Housing and Urban Indicators for Management of Sustainable Urbanisation

India represents a unique situation in the urban process. It has among the largest urban systems in the world, 250 million strong with an annual incremental urban population averaging 5-6 million over the last four decades. Urban India comprises 23 metro-cities, 4 mega-cities, 300 large towns (1 lakh plus) and 3,396 secondary towns. Urban population has gone up from 13.9% in 1947 to 25.7% in 1991 and is on the anvil to cross the 30.0% mark within 4 years, when India is expected to have 40 metro-cities and 60% of GDP will be generated in urban agglomerations. Urban experiences, however, suggest that India was not prepared for such a major entry into the "urban age" and the Habitat II National Report provides some insight, using a set of urban indicators.

The depressing situation in urbanising India is seen through several key indicators that were developed by the Society for Development Studies (SDS) for 11 Indian cities as part of the inputs for the India Habitat II National Report. House price to income ratio suggests that urban households require around 11 to 13 years of household income to own a medium category house in the mega-cities, as against a desirable norm of 6-7 years. Rentals to income ratio is 0.35 to 0.50, living space per capita is progressively declining, solid wastes collection is in a deplorable condition in terms of frequency of collection and method of disposal; open dumping is the normal disposal system with sanitary landfill evident in the larger towns; modern techniques of incernation and recycling is still not evident.

The supply of potable water, which is recognised as one of the most critical urban services for sustainable settlements is not regular and per capita consumption is much below desirable norms, especially in low-income settlements. Subsidised urban services like water and electricity fail to reach the poor in the informal settlements. The financial health of local governments promises little hope of urban regeneration. The law and order situation seems to be breaking down in an increasing number of urban societies, as is also the transport system. New "urban" crimes like arson, economic crimes, fraud, "supari" murders are being accepted as a price for urbanisation, growth and higher incomes.

The Housing and urban Indicators now provide a good professional tool for urban managers, planners and policy

makers to manage the growing urban situation. The indicators provide an insight into the malaise. As a diagnostic tool, it focusses the attention of the urban manager on the critical areas where interventions are required and also facilitates the narrowing down on the type of interventions from among a range of paths to urban growth and sustenance.

The analytical utility of the Habitat Indicators as an effective tool can be demonstrated with an illustrative indicator, housing cost to income ratio: if it is unusually high, it is clear interventions are required on the housing supply side - interventions to accelerate supply of critical inputs like land and finance and making legal and fiscal environment housing-friendly. But this would not be sufficient. In the post-economic reforms era of rising interest rates and cost of funds, housing production costs have to be contained through appropriate technological solutions, covering construction practices and building materials. The management of the programme has to be streamlined to reduce, if not eliminate, time and cost overruns. At the same time, special interventions may be required to facilitate vertical movement in incomes of the lower segments of the income quintiles through fiscal, financial and skill access programmes.

Vinay D. Lall,
Director, Society for Development Studies, New Delhi

The India Indicators Programme was conceived, developed and promoted in India by SDS and has been recognised by the UNCHS at the Habitat-II Conference as the Best Practice in the Global Indicators Programme, and India was presented the Awards for Excellence among all the 110 countries for these efforts.

Emerging Trends in Building Materials

In the past the buildings were designed taking into account the nature and type of materials available in the market. The current trend indicates that the materials are modified or tailormade to suit particular type of construction.

Building materials account for up to two-third of the total cost of house construction. Moreover, the speed of construction, safety, durability, and performance of houses greatly depend on the type of building materials used and appropriate technology of construction.

For sustainable development special emphasis would have to be laid on prevention of **environmental degradation, energy conservation, ecological bal-**
e, and **use of industrial and agricultural wastes as resources for building material industry.**

However, the total dependence on the natural mineral raw material resources for manufacture of building materials and components have caused enormous harm to the ecology of the country. The continuous mining of the lime stone at the foothill of Himalayas for making cement, indiscriminate felling of timbers from the forests for manufacture of plywood, excavation of earth for making bricks have taken away the precious natural resources in such a manner that it will have a major impact on the ecological balance by the end of the century if these activities are not pre-
v ..ed or reduced.

Production of durable materials requires use of energy in significant proportion. 70% of energy is consumed in the manufacture of Building Materials and the rest 30% in transporting the same. In light of severe constraints with regard to availability of conventional energy resources and their high cost, it is necessary to adopt measures which result in energy conservation and also to use non-conventional energy resources for production of building materials to the extent possible.

The technological advancement that have taken place in the last two decades have amply proved the efficacy of some alternative sources of materials such as industrial and agricultural wastes, composites, plantation timber, plastics etc. which are renewable and energy conservative in nature. The greater utilization of these materials will open a possible avenue for conservation of the virgin materials leading to restoring the ecological balance that is lacking at the moment. In this context, it has become necessary to review some of the advances taken place in the building material sectors which have made a conspicuous appearance in the Indian scenario. Few such innovations are discussed below :

BLENDED CEMENT

The use of blended cement is increasing world wide as they need less energy for production. The blending of well characterised flyash, blast furnace slag, red mud kilndust with cement is practised in most countries for achieving specific modifications in the behaviour of cement as well because it reduces cost, conserve energy and protect environment. Some of the advantageous of blended cements over OPC are :

i. higher long term strength
ii reduced heat of hydration
iii increased durability
iv better resistance to soils and acidic and alkaline water
v better resistance to sulphates and chlorides in water
vi prevent leaching of cement
vii minimal expansion with temperature variation
viii less possibility of developing cracks
ix consumption of less cement for concrete of the same strength and economises construction

The aggregate demand for consumption is expected to increase to 70 million tonnes by the end of the eighth plan (1994-95). After virtually stagnating in 1992-93, the demand and the supply of cement picked up in 1993-94, the production risen by 6.5% vs 1% in 1992-93 and despatches increasing by 8% vs .5% in 1992-93. A recent study carried out by financial institutions indicates that against the aforesaid growth in demand, the installed capacity is execpted to increase upto 75 million tonnes by 1996-97.

India generates almost approximately 7.80 million ton of blast furnace slag, 44 million tons of flyash, 2.00 million ton of kiln dust and other pozzolanas which can be gainfully utilized for blended cement and the recent trend shows that there has been sufficient demand for blended cement particularly in the coastal belt in the future. The export potential to nearby countries has also increased which prompted the manufacturers for increasing the quantity of blended cement in their manufacturing schedule.

READYMIXED CONCRETE

The Readymixed concrete (RMC) is a processed material which in a plastic and unhardened state is sold as a finished product ready for use. Unlike site mixed concrete it is manufactured in a factory and the process of readymixed concrete results in substantial economy as compared with present mixing practices. A satisfactory end product depends upon the design, material quality and the workmanship. RMC is both a product and service which has to be acceptable to the contractor.

The use of readymixed concrete in construction industry is well known. In developed countries like Australia, USA, Japan, USSR, UK etc. and even in countries like Malaysia, Korea, Indonesia, RMC industry forms a major sector of construction industry. The modern trend of RMC is to incorporate flyash which is waste material from thermal power station. It has been established that the incorporation of the flyash upto 20% or even more in RMC will not affect the properties or quality of concrete but

would rather improve certain properties and make it more economical than site mixed concrete besides saving cement consumption. The disposal cost of flyash and the environmental pollution created by its disposal can also be minimized. Apart from these, other advantages of RMC are :

i saving in cement
ii enables speed in construction
iii increased permissible strength is obtained as the grading, proportioning and mixing of RMC is done under the supervision of trained personnel and under controlled condition.
iv for preparing the concrete at the worksite, purchase, transport and storage of material is necessary. If RMC is used, the expenditure over the abovementioned items and the efforts involved in the same, are eliminated.
v when a construction is to be done in a congested locality, enough space for storing the materials and mixing concrete is not available. This problem will be eliminated if RMC is used.
vi elimination of waste and pilferage of materials.
vii reduction in supervision charges on the job.
viii reduction of working capital
ix economical compared to site mixed concrete.

The use of RMC in the construction project has been increasing particulary with installation of couple of plants in Maharashtra in the private sector. Apart from it some of the public sector projects are also using RMC as a captive unit set up to feed a particular plant or project. With emphasis on both sustainable development and cost reduction, the prospects of RMC in India has been increased in recent times and with indigenous availability of plant and machinery, the use of RMC is expected to be increased manifold in the future.

RECYCLED WASTE MATERIALS

It has become almost imperative to understand that not only the total energy required but also the form of energy required by different production processes and technologies and to arrive at the most cost effective and energy efficient process technologies for production of building materials and components. In this direction another area which has been particularly investigated has been utilisation of industrial and agricultural wastes and by- products for manufacture of building materials. Serious R & D efforts of recent past have made it possible to develop know-how for processing of industrial wastes like flyash, phosphogysum, red mud, lime sludge, blast furnace slags and variety of industrial sludges for production of building materials. All out efforts are being made for improvement in methods of processing to help in waste minimisation, reuse and recycling of waste and by-products being generated by different kinds of industries. At the same time, there is growing consciousness that while we start using waste based building materials and components we not only help in conserving natural raw materials but also help in improving the quality of environment around us as most of these industrial wastes substantially contribute to the pollution of air, land and water.In addition the energy required for manufacture of the building materials from Industrial and Agricultural wastes are less compared to virgin materials.

OBJECTIVE OF WASTE UTILIZATION

The objectives of waste utilization in the construction Industry is to provide an appropriate and alternative resources for conservation of mineral wealth, energy, to augment the supply of building materials and to create a pollution free environment. The specific objectives may be summarized as follows:

* Create employment and income generating opportunities for the poor in rural and peri-urban areas through activities based on the production of building materials and the construction of shelter based on waste materials.
* Improve standards of living and working conditions by promoting the production and use of affordable building materials and related infrastructure facilities based on waste.
* To reduce energy cost.
* Minimize environmental pollution by recycling the wastes.
* Increase the efficiency of construction by augmenting the supply of building materials at affordable prices.
* To conserve virgin materials by providing renewable resoureces for raw materials.

The final selection of potential fields of utilization of wastes should be based on the results of the industrial sector analysis and the needs formulated by the construction industry.

BIO-COMPOSITES

Composite is synthetic assembly of two or more components - a filler or reinforcing agent and a compatible matrix binder which can be cement or resin. These composites do not dissolve or merge completely but do act in concert. The components as well as the interface between them can usually be physically identified. The properties of interface generally control the properties of composites. They find wide application in building construction, automotive components, plants for chemical industry, sports, aerospace and electrical industry.

When the reinforcing agents are plant fibre or agricultural and/or forest residues the composites are termed as Bio Composites. Wood is the only natural Bio Composite available which is made of Cellulose fibre and lignin as binder which provides stiffness. Wood is versatile material which has been used by the mankind since early age for house building, agricultural implements, fuel, furniture etc. The modern composite materials are synthetic and are based on biomass and PVC resins.

In India according to the available statistics about 1.43 million cubic meters of log were imported from 26 countries in 1990-91, the bulk of which was utilized by the plywood industries. Reckoning a capacity utilization of 80% the shortfall in supplies was almost 40% and 20% in the DGTD and SSI units respectively. Plywood production has been chiefly sustained by log import and the mushrooming growth of small units. During

1993-94 the country was importing Rs 5 crore worth of wood from Malaysia, Africa, and South America. But the situation has changed after 1995 as log movement all over the world is being increasingly restricted in keeping with the emerging trends among nations to save their forests. Therefore, wood substitutes are bound to assume importance in a world that is increasingly conscious of preventing its natural resources.

As far as building material industry is concerned, the composites may be defined as 'processed panel product', which may be classified broadly under two categories based on matrix content:

i High Matrix content composites
ii Low Matrix Content composites

High Matrix Content Composites

The reduction of matrix contents can be achieved to a limited extent by increasing fibre volume fraction. Normally, this requires greater product densification to eliminate voids. There is a practicable limit to the reduction of a matrix content by this route. An alternative approach is to replace the solid construction through greater life of sandwich construction with hollow cores. Pulp mouldings offer particular promise here, partly because they can be made with low technology from low cost, poor strength, slow draining pulp made from fibre residues. In India, the biggest problem are the high cost of imported reagents or raw materials and the high manufacturing cost. Therefore, the only answer to this problem is to look for natural polymer available in India which might be converted to matrix systems. An obvious possibility is Cashew Nut Shell Liquid (CNSL). CNSL resins are typically faster curing than phenolics. However, Indian CNSL is of variable quality and quantity both. Hence for potential use the quality of the CSNL should be improved as per requirement. Another suitable natural adhesive is tannin. It is also noteworthy that there are large quantities of coirdust remained unused from which a reactive phenolic may be extracted.

Low Matrix Content Composites

Low cost small scale technology is available in India for production of particle board from residues and annually harvested crops, which can be classified under low matrix content composites. This is in use in India with bagasse, rice husk, cotton stalk, jute sticks and plantation timber. There is new potential also for making low cost cement based panels. It has been reported that some agencies in South Africa have increased the plant fibre from 15% to 80% with considerable cost and weight benefits.

MDF technology can also be used to make a short fibre matrix content high density product. This is now called HDF in Europe and is essentially a thick (3.6 mm) high pressure laminate used in exterior claddings. A product of this kind might also be made from annual harvested fibres or residues in India.

SUPER PLASTICISERS

The concrete admixture can be defind as material other than cement which are added in small quantity during mixing to produce one or more modifications in the properties of the concrete and mortar. The use of construction chemicals has revolutionised construction practice in the recent past. Construction chemicals are being used advatangeously in many construction projects in the country. At present, a large variety of chemicals, materials for construction are available in the Indian market. The number of manufacturers of such chemicals have increased to a dozen from merely couple of manufacturer in 1980.

Super Plastisizer, one of the known construction chemicals is capable of reducing water contents in concrete by about 30%, at the same time resulting in an improvement of various properties of concrete.The use of super plastisizer in concrete began in 1960 in Germany and Japan and later on in 1970 in Europe and America. Use of super plasticisers in India is of recent origin. Incorporation of the super plastisizer in the concrete, results in conforming of self compating, free flow of concrete of excellent workability having improved strength and high

durability. One of the advantageous of using a super plastisizer is low energy needs, lesser plantwear and large water reduction.

PLASTICS

The emergence of extremely tough but light weight plastics has revolutionised science and technology, especially the ever increasing sophisticated world of medicine and particularly in the rapidly advancing field of implants. Hi-tech plastics have also changed the face of agriculture, construction, office equipment and consumer products, apart from packaging. Products made from plastics are not biodegradable. The focus of plastic waste has limited application and, in ciritical applications such as medicine, food packaging and engineering, reuse is not tenable. This is a serious drawback in the West, where the average per capita consumption of plastics is about 16 kilogrammes. In the Indian context, the figure is a nearly 2.5 kilogrammes.

Plastic industry has undergone tremendous growth during the last two decades. Polymers outcast conventional material due to their high strength to weight ratio and reduced specific energy consumtion. For example, plastics are 23 times better than steel and aluminium and several times better than other building materials like bricks and concrete in strength to weight ratio. Also metals consume 2.5 to 7.0 times more energy units on volume basis. High corrosion resistance, ease of fabrication leading to high productivity, versatality of product design and ease of maintainance are other merits that favour plastics. On the other hand, conventional materials like iron and steel corrode, wood loses strength on ageing, concrete possesses poor tensile strength and ceramics and glass are fragile. Plastics too are no exception and have their limitation like low modulus of elasticity, proneness to degradation by UV light, poor fire rating etc. R & D may soon overcome these limitation.

Today the country faces a shortage of almost every conventional building material. There is an urgent need to find substitute for materials like cement, timber, steel etc. and it is hoped that polymer composites will play a vital role to meet the demands of building industry. Polymer complosites are basically combination of plastics with conventional materlas which often provide properties that are not attainable by individual constituent material. Some outstanding properties of composites in addition to those mentioned above are superior heat and sound insulation, high corrosion resistance and built in decoration effect and low maintainance. Composites could be of several types but most of them are classified into 5 categories - fibre reinforced plastics (FRP), sandwich panels, polymer concrete, wood/plastic composites and plastic cladding metal. Research efforts to develop and promote use of polymer composites are in progress in a number of R&d organisations in the country as well as abroad.

It has been estimated that about 25% of total world production of plastics go into building application.Out of this dozen are important from the building industry point of view. They are polyvinyl chloride, phenolics, urea and melamine, HDPE, Urethane, reinforced polyester, polystyrene, LDPE, acrylics ABS, polycarbonate.

PREFABRICATED BUILDING COMPONENTS

In recent years, several prefabricated systems of construction have been developed in India. At present, there are several factories manufacturing precast concrete components in and around major cities. Of these majority have been set up with considerable public financial participation and a few under private sector. Number of large construction companies have also applied for licences for foreign collaboration for the manufacture of various types of prefabricated building components in a large scale for mass housing programme. In addition, several research organisations, consulting engineers and contracting firms and State Housing Boards and planning organisations have done considerable onsite prefabrication for housing projects in India.

Assessment of Market for Building Components

In India the shortage of housing at the beginning of 7th Five Year (1985) Plan was estimated as 24.7 million (5.9 million units in the urban areas and 18.8 million in rural areas). It is estimated that every year the need for additional housing units will be on an average 3.5 million considering normal growth of population under best family planning scheme.

The National Committee on Science and Technology (NCST) panel on "Prefabricated including industrialised systems of buildings" in its report of August, 1973 had suggested that there was a scope for introducing full-fledged prefabrication (either on site or off-site) for mass housing, industrial and institutional buildings in Metropolitan cities with a population of a million and over where heavy transport and hoisting equipment are available.

In urban areas with a population of less than one million and in rural areas there may not be continuing demand for residential and institutional buildings to justify setting up of capital intensive factories. Partial prefabrication combining standardised and optimised precast component such as solid or hollow concrete blocks, light weight concrete blocks, columns, beams, lintels, doors and windows, purlin, roofing units, sanitary core units etc. produced on site or off-site combined with in-site-walls may be the solution.

FERROCEMENT

'Ferro cement', as its name implies, is a composite material consisting of a rich cement mortar matrix and steel mesh reinforcement dispersed through the matrix. A grid of steelrods is also sometimes provided alongwith layers of chicken mesh which helps in giving the required form. FC construction can be defined as reinforced concrete construction requiring no shuttering which can be

either cast in sites or precast as per requirement.

Ferro cement has an analogy with RCC. Rounds are used as reinforcement in RCC while different types of meshes are used in ferrocement. It is not possible to use aggregate in FC as in RCC. This is because its thickness is less and mesh used may not have enough openings to accommodate aggregate., They also differ in construction. While RCC needs elaborate shuttering and because of its heavy sections, practically it cannot be precast, FC needs no shuttering whether it is cast in sites for wall or water tanks or precast. As such the basic ingredients in RCC and FC are similar and their density is 2400-2500 kg/m3. The major advantages of FC are :

- It is low-skill, labour-incentive industry i.e. not being very high-tech, skill-oriented. The labour can be trained to mastermind through short term courses.
- It is economical (its costs are nearly 25% less).
- Its strength weight ratio being higher, it consumes less steel cement etc. compared to RCC.
- The execution is more flexible as it can be precast or cast in sites construction.
- Total projection can be time-saving for e.g. in housing project lintels/chajjas, slab panels etc. can be kept ready before work comes to level.
- Required repairs can be easily attended to.
- FC houses are quake-resistant. They can withstand even a Richter scale reading of 6.5.

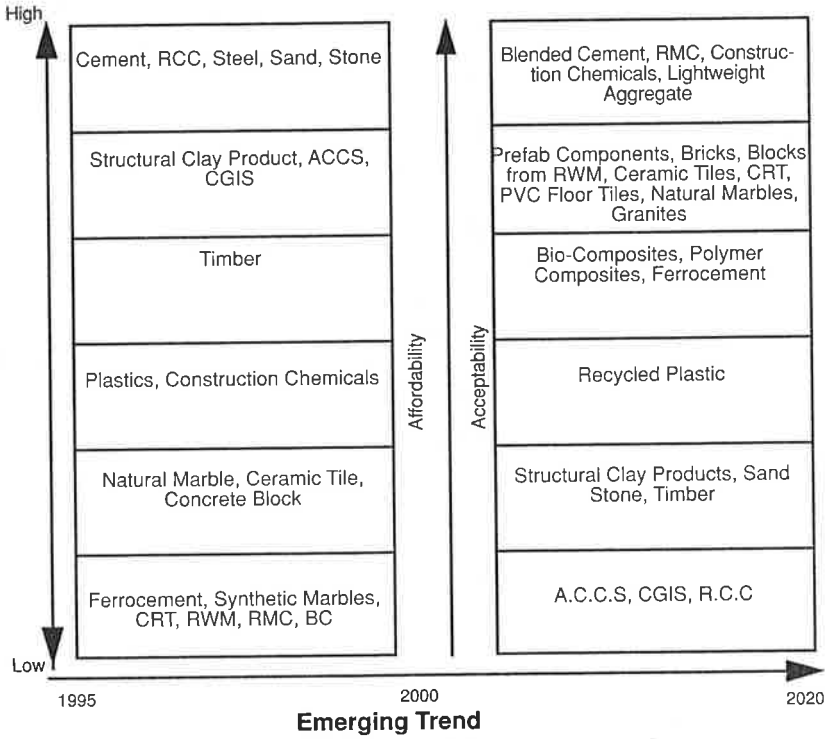
CONCLUSION

The development of a building material industry in the developing countries has an important social dimension or redistributive implication. In any strategy for the development of a building materials industry, therefore, highest priority would need to be given to the production of materials needed by the relatively poorer sections of the community. In any evaluation of production technologies, the primary objective should be to encourage production of building materials which are durable and inexpensive and which could be produced locally, using locally available raw material and skills. In devising construction technologies for the less affluent communities, the design and specification of the dwellings should broadly correspond to the traditional design and specifications, so that there would be no inhibition against the use or adoption of the new designs and specifications or of alternative materials or serious technical difficulties in the application of new materials and techniques involving the use of hired skills. There are just not enough resources in the world to build housing for everybody according to conventional standards, which may cost $100-$300 per square meter as against the $3-$10 required by the rural and urban fringe communities in a developing situation like ours.

Besides "traditional" materials many new materials and components are necessary for urban and large-scale construction. For many developing countries the market is not big enough to justify the production of all kinds of materials and components. A rational approach which is emerging in India may be summed up as shown in Fig-1.

Within these limitations a starting point for the assessment of appropriate materials and components would perhaps be to :

a) Identify and improve building components that require high performance in construction;
b) Identify and develop the production of building materials that should be considered for qualitative improvement;
c) Facilitate greater use of improved building materials that can be produced locally, using local skills and materials;
d) Encourage, through policy measures, the development of construction technologies that would harmonize with locally produced materials and with locally available skills.
e) The trend of Development should aim at Sustainable Development.



Emerging Trend

RCC : Reinforced Cement Concrete
BC : Blended Cement
CRT : Cement Roofing Tile
RWM : Recycled Waste Materials
RMC : Ready Mix Concrete
LWA : Lightwight Aggregate
CC : Construction Chemicals
ACCS : Asbestos Corrugated Sheets
CGIS : Corrugated Galvanised Iron Sheets

J. SenGupta
Chief - Building Materials, BMTPC

Machines / Equipment Developed by BMTPC

1. Hydraulic pressing Machine for Manufacture of Flyash Sand-Lime bricks

Production capacity	750 bricks/hr
No. of bricks per station	2 Nos.
Size of mould box	215x245x125mm or 190x200x162mm
Effective thrust	120 ton
Effective compacting pressure	240 kg/cm^2
Mortar	15 H.P.
Labour force required	4 Nos.
Overall size of machine	2.5mx1.3mx1.4m
Weight of machine	2000 kg.

Development and fabrication completed. Will be demonstrated in September, 1996

2. New Stabilised Earth Blocks making Machine

For large scale production of stabilised earth blocks, the Council has developed the following machines. (Pic. 1)

i. CRUSHMAN A manually operated soil crusher
ii. AURAMATIC A motorised semi-automatic press with a diesel engine
iii. MIXAMATIC A motorised soil mixer with a diesel engine
iv. CRUSHAMATIC A motorised soil crusher

The above equipment will ensure regular quality of blocks and lower the cost of blocks. The technology will be shortly transferred for commercial use.

With this development, production of compressed earth blocks would become a viable option for large projects and entrepreneurs would be able to set up stabilised earth block making units to meet the market demand.

3. Clay-Flyash Brick making Machine

The Council is developing a semi dry hydraulic press and mixing system for manufacture of clay-flyash bricks using all types of soils (including black cotton soil) and flyash continuously. The capacity of the press will be 10,000 bricks/day (under development).

4. Automatic Coal Stoker for Brick & Tile Industry. (Pic, 2,3)

The automatic coal stoker will be used for feeding coal in the bull trench's kiln. The coal stoker has been developed as a small motorised screwed conveyor fitted with a coal hopper and connected to the feed hole through a vertical pipe with inspection lid at top. The capacity of these stoker is 0.75 cft/° hr. and weight about 30-35 kgs. This device has been greatly appreciated and welcome by number of brick kiln owners who attended its demonstration recently.

5. Precast Concrete Door/Window Frame making Vibrating Table. (Pic. 4)

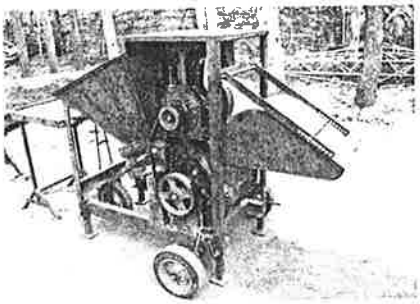
The council has developed a vibrating table for manufacture of RCC Door/Window frames of all sizes. This machine is capable of casting 4 door frames or 5 window frames in a day. The power requirement is 2 kw per table. The size of machine is 2400x1200x750mm. Nearly 70 machines have already been fabricated and supplied to production units.

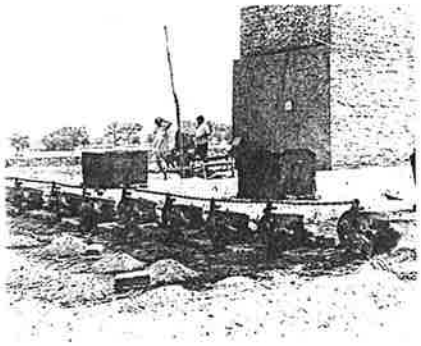
6. Development of Hot Press for Manufacture of Bamboo Mat Corrugated Roofing Sheets

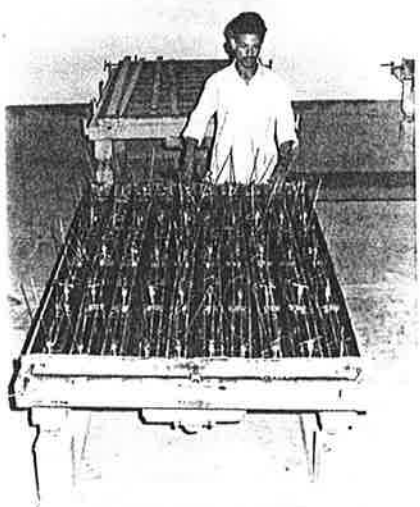
Recognising the urgent need for an appropriate roofing technology for North Eastern Region, a project for developing bamboo corrugated roofing sheets has been taken up by the Council. For this purpose, a day light hot press is being developed for production of standard size bamboo mat corrugated roofing sheets (Under development).

7. Machine for making Red-mud jute polymer door shutters

Laboratory scale trials have been successfully carried out. The technology has been transferred to an entrepreneur (at Madras) who is currently finalising the design for commercial production.







वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद्
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Dr KGK Warrier,
Head, Structural Ceramics

No. SCU/KGK/96 dated 18 December, 1996

DS	FEZ	HAM	Adv.	KOS
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	✗			

Mr Andre H. de Vries,
TNO Institute of Applied Physics
P>O> Box. 595
5600 AN Eindhoven
The Netherlands

FAX: 31-40-2449350

Dear Mr Andre,

We have received your faxes dated december 2 and 11. Thank you for the discussions on telephone too. I have not yet received the order ffrom The Netherlands Embassy. I do hope that the same will come by tomorrow.
Once I receive the information from the Embassy, I shall write to the Embassy for the transfer of money in Dutch Guilders to TNO. I shall also see that an order for work is released to TNO through Dr Damodaran.
I feel that the proposed dates of lyour visit is quite acceptable to us. Of course, we have also Dr Rolf Janssen from University of Hamburg visiting us during that time. However, we feel that we should able to manage with out much problem. I will be kin Trivandrum only from February 1st, but Mr Muralidharan will receive you and Mr Dennissen at the airport. All other things remain the same.
I was away for two weeks and hence the delay in this reply. I am sorry. We are sending a fresh copy of our proposal on CESC Mission to CSIR Head Quarters (Dr Bhandari). I hope there should notbe any problem.
Regarding the MOU, we have discussed with our planning section. We shall probably FAX one draft to you on which you can send your comments. We can finalise during your stay with us.
We are looking forward to your visit to Trivandrum with Mr Dennissen. We may discuss further on the reduction firing of flux bonded flyash.
Wishing you all a Merry Christmas Season and also Best Wishes for a Happy and Eventful New Year,

Yours sincerely,
(KGK Warrier)

adv

S

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Faxmessage

To	Regional Research Laboratory Trivandrum
attn.	Dr. Warrier, Dr. Damodaran, Mr. Muralidharan Nair
Faxnr.	00 91 471 491 712
From	André H. de Vries
Direct dial	+ 31 40 2656400
Date	30 December 1996
Subject	**Mission to CESC Calcutta**
Our reference	TPD-KK-FAX-96-2910
Copy to	DS-FEZ-arch HAM
Nr. of pages	1

Dear Dr. Warrier and Mr. Muralidharan Nair,

I received both your faxes from 27 December 1996, dealing with the mission to CESC. Answering your question by phone today I can inform you with the following:

Our bank account number is:	**5169 14 766**
Please send the money in NLG to	ABN/AMRO Bank - Delft
at the name of	TNO-TPD-TUD Delft
please refer to project number	653.814

The mission will be carried out according to our offer TPD-KK-LTR-96-2158, dated 26 September 1996, and according to the guidelines of the Royal Netherlands Embassy in New Delhi. As I have already informed you, we are planning the mission from 31 January to 18 February 1997. The exact time schedule is not known yet, but we will inform you in time. Since we want to write the final report during the mission, we think it will be necessary that one of your people is present in Calcutta during the mission.

Meanwhile, we wish you and all your colleagues from RRL-T a healthy and active 1997!

Yours sincerely,
TNO Institute of Applied Physics

André H. de Vries
Department of Traditional Ceramics

B K. Ramaprasad
DEPUTY ADVISOR
INTERNATIONAL S&T AFFAIRS DIRECTORATE

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वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2 रफी मार्ग, नई दिल्ली 110 001
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
Anusandhan Bhavan, 2 Rafi Marg, New Delhi 110 001

d.a.v. Andre de Vries
van Tna

No 26/391/96-ISTAD
3rd January 1997

Dear Drs Mrs Schmal-Vogelaar,

Thank you for your fax of 6th December 1996 regarding the two patents you enquired.

I am sorry I could not respond to you early as I was away in Brussels and Paris.

CSIR Patent office informs that the two patents have been filed. Their registration numbers are:

NF 58/95	892/DEL/95 dated 17.05.95
NF 59/95	893/DEL/95 dated 17.05.95.

With best regards and wishing you a happy new year,

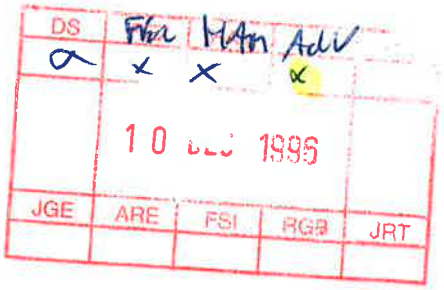
Yours sincerely,

(B K Ramaprasad)

DS	FEZ	HAM	Adv	KOS
X	X	X	X	
	10 JAN 1997			
JGE	ARE	FSI	RGB	JPT

Mrs Drs C.,Schmal-Vogelaar
Senior Adviser
TNO Buisiness Development (South Asia)
The Netherlands

Fax: 00 31 15 262 63 37



TELEFAX

To : Mr. André de Vries, TPD-E
c.c. : Ir. J. van Zijverden, TPD Delft

Faxno : 00 31 40 244 9350;

From : Mrs. Drs. C. Schmal-Vogelaar, Senior Adviser TNO Business Development

Faxno : 015 262 6337

Date : December 10, 1996; Ref.: 96 MP 1488

Pages : 3

Subject: Vliegas India

Beste André,

Hierbij een verslagje van mijn besprekingen over jullie projecten tijdens mijn laatste werkbezoek aan India in november 1996. We moeten maar gauw weer eens bijpraten over een aantal zaken. Vooral het gesprek met NRDC moeten jullie goed overwegen. Desgevraagd deelde Bhandari van CSIR mij mede, dat zij niet persé via NRDC hoeven te werken voor commercialisatie van patenten. Wellicht kom jij een dezer dagen een keer naar Delft. Laat even iets van je horen dan.

Tot zover weer groeten,

(Mrs. Drs. C. Schmal-Vogelaar)

Keramische industrie en vliegas

* **Calcutta Electricity Supply Company (CESC):**

Uit het gesprek met Mr. Tripathi van CESC ter voorbereiding van de bespreking met de National Research Development Corporation bleek o.a.

- dat Mr. Kallol Basu zeer te spreken was over het bezoek aan de fabrieken in Duitsland en Nederland, georganiseerd door André de Vries; hij was zeer onder de indruk van de kwaliteit van KELLER.
- De uitvoering van de demonstratie unit op schaal voor vliegas in bouwmaterialen wordt dan ook zeer waarschijnlijk gegund aan combinatie TNO-TPD en KELLER GMBH.

Mr. Tripathi op de hoogte gesteld dat de expertmissie voor experts TNO-TPD naar Calcutta inmiddels is goedgekeurd door Ned. Ambassade en vanaf eind januari 1997 zal worden uitgevoerd.

* **Energy and Environmental Improvements in the Ceramic Industries, Kerala**

Het project is goedgekeurd door de Ned. Ambassade op voorwaarde dat er nog een sociaal economische studie wordt ingebracht. Dit is van belang omdat de ambassade het project als demonstratieproject wil gebruiken, om het eventueel ook te laten uitvoeren in de andere door Nederlandse hulp gesteunde deelstaten in India. De Ambassade moet nu nog de BEMO aanpassen in overleg met TPD-E. Het begrotingsbedrag is opgenomen in het jaarplan 1997.

* **National Research Development Centre (NRDC)**

Uit het voorgesprek met Tripathy van CESC bleek, dat zij er belang bij zouden hebben om de TNO/RRL-T technologie via NRDC te laten commercialiseren omdat zij dan voor een groot aantal overheidssubsidies in aanmerking zouden komen. De door NRDC voorgestelde procedure is als volgt:

1. TNO en RRL-T stellen een MOU op voor het gezamenlijke gebruik van de patenten (Dit moet trouwens toch gebeuren, voordat er mee gewerkt gaat worden).

2. TNO, RRL en NRDC sluiten een MOU af, waarbij het R&D werk (technische stuk van TNO-RRL) wordt overgedragen aan NRDC voor commercialisatie. NRDC neemt het marketing gedeelte voor zijn rekening. Bij nader doorvragen formuleerde Dr. Swamy het fraai als volgt:
   "NRDC will have to upgrade the technology from laboratory scale to technical commercial scale through potential entrepreneurs" NRDC is the coördinating agency etc.
   Het komt er op neer dat je de technology volkomen uit handen geeft en geen zeggenschap hebt over eventuele toekomstige klanten

3. De financiering van een commerciële demonstratieplant zou als volgt zijn (voorbeeld demonstrationproject CESC), geïnvesteerd als volgt:
   CESC 70%
   NRDC 20%
   TNO/Keller? 10%

   De inkomsten zouden dan ook op deze manier verdeeld worden (als ik hem goed

begrepen heb naast de fee die in het MOU geregeld zou worden). Hij maakte onderscheid tussen commerciële en semi-commerciële plant. Voor semi-commercieel gelden niet de door CESC zo begeerde subsidies, want dan zou het niet gaan om "proven" technology. Zowel CESC als TNO hebben hem ervan verzekerd dat KELLER grote ervaring heeft met fly-ash plants etc.

Als klap op de vuurpijl bleek, na veel doorvragen onzerzijds, dat als het om een commerciële unit gaat elke ondernemer voor de toepassing van deze technologie overheidssubsidies kan aanvragen, hiervoor zouden wij NRDC niet nodig hebben!!

We zullen nog wel contact op moeten nemen met Tripathi CESC om na te gaan wat zij als volgende stappen zien in dit proces; gezien de tijdsdruk was het niet mogelijk direct na de bijeenkomst hierover te discussieren en een duidelijk standpunt te bepalen (Aktie Schmal). Tripathi was ook zeer kritisch en dacht ook niet dat er nog een aanleiding zou bestaan om NRDC (d.w.z. een extra bureaucratische stap) in te schakelen.
Bovendien was het niet duidelijk wat er nu eigenlijk precies met KELLER GMBH was afgesproken via een MOU.

* **Council of Scientific and Industrial Research, Dr. Bhandari, Head Int. Collaboration**

- Gesproken over goedkeuring van het E en M voorstel voor keramische industrie in Kerala en de goedkeuring van de expertmissie naar Calcutta.
  Bhandari was niet op de hoogte van de uit te voeren missie waarvoor RRL-T nu hoofdaannemer is geworden.
  Het lijkt mij gewenst dat de Directeur RRL-T CSIR op de hoogte stelt, zodat er geen vertraging kan ontstaan, bijvoorbeeld door gebrek aan goedkeuring TNO in vreemde valuta te laten betalen.
- Desgevraagd zullen de stafmedewerkers van Dr. Bhandari de stand van zaken m.b.t. de aangevraagde octrooien natrekken en ons op de hoogte stellen.

* **Bharat Heavy Electrical LTD (BHEL)**

- Mr. Sharma heeft mij onmiddelijk meegenomen naar zijn baas, Mr. Jain, om over een aantal onderwerpen te praten:
- Zij zijn zeer geinteresseerd in de vliegastechnologie, zij zullen contact opnemen met lokale vertegenwoordiger van KELLER. Zij hebben zelf een proces voor tegels ontwikkeld met 100% vliegas; helaas alleen in pikzwart te verkrijgen. (Sharma zei: in alle kleuren te verkrijgen, maar het is net als met auto's we hebben alleen zwart in voorraad!)
- Membraamtechnologie alleen belangrijk als het te gebruiken is voor Powerplants
- BHEL is een interessant groot bedrijf, brochure wordt per post toegezonden.

* **Mr. Atul Tripathi, Keller GMBH**

De heer Tripathi had van Mr. Sharma (BHEL) gehoord dat ik nog in India was en wilde graag langskomen om één en ander te bespreken. Het was een nuttig gesprek; Mr. Tripathi wil graag goed contact houden, zodat hij ook gebruik kan maken van mijn netwerken op de Ministeries etc. Hij is al lang uit India weg en moet dit weer opbouwen.

PROJECT DISCRIPTION

Short description:
The objective of the technical expert mission is to support CESC in the technical finalization of the design and investment plan, forming the basis for the technical and economical feasibility study of a demonstration plant for the production of CFBA building products.

Short description of activities:
A. Technical evaluation of the work carried out by RRL and TNO (Trivandrum).
B. Establishing the boundary conditions for a demonstration plant, the demands of CESC and the local facts (Calcutta).
C. Consultation of potential suppliers.
D. Support CESC with the revised technical design of the demonstration plant, based on the new findings.
E. Support CESC with the economic evaluation of the revised technical design.
F. Support in the decision "go/no go".
G. Identification and formulation of further activities such as:
   - Research
   - Techniques (suppliers)
   - Finances
   - Cooperation
H. Briefing at the Netherlands Embassy (New Delhi).

OBJECTIVES OF ACTIVITY/ PROJECT

Objectives
The objective of the technical expert mission is to support CESC in the technical finalization of the design and investment plan, forming the basis for the technical and economical feasibility study of a demonstration plant for the production of CFBA building products.

Description of separate activities
Planning of an investment project is usually performed in a number of phases and generally begins with the orientation phase with studies of basic data. Feasibility studies play a major role in obtaining credits, state grants and subsidies. This mission is to support in a pre feasibility study for the set up of a fly-ash utilization demonstration plant by CESC in Calcutta.

A. Technical evaluation of the work carried out by RRL and TNO (Trivandrum).
   Based on the analyses of the clays and the characterization of the fly-ash and the work that has been done in both institutes the criteria of the individual components of the body will be formulated. It will also give a better view on the processing techniques and formulation criteria for Indian building materials based on the latest developments (technical).

B. Establishing the boundary conditions for a demonstration plant, the demands of CESC and the local facts (Calcutta).
   - the quantity and availability of the waste materials to be used
   - the recipe of the mass to produce the building products
   - the need for, and the market of the building materials
   - energy and environmental aspects
   - the selection of new products based on fly-ash which will be produced
   - potential market: making an estimation of the potential market for fly-ash products is not easy. The nearby market is the building market in the city of Calcutta which is still growing. Calculations have shown that in Calcutta there is a need of 800.000 bricks/day.

C. Consultation of potential suppliers.
   This task consists of drafting an assessment of a survey of potential suppliers of Indian machinery for the production, and meetings with the relevant suppliers.

D. Contribution to the revised technical design of the demonstration plant, based on the new findings.

F. Contribution to the economic evaluation of the revised technical design.
   The demonstration production plant can in principle produce building products in several varieties such as bricks, tiles, blocks etc. However, the blue print and the economic and technical feasibility study will at the start be based on the production of bricks.

G. Contribution to the decision on whether the project will continue or not (go/no go decision). The preliminary calculations will be based on data supplied by CESC and involvement of an Indian economic expert is foreseen.

H. Identification and formulation of further activities such as:
   - Research for the final details regarding the process parameters with respect to the raw materials, additives, firing schedules, forming method etc. Additional research will be necessary, even when the feasibility study has led to a positive result.
   - Techniques (suppliers)
   - Finances
   - Cooperation

I. Briefing at the Netherlands Embassy (New Delhi) to inform the sector specialist on the latest developments in the project.

Results

At the end of the mission CESC will be able to make a decision on the technical and economical feasibility to build a demonstration plant for the production of CFBA building products, based on well-defined facts.

Adv.

TNO Institute of Applied Physics (TPD)

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Faxmessage

To	Keller GMBH
attn.	Atul Tripathi
Faxnr.	00 91 11 2942312
From	André H. de Vries
Direct dial	+ 31 40 2656400
Date	1997-1-8
Subject	**Mision to CESC Calcutta**
Our reference	TPD-KK-FAX-97-046
Copy to	DS-FEZ-arch HAM, Ralph Schockert (0049 5451 85310)
Nr. of pages	4

Dear Atul,

First of all I want to wish you a happy, healthy and successful 1997.

For your information I sent you the information about our mision to CESC Calcutta. I hope you will find the time to see us there. On the other hand, I hope that you now have the official order from CESC for the first factory.

I hope to see you in Calcutta.

With warmest regards,

André H. de Vries, TNO-TPD Ceramic Department