalized and be prepared to take off when the funds are made available. If not, the implementation could be further delayed.

In the Chamber's view, the Rehabilitation and Reconstruction should be the first priority and there should be a short term strategy to identify the urgent projects of a priority nature. If its implementation is to be by the traditional procurement procedure followed by the Donor agencies and the Donor countries the process could be lengthy since the regulations of these Institutes are different from each other to select both Consultants and Contractors. Consequently these delays together with the bureaucratic and political delays in awarding projects, some of which may even need Cabinet approval, will seriously prolong the decision making process.

Since a substantial amount of the funds will be disbursed for construction related projects and in this situation of an implementational gridlock, the apex bodies of the private sector may come to the fore. In the construction sector, the Chamber Of Construction Industry Sri Lanka is the umbrella organization of Consultants, Contractors, Building Material Manufacturers and Suppliers and Insurers, who will be best positioned to speed up the procurement procedure, while maintaining transparency & accountability.

This way a large number of projects of different nature could commence simultaneously in all parts of the country. Where necessary the Chamber offices will be opened in the Provinces or Districts for better monitoring and supervision of the works. The Chamber would charge the Consultants and Contractors a nominal commission for its services and will distribute the work directly to the Member Associations. The Member Associations will ascertain the competence of the firms in terms of skills, experience, competence and other requirements and award the work. The respective associations will be responsible for ensuring the proper execution of the works.

A precedent has been set on the above procedures during the term of

office of Prime Minister Premadasa around 1979 where a vast amount of Housing and Infrastructure work of varying sizes were offered to the Chamber of Commerce, Sri Lanka, and the Chamber in turn distributed this work through the member Associations with the help of the Institute of Architects and the Institute of Engineers and other professional Organizations. The Institutes thereafter evaluated the competence of their member firms and awarded the projects accordingly. Consequently the mega housing projects at Wickramasinghepura, Ranpok-nugama, Rukmalgama, Mattegoda, Raddoluwa and other infrastructure projects were implemented expeditiously.

The Chamber of Construction Industry is in a position to handle this service in a better manner today since the allied Professional Associations and the Contractors Association are members of the Chamber. In this connection the Chamber is currently preparing procurement procedures compatible with both the Government and the Donor Agencies.

The ideal scenario would be for the Donor Agencies, Government Officials, the LTTE in the case of the North and East and the Chamber of Construction Industry, Sri Lanka to work out a mechanism acceptable to all parties and thereafter the Chamber of Construction Industry to be entrusted with the responsibility of implementation using their Members, both Consultants and Contractors. The Chamber could be held responsible for the design and the implementation, including the rates to be competitive and also for the quality of work and the time frame for completion. The Chamber is in a position to undertake Projects in any part of the country provided adequate time is provided for mobilization. The Chamber is the ideal vehicle for the Government and the Donor Agencies to entrust their work.

In the long term, it is necessary to prepare comprehensive land use plans incorporating the different land uses in the context of the entire development. These Plans should be integrated with infrastructure facilities so that when implementation takes place whether it is a Township, an Industrial Estate, a Commercial Area, or an Agricultural Land, the need to continuously make and break to provide for additional services could be avoided to a great extent. This way the funding, particularly for infrastructure will not be duplicated and the end result would be an efficient and effective plan.

The Chamber could once again assist the Government and the Multi-lateral Agencies with the planning of the different Sectors within the North and East, with or without the assistance of foreign firms or individuals. Thereafter the design and implementation could follow in a similar manner by using the members of the Chamber, both Consultants and Contractors and other professionals to carry out the different Projects.

It should be the Governments intention to promote entrepreneurs within the Construction Industry. These entrepreneurs should be encouraged to venture out on mega infrastructure, urban regeneration, tourism, industrial and similar projects by the Government advancing

"Construct 2003" Exhibition.

The National Construction Association is holding the "Construct 2003" exhibition from 18th - 20th July 2003 at the Srimavo Bandaranaike Memorial Exhibition Centre for the 3rd consecutive year.

The Hon .S.R.m.A. Thondaman, Minister of Housing and Plantation Infrastructure will be the chief guest at the inauguration of the exhibition on the 18th of July 2003.

Construction & Infrastructure Expo
September 4 - 6, 2003. Colombo, Sri Lanka

Organised by, Federation of Indian Chamber of Commerce & Industry.

Progress of the A9 highway rehabilitation project funded by the Asian Development Bank.



As at June 2003 approx. 40% of the project work is now complete & the existing road is in very poor condition. Over 500 vehicles pass the stretch of the A9 highway mostly heavily loaded lorries on a daily basis. From 194kms [omanthai] to 290kms [Pallali] the 96kms stretch was parceled out in to 8 contract packages & awarded to 7 members of the National Construction Association of Sri Lanka [NCASL]. The NCASL is playing the role of a coordinator and assisting member contractors in their performance to ensure the time targets and quality standards. 50% of the length of

the stretch has already been cleared of land mines and the balance work is expected to continue up to July 2003. As this stretch is the LTTE held area 85% of the raw material is transported from outside the area going through the check points of the LTTE and the Sri Lanka Army. The quantities of materials expected to be used are 2000tons cement, 200tons steel, 1.9million ltrs. of fuel, 1.7million ltrs of bitumen, 70000cu/m of crushed metal. Snowy Mountain Engineering Corporation of Australia are the consultants for the project.



The new SLIA President pronounces his vision of 'Architecture to the people'



A. At the moment we have 69 fellow Members, 73 Student members all adding up 702 Members as per our present directory.

Q. You have the Council which is the governing body of the Institute. Would you like to elaborate on the administrative structure and the functional features of the Council?

A. Well, the council is elected from among the members of SLIA. It is the Executive body of the SLIA and for that matter for the profession of Architecture in Sri Lanka. We have the President that is me, the Senior Vice President, the Immediate Past President etc. coming up to 20 members of the council who are responsible for collective decision making on administrative and policy matters of the Institute.

Q. What is the duration of the term of office of the present Council?

A. We were elected on the 23rd February 2003 at our AGM held at the BMICH and our term will expire on 23rd February 2005. Term of office for office for office bearers is two years and in the case of council members it is one year.

Q. What is the criteria of eligibility to become a member of the SLIA?

A. Usually you have to become either an Associate member or a Fellow member. They are generally called 'corporate members', those who have passed the Part 1, 11, and 111 examinations of the Sri Lanka Institute of Architects and possesses practical experience for a prescribed period are eligible to become members. The option of obtaining the membership by registration is now non existent.

Q. Recently there were a few cases of people who, without the membership of the SLIA, pontificated to be Architects and who had in fact carried out certain functions as practicing Architects. What kind of action can the SLIA Council or you as the President could take against such 'imposters'?

A. This is the importance of the amendments passed in 1996 with the provisions for Architects Registration Board. Now SLIA has the powers to prosecute such persons. I could sight a few examples of such cases where we have taken action. One of the buildings of the Health Department in Kandy was designed by a person who called himself an Architect. We discovered that no such name appeared in our registration and informed the Health Department as well as the authorities that this particular person was not entitled to call himself an Architect and

it is unethical for a profession like the medical profession to employ a quack to get a public hospital designed. As empowered we published a paper advertisement with a declaration to that effect. There was another instance of a man who conducted an office down Vinayalankara Mawatha in Colombo with a board advertising himself as a chartered Architect. I accidentally noticed this when I was passing by and then I walked in to his office and apprised him of the consequences of calling one a Chartered Architect when in fact he is not. He claimed to be a professional engineer [which I am not sure either]. I explained to him that it is possible to tie up with a Chartered Architect so that he could continue his business. He in fact invited me to join him. I declined his offer and warned him as the Vice President of SLIA (the office I held then) to refrain from advertising himself as a Chartered Architect. However this man continued to exhibit the board and we had to prosecute him and the court of law imposed upon him a one year suspended imprisonment sentence and a fine of Rs.500. In addition he had to put a news paper advertisement to rectify the situation.

Q. What about BOI projects where foreign consultants come here and practice as Architects and other such professionals without local license?

A. The BOI could have projects under the present law to export the profession of Architecture. They cannot permit people to come and work as Architects in local projects without the ARB license.

Q. What are your plans with regard to the SLIA during your term of office?

A. I have many plans and I think I should start from the present curriculum of the Architects. We have plans to introduce specialization within the field of Architecture. This means that new entrants will have the opportunity of specializing in one field or the other in architecture such as landscaping, Interior Design, project management, Urban design, conservation, etc. With this specialized knowledge future Architects would be better equipped to take up special assignments and to serve their community better. We are doing this with an eye on the future as we expect the demand for specialization to increase in the future.

Q. I think you mentioned that you have some plans for the new entrants beyond the curriculum too. Could you please elaborate on those?

A. We hope to encourage young people to take over this profession and also to broaden their horizons. Therefore we

arrange them to travel abroad with 100% cost of such trips as a loan with 75% repayment without interest. Such trips subsidised by the SLIA are in collaboration with Architecture Institutes in Countries like Singapore, Indonesia and Malaysia. We are still working on the details of this project and it may be possible for us to get those countries to reciprocate such visits. This way the new Architects will receive the exposure they need on the indigenous Architecture of different countries and then to evaluate as to how such models could be adopted to suit the local conditions.

Q. What is your vision for the future of the Architectural profession?

A. This profession as you know is considered as a profession, services of which could be obtained only by a few exclusively rich people. I am determined to change this impression and I would like this profession to reach the lowest level it possible can. We would like to be of service to ordinary people and for them to feel the benefits of a properly designed and structured house. We would also advise them on the alternative material available and their durability in relation to environment, costs etc. and help them to make the maximum use of the financial resources they have. This way the benefits of the Architectural profession will be more tangible to the general masses and with more people seeking our services in this future scenario it may be possible for us to make our fees moderate and more acceptable to the ordinary man. Very general economic principle, 'more units less cost' or else 'high turnover small margin' This will be the social benefit. For instance in Rathnapura and other flood affected areas the government is making a grant of Rs. 100,000 for every family that have lost their house due to the floods and landslides. The members of the SLIA [jointly with the University of Moratuwa] will give their services free to those families to help them make the maximum use of that Rs.100,000.

Q. This certainly is an act of benevolence but how long can the member of the SLIA sustain this and how do you propose to make this type of activity viable for the members?

A. When we advise the poor people to build attractive, eco friendly and spacious houses with just Rs.100,000/- the affluent people in the area also will observe the difference. This could be a good advertisement for Architects and that way we hope to canvass for work for which the respective members who are involved could also charge a fee. In other words we are striving to convert a hopeless situation into an opportunity.

Jinasenas find solution for inadequate water pressure in high rise buildings

With more emphasis placed on the aesthetics in building construction the conventional water tank 'on top' has been getting replaced by 'just above the ceiling' water tanks in modern buildings. This created water pressure problems in the buildings main line. Alternative sump and pump operations by the users proved ineffective as the modern fittings specially in the W.C's required high water pressure

This problem first came up with domestic consumers and Jinasenas responded immediately by designing and manufacturing the now famous BR50 Pressure Booster Pump, which had a

unique electronic circuit to sense the water flow and control the operation of the pump whenever a tap is opened. Since then hundreds of these pumps have given service to consumers over the years, with a simple operation of only one moving part. The only drawback of the BR50 system is, that it is a half inch pump and can cater to only 2 bathrooms. However, with the problem becoming complex there was a demand for a pump to take over the total pressure boosting function of the whole building requiring a booster tank operated by a centrifugal pump. The PB100 series introduced by Jinasenas with a 12 litre booster tank was the solution, and this

once again found extensive use in domestic installations. The introduction of the CENTRIC Package Booster System for industrial applications soon followed, and today, Jinasenas have successfully installed Package Booster System with booster capacity of more than 1000 litres and pressure in excess of 16 bar (225psi).

This system wholly designed by Jinasena's and the complete package, including the pressure booster tank, is guaranteed by them. To support this high quality product, Jinasenas have obtained the exclusive rights to Italy's largest manufacturer of pressure booster tanks.

The need to pressurize the rubber bladder and its deterioration with time requiring replacement was considered a drawback in this system. The pressure switch in operation too required maintenance and adjustment. Thus for a durable, trouble free service, the customer is greatly dependant on the supplier of the system. However, with the type of reputation Jinasena's have for after sales service the customers may not consider that feature to be a drawback. Jinasena's innovative design of the system, including the manufacture of

Contd. on page 8...

Portland limestone cement

Following world trends in the cement industry

MANAGEMENT DEVELOPMENT PROGRAMME

COST ENGINEERING.

OBJECTIVE – Cost Engineering is a programme focused on critical analysis and examination of the elements, ingredients and processes that make up both direct and indirect cost with the objective of reducing cost and enhancing the value of the product or process. The programme will meet with needs of facilitating a strategy for cost reduction, productivity enhancement and value improvement. Programme includes many strategies and easy to implement action plans for eliminating non-value adding cost, reducing overhead costs and enhancing managerial effectiveness and efficiency. Enhancing performance and profitability has been extensively covered using many tools and techniques.

Benefits

Reduction of direct and indirect cost at all levels.
Insights in to organizational restructuring and process re-engineering.
Elimination of non-value adding activities.
A strategy to deal with "management Failures"

PRESENTER- Mr. Gihan Talgodapitiya has been in corporate Training and Consulting since 1986. He is presently the Senior Consultant at Stafford & Chang Training Pte. Ltd. in Singapore & Hong kong and the Principal Consultant of Gihan Talgodapitiya Associates and Director, Garment Industry Management Institute of Sri Lanka. Gihan holds a Master of Business Administration [MBA] degree from the National University Singapore [NUS] and a Doctoral candidate at the Maastricht School of Management [MSM] in the Netherlands. He is also a Fellow Member of the Chartered Institute of Management Accountants, [CIMA] UK. During the past 15 years Gihan has presented over 1700 Seminars/ Workshops and has been retained by over 200 Multi-national companies in Singapore, Sri Lanka and in East Asia. He was the recipient of the 1994 Commonwealth Fellowship awarded for his contribution to Management development in Commonwealth countries.

Course Fee: Rs. 4000/ per participant.

Date: 12th August 2003.

Time: 9a.m. - 5p.m.

Cont. from page 7...

Jinasenas...

specific purpose pumps for the system, gives them a distinct edge over their competitors.

They have recognized the importance of their commitment to research and development to maintain their technological edge and the position as the Sri Lanka's largest manufacturer of water pumps.

By: T.I.R. Thilak Silva.

Bsc., Eng(Hons), M.Eng., MIE(SL), Ceng.

Revolution in the Cement Standardisation.

With the merger of many of the countries in Europe as the European Union, many modern cement types that were under different standards also came under one umbrella standard as EN 197-1.

Almost after 30 years of discussion, negotiation and compromise the first harmonised European Standard under the Construction Products Directive, EN 197-1 for common cements, was formally adopted in the year 2000.

What are common cements? The Table 1 of EN-197-1 defines the various types of common cements. While CEM-I is the Ordinary Portland Cement (OPC), other types are a composition of finely ground clinker with one or several of mineral components, such as limestone, fly ash, natural or artificial pozzolana, silica fumes, blast furnace slag etc.

Mineral components available in our country at present are limestone, rice husk ash, bunt shale and laterites, out of which limestone is the most economically viable alternative for the local cement manufacturers for the time being. The cement that is produced using limestone as a mineral addition is called "Portland Limestone Cement" (PLC).

Manufacturing of Portland Limestone Cements (PLCs).

Portland Limestone Cements are produced by grinding cement clinker with a certain percentage of limestone in the cement mill. While PLC with limestone percentage between 6-20 is designated as CEM-II/A-L&LL, limestone between 21-35 is designated as CEM-II/B-L&LL.

The properties of PLCs are strongly influenced by the fineness of grinding, the limestone quality and the type of milling equipment. PLC has to be ground finer than OPC to compensate for the lower content of hydraulically active material. Modern chemicals used in the grinding process as "Grinding Aids" give the cement manufacturer better cost advantage in achieving finer grinding.

Role of Limestone in PLC.

Although it had been agreed that the addition of finely ground limestone with the cement clinker improves the particle size grading of the cement paste in concrete or mortar, it has also been recently established that limestone enhances the chemical reactions of the cement paste in the following manner,

- Formation of monocarboaluminate phase, by reacting with C3A (Tricalcium Aluminate), which is a stable compound.

- Acceleration of hydration rate of

C3S (Tricalcium Silicate).

Benefits of PLC in Concrete.

PLC in comparison with OPC, imparts better properties that improve the workability of concrete, optimise water demand and reduce bleeding and segregation. Improvement in such rheological (fresh state) properties gives greater advantage to the local House Builders as well as to the major Contractors.

At the House Builder sites, masons add excessive quantity of water to make compaction and finishing of concrete easy. Such unacceptable practices result in poor quality of concrete, which has a lesser strength and higher porosity that makes concrete less durable. PLC would impart plasticizing effect to the fresh concrete, which would give the masons easy working conditions without adding excessive water. PLC would definitely promote better quality standards with the local construction practices resulting in stronger and dense concrete with lesser honeycombs.

PLC is also advantageous to the major contractors as well as to the ready mix concrete suppliers. In addition to the favourable rheological properties mentioned above, PLC would improve the

The Earth Summit held in Rio in 1992 highlighted the need for governments, industries and society general to re-evaluate the assault on the environment and pursue sustainable development practices. Particular emphasis of this issue on the cement industry is the need for the preservation of non-renewable resources and a reduction in the production of 'Greenhouse' gases such as 'CO2'.

The environment advantage of PLC include a significant reduction of CO2 emission per Ton of cement.

Most of the large cement manufacturing companies have made commitments to reduce CO2 emission under Kyoto Protocol. Reducing the clinker factor and substitution with mineral components would be a common goal of all the major cement companies. Our hope in this respect is non other than limestone.

Strength Effect of PLC in Concrete.

PLC with moderate limestone addition below 15% can be ground finer to achieve strengths equivalent to OPC. Hence PLC can compete effectively with OPC both in respect of rheological properties as well as

concrete. CEM-II/B-L&LL is normally used for other general applications such as mass concretes, masonry work etc.

Usage of PLC in Other Part of the World.

The standardisation and use of Portland cements containing limestone for concrete production was pioneered by Spain and France during 1970s. In 1979, France introduced a new standard, which permitted the incorporation of up to 35 percent of slag, fly ash, natural or artificial pozzolana and limestone in a new type of cement designated CPJ. A key feature of the new standard, which encouraged the utilisation of limestone, was the introduction of four different strength classes with upper as well as lower strength limits. Italy, Denmark, Sweden and Germany have stepped up production of Portland Limestone Cements (PLCs), in the recent years with the introduction of new European Standard. In the year 2000, 24 per cent of the cement produced in the EU countries was PLC. Italian standard for PLC was implemented in 1993 and this was readily accepted as an alternative pozzolonic cement. Thailand is the Asian example of PLC using countries. Barrier for most of the countries outside Europe in utilising the benefits of Portland Limestone Cement is the non-availability of local standards. It can very soon be expected that rest of the world also would follow the European Example of revolutionising the blended cement standards.

Most of the large cement manufacturing companies has made commitment to reduce CO2 emission under Kyoto Protocol. Reducing the clinker factor and substitution with mineral components would be a common goal of all the major cement companies. Our hope in this respect is non other than limestone.

Limitations of Portland Limestone Cements.

Similar to the ettringite formation of OPC in sulphate bearing grounds, PLC is suspected of forming thaumasite in such environments. Both ettringite and thaumasite are expansive compounds, which can disrupt the hardened concrete. The recommended cement type for sulphate environments is the " Sulphate Resistant Cement".

Concluding Remarks.

Increasing awareness and disseminating the correct information and real advantages of Portland Limestone cement to the house builders, contractors, architects and engineers is vital, if this product is to win the market acceptance. As a local standard is not yet available for the blended cements in Sri Lanka, it would be essential that an internationally accepted standardisation such as 'Kite mark' be obtained, if PLCs is to be introduced to the local market.

Table 1 — The 27 products in the family of common cements

Main types	Notation of the 27 products (types of common cement)	Composition (percentage by mass ^{*)})											Minor additional constituents
		Main constituents											
		Clinker	Blast-furnace slag	Silica fume	Pozzolana natural	Pozzolana calcined	Fly ash siliceous	Fly ash calcareous	Burnt shale	Limestone			
		K	S	D [†]	P	Q	V	W	T	L	LL		
CEM I	Portland cement	CEM I	95-100	-	-	-	-	-	-	-	-	0 to 5	
CEM II	Portland-slag cement	CEM I/A-S	80 to 94	6 to 20	-	-	-	-	-	-	-	0 to 5	
		CEM I/B-S	65 to 79	21 to 35	-	-	-	-	-	-	-	0 to 5	
	Portland-silica fume cement	CEM I/A-D	90 to 94	-	6 to 10	-	-	-	-	-	-	0 to 5	
		Portland-pozzolana cement	CEM I/A-P	80 to 94	-	-	6 to 20	-	-	-	-	-	0 to 5
	CEM I/B-P		65 to 79	-	-	21 to 35	-	-	-	-	-	0 to 5	
	CEM I/A-Q		80 to 94	-	-	-	6 to 20	-	-	-	-	0 to 5	
	CEM I/B-Q		65 to 79	-	-	-	21 to 35	-	-	-	-	0 to 5	
	Portland-fly ash cement	CEM I/A-V	80 to 94	-	-	-	-	6 to 20	-	-	-	0 to 5	
		CEM I/B-V	65 to 79	-	-	-	-	21 to 35	-	-	-	0 to 5	
		Portland-burnt shale cement	CEM I/A-W	80 to 94	-	-	-	-	-	6 to 20	-	-	0 to 5
			CEM I/B-W	65 to 79	-	-	-	-	-	21 to 35	-	-	0 to 5
	Portland-limestone cement		CEM I/A-T	80 to 94	-	-	-	-	-	-	6 to 20	-	0 to 5
			CEM I/B-T	65 to 79	-	-	-	-	-	-	21 to 35	-	0 to 5
		Portland-composite cement [‡]	CEM I/A-L	80 to 94	-	-	-	-	-	-	-	6 to 20	0 to 5
			CEM I/B-L	65 to 79	-	-	-	-	-	-	-	21 to 35	0 to 5
	CEM I/A-LL		80 to 94	-	-	-	-	-	-	-	-	6 to 20	0 to 5
	CEM I/B-LL		65 to 79	-	-	-	-	-	-	-	-	21 to 35	0 to 5
	CEM III	Blastfurnace cement	CEM III/A	35 to 64	36 to 65	-	-	-	-	-	-	-	0 to 5
			CEM III/B	20 to 34	66 to 80	-	-	-	-	-	-	-	0 to 5
CEM III/C			5 to 19	81 to 95	-	-	-	-	-	-	-	0 to 5	
CEM IV	Pozzolanic cement [§]	CEM IV/A	65 to 89	-	11 to 35				-	-	-	0 to 5	
		CEM IV/B	45 to 64	-	36 to 55				-	-	-	0 to 5	
CEM V	Composite cement	CEM V/A	40 to 64	18 to 30	-	18 to 30			-	-	-	0 to 5	
		CEM V/B	20 to 38	31 to 50	-	31 to 50			-	-	-	0 to 5	

^{*)} The values in the table refer to the sum of the main and minor additional constituents.

[†] The proportion of silica fume is limited to 10 %.

[‡] In Portland-silica fume cements CEM I/A-D and CEM I/B-D, in Pozzolanic cements CEM I/A and CEM I/B and in composite cements CEM V/A and CEM V/B the main constituents other than clinker shall be declared by designation of the cement (for example see clause 8).

* The values in the table refer to the sum of the main and minor additional constituents.

† The proportion of silica fume is limited to 10 %.

‡ In Portland-composite cements CEM I/A-M and CEM I/B-M, in Pozzolanic cements CEM IV/A and CEM IV/B and in composite cements CEM V/A and CEM V/B the main constituents other than clinker shall be declared by designation of the cement (for example see clause 8).

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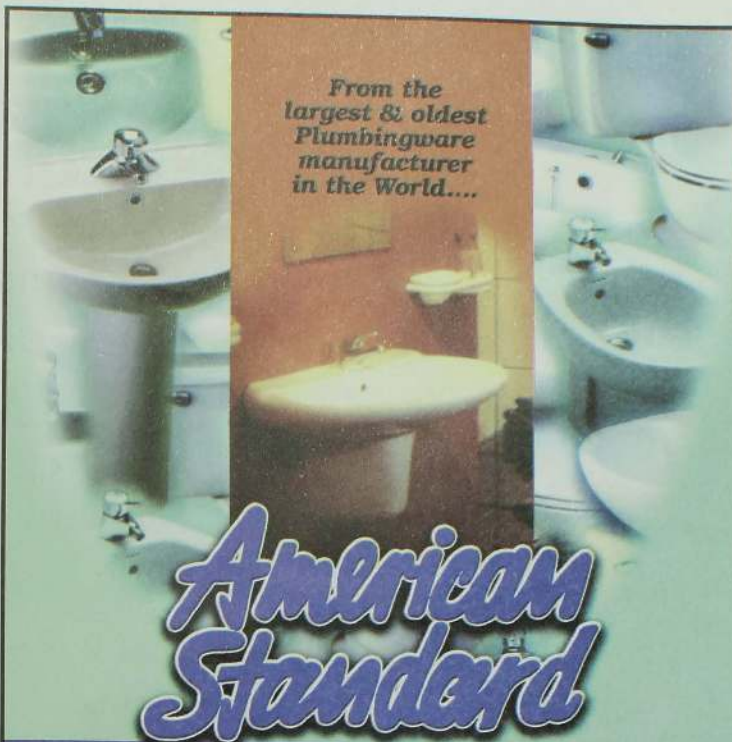
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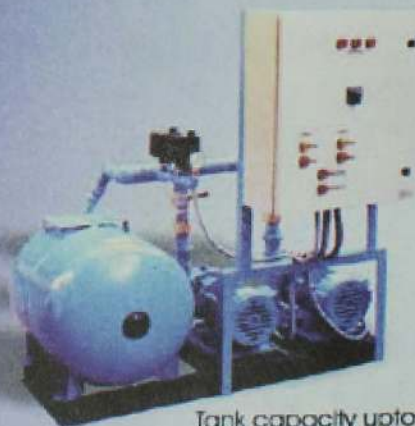
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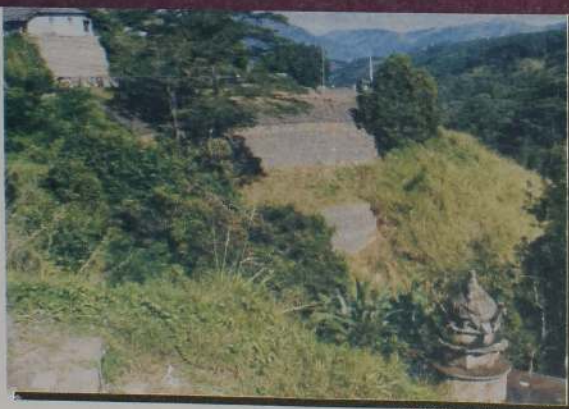
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Form of contract for design & build projects

ICTAD/SBD/04 - November 2002

by: **H.D. Chandrasena**

DIP.Q.S.(AUST), A.R.M.I.T.(Q.S.), F.A.I.Q.S.,
F.I.Q.S.(S.L.), A.I.Arb.(AUST.)

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Introduction

The Institute for Construction Training and Development (ICTAD) launched its latest Standard Bidding Document for procurement of works under Design and Build type of Contract, on 9th of May 2003. This document, titled "The Standard Bidding Document, Procurement of works Design and Build Contract - ICTAD/SBD/04 - November 2002", is the third ICTAD publication on design and build procurement system since 1994. Although the first publication titled "The Conditions of Contract for Design and Build Projects" was in draft form, it was extensively used by Architect, Engineer and Project Manager in managing design and build/turnkey projects. The second publication was a revision of above document based on the following internationally recognized forms of contract;

I. Conditions of Contract for Design, Build and Turnkey - FIDIC 1995 Edition

II. Contractor's Designed Portion Supplement for use with the Standard Form of Building Contract with Quantities 1980 Edition (Joint Contract Tribunal)

III. Standard Form of Building Contract with Contractor's Design - 1981 Edition (Joint Contract Tribunal)

This was published in June 2002 as a Standard Bidding Document. includes in addition to the General

Conditions of Contract, the guidelines to prepare the following sections;

Invitation for bids - the invitation for bids for major works is sent to the firm determined by the Employer to be pre-qualified in accordance with the Employer's Prequalification Procedure. In the absence of prequalification, post-qualification is followed. Post-qualification procedure is covered in the Chapter IX of the Guidelines on Government Tender Procedure. (August 1997)

Instruction to Bidders - This section provides the information necessary for bidders to prepare responsive bids in accordance with the requirements of the Employer. It also gives information on bid submission, opening, evaluation and award of Contract.

Bidding Data - The purpose of this section is to assist the Employer in providing this specific information in relation to corresponding clauses in 'Instruction to Bidders'.

Contract Data - The provisions of Contract Data complement the General Condition of Contract. This section replaces the 'Conditions of Particular Application' or 'part 11 of the Condition of Contract' which forms an essential and inseparable part of the FIDIC and ICTAD Condition of Contracts, in projects where a standard bidding document is not used. The Contract Data should specify the contractual requirement linked to the special circumstance of the Contract Works, the Employer, the Engineer and the overall

project. The Contract Data may incorporate essential information to complete the provision of the Condition of the Contract, add information referred to in the respective provisions of the Condition of Contract and add, delete, amend or supplement the provisions of the Condition of Contract.

Standard Forms - This section includes samples of Form of Bid Security, Letter of Acceptance, Form of Performance Guarantee and the Form of Agreement. All the above forms are recommended samples excepting the Form of Agreement which is the copy of the mandatory form which the Employer and the Contractor will be required to sign and seal after the award of the Contract.

Form of Bid - This is the standard Form of Bid which the bidder is required to perfect and submit. Since the bidding procedure is the "Three envelope system", there is no provision in the Form of Bid to enter the bid price. The bid price is stated in the Form of Price Proposal.

The other section of the standard bidding documents namely the "Schedule" comprising the preliminary information, publication of annual turnover etc., working capital, construction experiences, particulars of construction equipments and the "Employer's Requirements" are peculiar to the project and the contract concerned and therefore are not detailed.

The present publication is not a revision of June 2002 document but new Standard

Bidding Document incorporating a new Form of Contract for Design and Build Works. This Form of Contract primarily based on the *Conditions of Contract for Plant and Design - Build (First Edition 1999)* published by *Federation Internationale Des Ingenieurs Conseils (FIDIC)*.

This document contains certain fundamental noteworthy differences to the Design and Build Forms of Contract hitherto used in Sri Lanka. Therefore it is of utmost importance that the users of this document specially the Consultants, have a clear understanding of the document and fully appreciate the obligations stipulated in respect of duties and responsibilities of the parties to the Contract and of the 'Engineer'.

The Contractor

The obligations and responsibilities of the "Contractor" are adequately dealt with in this Form of Contract. The Contractor designs, executes and completes the Works and is responsible for the adequacy, stability and safety of all site operations. The Contractor is obliged to employ experienced qualified persons to design and document the Works and to obtain and maintain a Professional Indemnity Insurance Policy as a safeguard against professional negligence as far as the design of the Works is concerned.

The Employer

The "Employer" originates and sets in motion the construction process. The "Employer's Requirements" is the single most important section in the Bidding document, which spells out the general requirements of the project, in conformity with which the tenderer shall prepare the "proposal". In order to attract an efficient, cost effective and a technically sound offer, the "Employer's Requirements" shall be designed to achieve the following, among other things;

i. Provide broad design concepts and performance specifications pertaining to the proposed Works.

ii. While defining the "Employer's Requirements" as precisely as possible, avoid being specific as this may impede the flexibility and competitiveness of Bids.

iii. If the project requires training facilities to Employer's personnel, or service / operational manuals or warranties / guarantees that should be provided by the Contractor which may even extend beyond the maintenance period, this shall be stated specifically.

A well-drafted, unambiguous "Employer's Requirements" is undoubtedly the forerunner to a well-balanced, economical offer.

The Engineer

The "Engineer", defined as "the person who is responsible for administering and supervising

the execution of the work" accepts far more responsibilities than those of his counterpart, the "Employer's Representative" in the former publications. The Employer's Representative was "responsible for monitoring that the Works are built in accordance with the Contract Document to the extent which the Employer may otherwise specify by written notice to the Contractor, for the receiving or issuing of such drawings, applications, contents, instructions, notices, requests or statements or for otherwise acting for the Employer". This document empowers the Engineer to act as the Employer's Agent as it is evident from sub clause 3.1 (a), which stipulates, "that whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer". The Engineer is in a unique position in this Form of Contract where it is not obligatory on his part to obtain the Employer's consent or concurrence in making determination with regard to certain vital contractual matters.

The Engineer's powers in this Form in respect of certain issues, even surpass those of the Engineer in the traditional design, bid and build contracts.

The Engineer in this Form of Contract is not merely the "Employer's Representative" but the Employer's Agent on whom the parties have bestowed certain specific powers and responsibilities. Sub clause 3.4 (Determination) is the pivotal clause, which empowers the Engineer to make decisions or determination on a several important matters. The Engineer's determination under this sub clause is binding on both parties unless and until varied or revised in consequent to an Arbitral Award under clause 19. The Conditions of Contract requires the Engineer to exercise power and authority derived from this clause to make determinations in respect of a several important issues, including the following ;

Possession of site

If the Employer fails to give the Contractor the possession of or access to the site, within 14 days of issuing the Letter of Acceptance and the Contractor makes claims for time extension and / or expenses incurred, arising from such delays then the Engineer is obliged to determine the period of extension and/or amount of damage (if any) and notify the parties accordingly (Refer sub - clause 2.1)

Employer's Claims

Process Employer's Claims for cost or extension of Defects Notification Period and determine the amount if any, the Employer is entitled to be paid by the Contractor and / or extension of Defects Notification Period. The sub clause further states that the amount so determined may be deducted from the amount certified in a Payment Certificate.

contd. page 14...

Women in construction

By: **Professor. Chitra Weddickara**

The industrial and occupational distribution has been such that women are concentrated predominantly in few occupations, mostly in the service sectors. The working conditions and practices in these service sectors are traditionally poor with low wages and short-term employment. This has remained relatively consistent over the last 20 years (Martin and Roberts 1984). However in Sri-Lanka due to welfare policies initiated by the state both women and men have been given equal opportunities to study thus increasing the literacy rate of women and decreasing the gender gap. Even though overall numbers of women involved in the development process seems equal in Sri-Lanka there is a great difference in the type of education or jobs seen as suitable for men and what is perceived suitable for women. Construction is such a sector where great disparities are visible.

Construction industry, regardless of any country

traditionally is considered as male dominated.

Despite the fact that it is male dominated, women are increasingly contributing to the sector in design implementation and construction. This contribution is mostly at the professional level and at the menial level of unskilled labour. With in the professional group



Architecture is perceived as being a women's role and the number of men and women are more or less equivalent. In Engineering and Quantity surveying too, the numbers are beginning to be equivalent due to the liberalized education policies. When it comes to the vocational training levels in construction related trades such as the artisans' level & the supervisory level there is a high

level of gender disparity. Apart from the figures on participation in training and statistics, the proportion of women working in the sector are limited. Due to male dominance of the sector, women in construction are vulnerable to number of issues such as lack of upward mobility. There have been scattered programs such as the ICTAD training program, NGO program, and the Sarvodaya initiative which have been successful and show the potential for improvement.

The women have the capability to participate at various levels especially at the vocational level if programs are identified to facilitate women participation in the construction industry. Therefore it is recommended to the policy makers that research should be carried out in the collection of data related to gender in the construction industry. They should also facilitate training opportunities targeting employment niches, training in management and entrepreneurship and encourage partnership and relationship building between Public sector, NGOs and the private sector with gender equality in mind.

Contd. from page 13...

Forms of contract...

(Refer sub-clause 2.4)

Setting Out the Works

If as a result of any erroneous information furnished by the Employer concerning the setting out of the works, the Contractor suffers delay and/or incurs cost the Engineer is expected to determine such cost or time extension. Further, the Engineer is required to certify the cost incurred by the Contractor and grant time extension if necessary and may also increase the Contract Price. (Refer sub-clause 4.7)

Unforeseeable Physical Conditions

The Engineer is required to process claims made by the Contractor arising from delay or damage suffered by him due to unforeseeable Physical Conditions etc. The Engineer is further required to determine the amount payable and/or extension of time and so notify the parties.

The sub-clause lays down an unprecedented condition for recommending payments for damages suffered by the Contractor. The Sub-clause requires the Engineer to review whether other physical conditions in similar part of the works were more favourable than could have been foreseen when the Contractor submitted the bid. This condition may even result in the reduction in the amount of payment determined but without affecting a net deduction of the Contract Price. (Refer Clause 4.10)

Testing

If the Contractor suffers delay and/or incurs cost in respect of additional tests ordered by the Employer/Engineer, regarding which a claim had been made by the Contractor, the Engineer shall process the claim and determine the amount payable. (Refer Sub-Clause 7.3 and 10.3)

Variation Procedure

The Engineer shall value variation to the Employer's Requirements or to the Contractor's Proposal, ordered or approved by him. The Engineer may also order the Contractor to record cost of such variations. (Refer Sub-Clause 13.3)

Adjustment to change in Legislation and change in cost.

Engineer is required to check and determine the additional cost or time necessitating from a change in the laws or from change in cost. These include claims under Sub-clause 19.1 (Contractor's Claim) and Sub-clause 8.4 (Extension of time for Completion). It is also the responsibility of the Engineer to determine any decrease in cost due to occurrence, under Sub-clauses 13.6, 13.7 & 19.1. Which means that the Engineer should be vigilant to identify such events as it is unlikely that the Contractor would notify the Engineer of events which are disadvantages to him.

Payment on Termination

On termination of the Contract, the Engineer is responsible for determining and recommending payments due to the Contractor or to the Employer from the other

party, as the case may be. This is similar to the authority entrusted to the Engineer under other types of Contracts where he is expected to act impartially.

This provision applies to all forms of termination identified in this Conditions of Contract, namely;

i. Termination by Employer - clause 15.0 Including Termination for Employer's Convenience

ii. Termination by Contractor due to prolonged suspension of work - Sub clause 16.2 (f)

iii. Termination by Contractor due to other reasons attributable to the Employer - Sub clause 16.2 (a), (b), (c), (d), (e) & (g) and

iv. Termination by either party for a reason, which is beyond a party's control, such as Force Majeure. - Clause 20.0

The above are references to provisions in the Contract, which authorize the Engineer to determine amounts payable by one party to the other or to extend time for completion of work or prolongation of Defects Notification Period. The Conditions of Contract also makes the Engineer responsible for several other vital functions including;

i. Issuing necessary clarification or instruction on ambiguity or discrepancy in respect of documents forming the Contract.

ii. Obtaining from the Contractor detail drawings and other documents necessary for the proper execution of the works.

iii. Giving notice of Employer's claim to the Contractor.

iv. Approving sub contractors, other than those named in the Contract.

v. Instructing the Contractor to employ Nominated Sub Contractors.

vi. Approval of Contractor's Documents, designers and design sub contractors.

vii. Checking and approving As Built Drawings.

viii. Inspection and supervision of work.

ix. Monitor testing of materials including rejection of materials or parts of the work found to be unsatisfactory.

x. Reviewing program of work and revisions thereto, submitted by the Contractor.

xi. Recommending extension of time for completion and damages for delay in completing the works.

xii. Ordering suspension of work.

xiii. Issuing Taking Over Certificates in consultation with the Employer.

xiv. Issuing Variation Orders and valuing Variations.

xv. Issuing instructions in respect of the use of Provisional Sums.

xvi. Ordering execution of work on Day Works basis and approving Day Works statements.

xvii. Issuing Interim Certificates including Mobilization Advance Payment.

xviii. Checking the final statement of account submitted by the Contractor in issuing the Final Payment Certificate.

5.0 Conclusion

There are a few critical areas in the contract where the 'Conditions of Contract' is silent on the Engineer's participation. The most important among those are;

i. Determining the "mode of payment" for interim or final valuation.

ii. Determining the Construction Input Percentages in respect of ICTAD formula for computation of price variation.

Sub clause 14.1 (The contract price) states the contract price is Lump Sum but with provision for "measurement and valuation". Since the contract is essentially Lump Sum, a completed priced B.O.Q in the form of a Contract Sum Analysis would be necessary. It would be advantageous for both parties if the Contract Sum Analysis were made a part of the contract. Further more to facilitate realistic valuation of work progressively, a mode of payment should be agreed between the parties before commencement of work. If the Contract Data states, that certain parts of the work should be valued by measurement, further amendments should be made to the mode of payment. These scheduling and analysis require positive participation of the Engineer and if necessary, authority under sub clause 3.4. Similarly, the Construction Input Percentage should be computed and agreed between the Contractor and Engineer or the Engineer should be given the power to determine the same under sub clause 3.4. The schedule of Construction Input Percentages should be finalized and included in Contract Document before commencement of work.

The primary aim of this article is to draw reader's attention to the role of the Engineer in the latest ICTAD publication as it substantially differs from the role of the "Employer's Representative" identified in earlier publications. It should also be emphasized that for effective contract administration under this Form of Design and Build Contract the "Engineer" should be a team of professionals comprising Architects, Design & Construction Engineers, Quantity Surveyors and Services Engineers, and not an individual or a firm who or which claims to be conversant with all the aspects of contract administration.

Charter House express concern on lack of standardization

and spuriousness of construction material

Charter House International (Pvt) Ltd is a fast growing Sri Lankan Corporate entity with its core business and growth primarily in the trading and project activity.

They hold franchise from leading Principals worldwide for a wide range of product lines which cater to the building construction and engineering industry. Amongst a diverse product portfolio their Builders Hardware Supplies Division represents prestigious products such as Grohe Sanitary Fittings from Germany, Jacob Delafon Sanitaryware from France, Inda Bathroom Accessories from Italy, Mediclinics Washroom Equipment from Spain and VingCard Electronic Card Lock Systems from Norway, which products have a very high acceptance and market share in Sri Lanka.

Their Engineering Sales Department is actively involved in setting up of power generation equipment, service station and garage equipment, petroleum dispensing equipment and fuel management systems and a host of other machinery and equipment. They undertake total turnkey projects by way of supply, installation and maintenance of equipment they market. The company is also actively engaged in major projects of both the government as well as the private sector in these areas.

The company offers excellent technical backup facilities by way of trained technical personnel and fully equipped workshop facilities in order to provide after sales support and services for the products they market.

As for plans for the future, the company has plans to introduce many technologically advanced new product lines for the building and construction sector which they believe will go side by side with the development process of the country.

The company believes in the philosophy that sales and services support to customer is of paramount importance, towards which end their staff are geared and as such the company is not willing to compromise with quality and standards for its marketing strategy.

In the above context, Charter House feels that due to inadequate controls and standards in the import of most products in the building and construction sector, products of very poor quality, and most of the time duplicates of branded products are flooding the market. This has caused confusion in the minds of consumers who have no proper idea or experience to differentiate between the good and the bad. In fact, at a recent consumer survey carried out by them, most consumers were of the opinion that, had they been educated on to expect standards, they would have preferred to purchase quality branded products even at higher prices, rather than be duped by unscrupulous traders into buying cheap low quality products which do not last them 1/4 of the lifetime of a quality product. It is therefore felt that the time has now come for authorities concerned to step in to install the necessary machinery to control standards of products imported into the country. This would be in the interest of the consumer in particular and by and large the country in itself.

Low Cost Housing a National priority

The Government's 'Regaining Sri Lanka' concept is highlighting the need to invent ways and means to introduce low cost housing as a solution to unplanned urbanization, shanties and low-income settlements around the city of Colombo. Realizing the urgency of this national priority even before the publication of 'Regaining Sri Lanka' certain private companies have embarked upon the manufacture of low cost houses on a pre-cast form. In designing such models it is important to consider the compactness, assembly & transportability also as well as the cost. The model produced by the International Construction Consortium come close to these specifications.

International Construction Consortium Ltd., (ICC) is today one of Sri Lanka's leading contractors and they have now introduced a new concept in pre-cast house construction called the "kit houses". In this all the components which come in knock down form could be easily assembled at ground level. The material for wall cladding and the

types of finishing could be decided by the house owners themselves based on their requirements and their budgets. A good value opportunity for middle income house builders who could take advantage of the government sponsored housing loans at 10.5% p.a. Concrete column bases, columns, foundation beams, tie beams, steel roof frame & asbestos sheets are included separately in the house building kit. These can be assembled and the house structure can be built in 4 to 5 days even by unskilled laborers with the instruction leaflet for the construction. To assemble the kit house you will receive necessary tools and other equipment too.

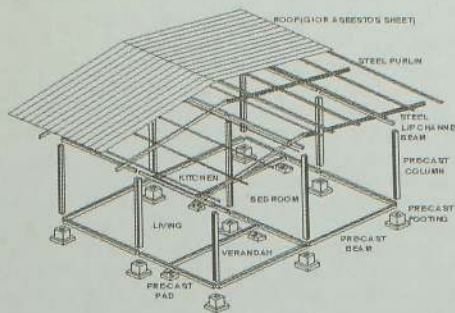
As the weight of 438 sq. ft house kit is only 3 1/2 tons, the material can be transported in a small lorry to the required site. When a kit is assembled you will have a foundation, roof and the structure of the house, the length and breadth of the rooms can be altered to your requirements. You can also select your floor, walls,

Contd. on page 17...

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The construction of thermally comfortable factory buildings.

By: **Dr MTR Jayasinghe**,
Associate Professor, Department of Civil Engineering,
University of Moratuwa.

The modern factory buildings are generally single storey buildings covering a large floor area. Thus, those will have a large roof supported either on roof trusses or portal frames. The height to the eaves generally can vary from 3.0 – 4.0 m. and invariably there will be no ceiling for the factory in the conventional sense. However, some insulating material will be provided below the roofing sheets to reduce the heat flow through the roof. Some of the factory buildings, specially those used for garment and electronics industry could be air conditioned as well, but the other buildings would be free running and ceiling fans would be used to improve the thermal comfort.

The roofing material used could be either cement fibre sheets (asbestos) or profiled galvanised iron sheets. Both these materials could absorb a considerable amount of solar radiation and that could be transmitted inwards to the factory building. Therefore, it is absolutely necessary to provide some insulation for the roof of the factory building.

There are two types of insulating materials that could be used in the factory buildings:

1.The materials that rely on extremely low conductivity to reduce the heat flow. These are generally low density light materials consisting of large amount of air bubbles. These air bubbles are not interconnected such as in mineral fibre or expanded polyethylene foam. This is called 'resistive insulation'.

2.The materials that rely on the reflectivity as well as low conductivity. This type consists of the insulating materials of certain thickness such as 8 to 50 mm provided with reflective surfaces either on one side or on both sides. The reflective surface is generally bright aluminium foil. This type of insulation is generally called reflective insulation.

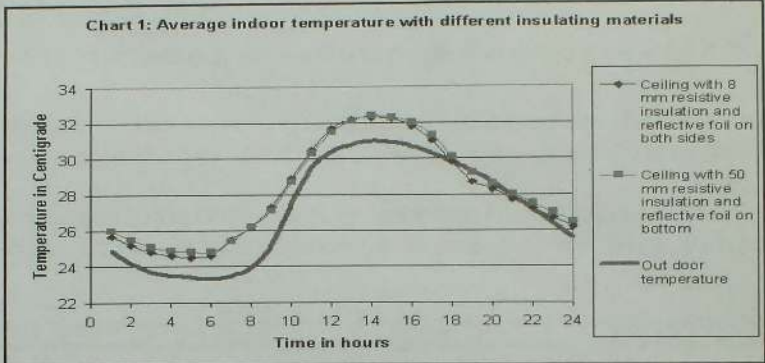
When reflective insulation is used for factory buildings, it should be installed with a very small air gap below the roofing sheets. Since air is a very poor conductor, it will cut down most of the heat transferred downwards through conduction. The air gap also helps to reflect most of the heat radiated by the roofing sheets. It could generally reflect about 95% percent of the heat back to the roof.

The heat energy that is not reflected will be absorbed by the insulating material and transmitted downwards through conduction. Since only a small portion of the heat is transmitted downwards, the air in between the top surface of the insulating material and the bottom of the roofing sheet could become quite warm. This temperature could be as high as 45 – 55 C in a sunny day. Therefore, it is quite important to ensure that this hot air will not leak downwards. It will also be quite useful to facilitate the escape of this hot air into the atmosphere at the ridge of a double pitched roof.

If reflective foil is not provided at the top, more heat would be transmitted through the insulating material and hence a greater insulation thickness would be necessary. Some of the insulating materials available in the market rely on this very low conductivity of the material and does not have a reflective surface for the top side. These are generally installed touching the roofing sheets. There are others that

would provide a reflective surface for the top side as well.

The reflective surface in the bottom side of the insulating material could perform a different function. When any object is heated, it will emit long wave radiation. This is called the emissivity of the material. Almost all the materials and paints will have approximately the same emissivity and this is generally about 85 – 90%. This will not depend on the colour. However, polished metal surfaces such as aluminium foil would have a much lower emissivity. It is only about 10%. This means that it is beneficial to have a bright metal surface facing the factory, since it will not emit much long wave radiation indoors.



Thus, if the reflective surface is available on both sides, the top surface could reflect most of the heat and the bottom surface could minimise the long wave heat emitted downwards. This could help to reduce the indoor temperature of the factory building. If only one reflective surface is provided with thick insulating materials, the heat transfer could be reduced by using low conductivity and the reflective foil facing the indoor of the factory could cut down heat emitted indoors. This also could help to reduce the indoor temperatures low. This means, one of the above insulation types should be provided in factory buildings.

The thermal comfort within a factory building will depend on many factors. The two main factors would be, the indoor temperature and the humidity. Generally, for Sri Lankans, a temperature up to 31°C could be tolerated during the daytime with the following conditions:

- 1.The relative humidity is about 70%.
- 2.The indoor air velocity is about 0.6 m/s.
- 3.There are no heated bodies in the vicinity.

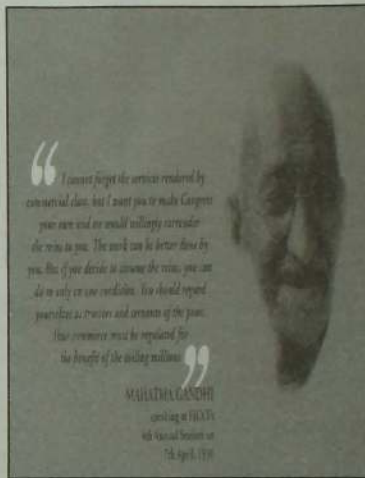
In a factory building, maintaining the first two conditions would be relatively easy since the humidity drops to about 65 – 70% during the daytime. It is possible to use ceiling fans to provide an air velocity of even 1.0 m/s. The third condition would be the most critical since any surface at higher temperatures would emit long wave radiation that could affect the thermal comfort. This could easily happen through the roof. Therefore, it is absolutely necessary to use insulating materials with a reflective metal surface facing indoor, for factories located in Sri Lanka. A comparison of the indoor temperatures obtained based on computer simulations for the resistive and reflective insulations are shown in Chart 1. The resistive insulation consists of 50 mm thickness with bottom side with aluminium foil. The reflective insulation consists of aluminium foil on both sides of 8 mm of resistive insulation. The reflective insulation is installed with a small air gap. The results of Chart 1 indicates that both the above types could perform approximately the same. The same result was observed even with the actual measurements made with the

models. These results are obtained for March, which could be considered as the hottest month for Sri Lanka.

Since the thermal comfort of the factory worker could affect the productivity, every other possible measure should be explored to make a thermally comfortable environment indoors. Since some of the factories have profile galvanised iron sheets as the walls, it is advisable to add insulating materials for the walls as well. For example, the walls facing west will have a quite high temperature during the afternoon as the sunsets. These walls could emit long wave radiation that could affect the workers close to such walls. However, the use of insulating materials

40% of the energy is within the visible light. It is well known that dark colours such as grey, blue, red and black would absorb much more solar radiation than light colours. If the roof is painted with a light colour, it would be possible to reduce heat absorbed by the roof and as a result the heat transmitted indoors. Therefore, it is advisable to use a roof covering material having a light colour. It is also possible to paint the roof with a light colour. The same principle could be adopted for the walls of the factory building as well.

These measures could enhance the thermal comfort provided to the workers thus enhancing the productivity in free running factory buildings. Even in air conditioned factory buildings, the above measures could help to reduce the air conditioning load thus making a saving in the electricity used.



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Gabion Walls

To hold the earth & drain the water

By: Palitha Senanayake

Dip.in.Lim. SAMC
(CCI Correspondent)

We in Sri Lanka were unfortunate enough to experience more than our share of disaster during the past few months and to witness the deaths of thousands of people in parts of Sabaragamuwa and the Southern Provinces. Those were national catastrophes of considerable proportions which took these areas unawares with no respect for any being or thing destroying everything in its path. Those disasters could be described in simple terms as 'floods' and 'landslides' yet in more specific terms these could be analyzed as having emanated from adverse circumstances that are two fold. One is the excessive rainfall experienced in these areas unprecedented for the last 60 yrs and the other is the inability of those areas to contain such a barrage of rain power within the confines of their normal water ways.

As for the extraordinary levels of rainfalls this is a matter for the meteorological Department to forecast with certain levels of reliability and then for the institutions concerned to take precautionary action at the national emergency level. The success or failure of this exercise may bound to affect the resulting process which is the act of containing such large quantities of water within the normal water ways and then to facilitate their flow down stream to the sea. We in the construction industry could well leave the changing moods of the weather gods in the hands of the meteorological wizards and concentrate on ways and means of employing the construction techniques, old and new to facilitate the down streaming of flood water with the minimum of damage to the environment. It is in this quest that we stumble upon the concept or the technique of Gabion Walls.

These are a kind of firm but permeable walls made of hard material but of rather soft texture.

Although it is known that gabions have been used from ancient times, it is only in the last few decades that their widespread use has led them to become an accepted construction in civil engineering. In modern day Sri Lanka it is not difficult to find the sight of gabions supporting either a canal bank or a road bank but a layman who is generally used to a hard cement constructed wall may view these as clumsy impermanent structures and sometimes may wonder what is the big idea? It is important to understand the rationale behind the gabions and it is not the cement or metal that would eventually give strength to the bank but the integration of the fill itself and the gabions facilitate this fill far better than the traditional cement wall. As to the clumsiness of the structure the wire mesh properly filled with metal will always have more strength than the mortar holding

the metal even though sometimes the mesh may appear somewhat bulging compared to the cement wall. However as the technology is constantly improving the modern gabions are done with hexagonal boxes called the 'Box Gabions' which tremendously improves the appearance as well as the strength of the wall. This bulletin in its February issue featured an article on landslides where the role played by the water table beneath the earth in the landslide prone area was explained. When the speed with which the water gets drained is not kept pace with the seeping in of water leads to a 'built-up' in the water table. Properly constructed Gabion walls could drain the water without moving the earth. In other words it holds the earth without holding the water.

Modern technology has improved on this concept and has made possible the manufacture of reliable and sound products with the mild steel mesh to be used in the gabions. The wire is woven into a hexagonal pattern with double twist joints which prevent the whole mesh from unraveling should a wire break or be cut. An outstanding advantage of the gabion is its flexibility. Its double-twist hexagonal mesh construction permits it to tolerate differential settlements without fracture. This property is especially important when a structure is on unstable ground or in an area where scour from waves or currents can undermine it. The strength and flexibility of the steel wire hexagonal mesh from which gabions and mattresses are made is utilized to withstand and absorb the forces generated by retained earth or flowing water.

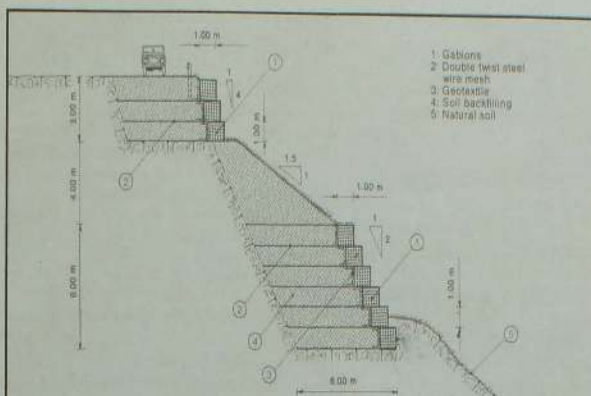
Hydrostatic heads do not develop behind gabion structures because of their permeable



U.S.A. - Vermont construction of a wall at Burlington.

nature. Their ability to combine drainage and retention functions make them ideal structures for slope stabilization. A Maccaferri gabion or Reno mattresses is a heavy monolithic gravity unit able to withstand earth trust. Its efficiency increases instead of decreasing with age since further consolidation takes place as slit and soil collect in the voids and vegetation establishes itself. Gabion installations are more economical than rigid or semi-rigid structures for a number of reasons. The following are the most important ones.

• Little maintenance is required.



Australia-Victoria, a 6.5m high retaining wall, built to prevent an earth slip south of the R.Wye, on the great Ocean Road.

• Gabion construction is simple, does not require skilled labour.

• Suitable stone fill is available normally on site or from nearby quarries.

• Minimum foundation preparation is required, the surface needs to be only reasonably plane.

• No costly drainage provision is required as gabions are permeable.

Because gabions permit the growth of vegetation and maintain the existing environment they provide attractive and natural building blocks for decorative landscaping.

Zinc coated box gabions

Box gabions consists of rectangular units fabricated from a double-twist, hexagonal mesh of soft annealed, heavily zinc coated wire. The wire quality and the zinc coating meet all international specifications. The mesh panels are reinforced at all edges with wires of a larger diameter than that used for manufacturing the mesh,

to strengthen them and to facilitate construction. Gabions may be divided into cells by fitting diaphragms which have the function of reinforcing the structure and making assembly and erection easier.

Zinc coated box gabions with PVC sleeve.

The characteristics of these products are similar to those of the zinc-coated gabions: however the wire, prior to manufacturing the mesh, is coated with a 0.4 to 0.6 mm thick special PVC (polyvinyl chloride) continuous sheath. A complete protection

against possible corrosion is thus obtained making the gabions suitable for use in marine or polluted environments. Diaphragms are always recommended when gabions are subject to continuous stress caused by wave motion or high water velocity etc. Filled with stone gabions become a large flexible and permeable building block from which a broad range of structures may be built.

Terramesh System

An interesting application for our zinc/PVC coated mesh products can be found in the field of reinforced soil. A combined anchorage system and cladding can be constructed as a single element. The facing can be 0.5-1.0m thick, with a sheer stepped face, similar to a normal box gabion wall which can be filled with stone or soil inside a fiber mat. Where stone is used as a filling material the external face can be covered naturally by inserting cuttings, planting climbers or covering the external steps with soil. However when soil is used for filling (Green Terramesh) then a superficial hydro seeding, using an enriched soil and seed mix, can be applied to the face and a complete "greening" of the structure can be obtained.

With the popularity of the concept of gabions and more so due to the necessities in different parts of the world to construct reliable banks specially for roads, canals and rivers this practice is gaining acceptance the world over with reputed international engineering firms joining with funds for research and development. Among many countries where gabions have been extensively used includes countries such as the USA, Australia, Italy, Brazil, Philippines, Indonesia, Malaysia and Thailand. In many of these countries there are engineers specialized in the various applications of gabions and there are special machines designed and used for these purposes. Gabions and mattresses are shipped folded and packed together in bundles, in order to occupy less space and make transportation to sites economical and easy. On site they are opened and assembled. Filling is also usually carried out by mechanical means using rounded river shingle or quarry stone

having a size slightly larger than that of the mesh, so as to have minimum percentages of voids. In today's world 'Gabion Walls' is not only a technique but also an industry.

Nature has its own course and usually the natural forces on earth are governed by the laws of nature without regard for the havoc they cause or the bonanza they bring about. Man being the most intelligent living being on earth has been battling from the time immemorial to understand and control the forces on his planet. With the emergence of 'Science' as the rationale of knowledge in this century it has been possible to increasingly comprehend the behavior patterns of the laws that govern the earth and with that to device means to control the resulting forces of such laws. Certain such devices invented earlier on concentrated purely on the unilateral effect of what it is designed to achieve with little regard for after effects. Yet with improved understanding of these forces and counter forces the modern engineering world could design more balanced devices to control the forces on earth without earning their wreath. Gabion walls and the associated technology could be considered as one such device.

Contd. from page 14... Low Cost...

window and doors to your affordable standards. In the alternative till you get sufficient funds the house can be temporarily enclosed with plank sheets, etc. Manufactured conforming to the highest quality standards at the ICC pre-cast factory, these kit houses are available at reasonable prices.

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An 652 sq. ft kit house - Rs. 108,000 (2 bedroom, living room, verandah, kitchen & bathroom)
An 866 sq. ft kit house - Rs. 140,000 (3 bedroom, living room, verandah, kitchen & bathroom)

The ICC has taken an appropriate step considering the state of the country's economy as well as the economy of those who are in need of such houses. Yet there is room for improvement as what is offered is only the basic structure at the price mentioned. In the same breath, it would be very useful to have a simplified but more complete house at a cost majority of the people who need houses can afford.



'Saviya' brand cement marketed by Adamjee-Lackmangee and Sons Ltd has received the SLSI certificate from the Sri Lanka Standards Institution (SLSI). Here, Chairman of the company K.T. Gulam Hussain receives the quality certificate from SLSI Chairman Arjuna Weerasingha at the Institute's premises recently.

Projects handled by the Bureau Of Infrastructure Investment

POWER.

Project Name: 300 MW Kerawalapitiya Power Plant.

Profile: Combined Cycle Power Plant(s) with a total capacity of 300 MW plant is expected to be developed on a BOOT basis. The prospective bidders are given opportunity to develop one or two 150 MW plants or one 300 MW plant. The fuel option is kept open at the discretion of the bidder. The plant will be located adjacent to the Tank farm presently being constructed by the Ceylon Petroleum Corporation. Power Purchase Agreement(s) will be signed with the Ceylon Electricity Board to purchase electricity over a period of 20 years where a US \$ denominated "take or pay" tariff is assured. A Fuel Supply Agreement(s) will be available with the Ceylon Petroleum Corporation and an Implementation Agreement(s) will be signed with the Government of Sri Lanka, which will guarantee the undisputed payment obligations of the Ceylon Electricity Board and the Ceylon Petroleum Corporation. The combined cycle is expected to be commissioned by January 2006.

Current Status

Six parties have been qualified. RFP to be issued shortly.

Investment Size

Approx US \$ 200 - 250 m.

Project Name: 200 MW Medium Term Power Plants

A development of a number of power plants with an aggregate up to 200 MW on a BOO basis. 12 locations with varying capacity levels from 20 MW to 100 MW have been identified. The plants are expected to be operated on Auto Diesel or fuel oil (1500 sec) where the fuel would need to be transported through bowsters. For each selected bidder, a Power purchase Agreement, Fuel Supply Agreement and an Implementation Agreement valid for a period of 10 years from the Commercial Operation Date, would be available. The Power Purchase Agreement would assure a US \$ denominated 'take or pay' tariff. Through the Implementation Agreement the GOSL would assure the payment defaults by CEB and CPC. The Commercial Operation for 20 MW and 60 MW plants are expected to be April 2004, whereas for 100 MW plant it is expected to be August 2004.

Current Status

The Agreements have been signed. Financial Closure to be achieved by September 2003.

Investment Size

Up to US \$ 120 m.

Project Name: Wind Power Plants

Profile: One plant not exceeding & capacity of 30 MW to be developed on a BOO basis either at Hambantota or Puttalam in terms of Generation Expansion Plan of the Ceylon Electricity Board (CEB). The Power Purchase Agreement and an Implementation Agreement will be made available for a period of 20 years. The bidders are expected to secure the necessary extent of land. The plants would be connected to the Hanbantota and Puttalam grid substation depending on the location.

Current Status

One bid received. Evaluation of this proposal is ongoing.

Investment Size

Approx. US \$ 30 m.

Project Name: Mini Hydros

Profile: Total of 43 sites on Mahaweli regulated waterways and areas under the control of the Irrigation Department which is expected to generate approximately 50 MW. This would be offered to developers on the Standard Purchase Agreement.

Current Status

Cabinet approval has been sought to issue the LOI to selected parties.

Investment Size

Approx. US \$ 50 m.

WATER.

Project Name: 40 MGD capacity Water Treatment Plant at Kelani Right Bank.

Profile: Project Proponents who have experience in Investments, Design, Construction, Operation and Maintenance of Water Supply Projects to Invest, Design, Construct and Operate (long term) the proposed 40 MGD (million gallons per day) Water Treatment Plant on the right bank of the Kelani River at Ambatala in the Western Province of Sri Lanka.

Current Status

RFP has been issued. Proposals to be received by 4th July 2003.

Investment Size

US \$ 25 m.

WASTE MANAGEMENT.

Project Name: Solid Waste Management in the Western Province

Profile: As a result of the immense environmental degradation caused by unattended solid waste, the Western Provincial Council has decided to construct a 750t/p/d solid waste disposal facility in the Western Province (excluding CMC limits). The solid waste facility will be designed, constructed and operated on a long-term basis (25yrs). It is envisaged that investors will be invited to identify suitable sizes, propose the most appropriate technology with due consideration for the environment.

Current Status

EQI's have been evaluated and seven parties short listed. RFP is currently being prepared.

Investment Size

Approx. US \$ 25 m.

Project Name: Hazardous Waste Integrated Project

Profile: Hazardous wastes from various commercial, industrial and institutional sources are having an immense environmental problem in Sri Lankan cities and towns resulting in deteriorating health conditions and quality of life of the residents. It has been projected that by 2005 (at a growth rate of 15%) the amount of hazardous waste is almost 60,000 tons per annum, which is not properly attended to in Sri Lanka.

It is expected that the prospective investor will finance the construction of this plant (using appropriate technology) and take over the operation of the plant for a period of 20 years, thereafter, the facility is expected to be transferred to the Government of Sri Lanka (GOSL).

Current Status

One party pre-qualified. Negotiations of Agreement are presently ongoing.

Investment Size

US \$ 33.5 m.

TRANSPORT

Project Name: Colombo - Katunayake Expressway

Profile: The construction of an

expressway from Katunayake to Colombo is a long felt need to provide easy transport between the international airport and the capital city.

The expressway with a length of 25km has four lanes and the facility is designed to cater for speeds of 110 km/hr. there are four interchanges at Kelaniya, Peliyagoda, Ja-Ela and Katunayake. Soft ground treatment has been partly completed.

Current Status

RFP is being prepared to invite the private sector on a BOT basis.

Investment Size

US \$ 125 m

Project Name: Sri Lanka - India Bridge

Profile: This project proposes a land - bridge linking the Sri Lankan and Indian cities of Talaimannar and Dhanushkodi respectively. This permanent link will facilitate the effective and efficient movement of both passengers and cargo, resulting in increased economic opportunities for both countries.

Current Status

Concept report is completed. Feasibility study to commence.

Investment Size

US \$ 880 m

Project Name: Development of the New South Port of Colombo

Profile: The development of the New South Port of Colombo is expected to be a phased development, where up to 12 berths would be offered to the private sector on a BOT basis. These berths would

be offered for development at blocks of 2 berths. The complete development would add a capacity of 4.8 million TEU's. It would be situated adjacent to the Queen Elizabeth Quay and necessitate a construction of a new breakwater. It is expected to be dredged to a depth of 17-23 m.

Current Status

The Consultants for the design and preparation of the contract documentation are expected to be appointed shortly. This consultancy is expected to be funded by the Asian Development Bank.

Project Name: Colombo-Kandy Expressway.

Profile: The need for expanding the existing transport network in the Colombo - Kandy corridor has become imperative, given the industrial development, which is now taking place in the country and particularly in this corridor. Current conditions along road A1 are far from satisfactory. Travel speeds during daytime and evenings are low. Three hours are normally required to travel 115 km from Colombo to Kandy. The starting point of the expressway will be the Kadawatha Interchange of the Colombo Outer Circular Highway and the end point will be at Katugastota. Design speeds of the expressway would be over 80 km/h. The road from Kadawatha to Ambepussa will have 4 lanes narrowing to 2 lanes from Ambepussa to Katugastota. The number of proposed interchange are 13.

Current Status

Evaluation of Interest in progress.

Investment Size. US \$ 300 m.

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