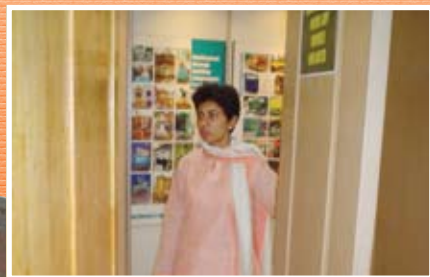




# bmipc

निर्माण सामग्री समाचार पत्रिका  
**Building Materials News**



*Cities – Magnets of Hope*  
World Habitat Day, 2 October, 2006





## From the Desk of Executive Director

**N**early half the world's population and three quarters of all westerners live in cities. The rapid population growth is bringing an economic transformation to most cities. The major share of aggregate value added is generated in metropolitan regions. At the same time, social disparities and tensions are increasing and as such the majority of world cities are vortices of unsustainability, concentrating environmental, social and economic distress, reflecting the growing inequality of wealth and income distribution.

Cities act like magnets for people far into the rural areas. They attract the poorest of the poor, inducing them to leave the countryside in the hope of a better future in the city. In many cities in the 21<sup>st</sup> century, this trend is causing massive problems. Densely built informal settlements are shooting up uncontrolled. Access to utilities is inadequate. Municipal administrations are overstrained and there is massive inefficient energy consumption, waste resources and generate green gases. The problem is compounded with the lack of urban planning which usually stops at the cities border failing to integrate with the overall planning aspects of the regions that it impacts so deeply.

BMTPC is actively engaged in improving the technical environment in the housing and human settlement sector. Over the years, Council has been actively engaged in promotion and development activities in this sector. However, with the changing times, the Council has now embarked upon an endeavour to undertake large scale field level application of innovative and environment friendly building and disaster resistant construction technologies in the mass housing projects with the active support of the Government.

The Council would be most happy to offer its expertise in technology, building materials, skill upgradation & capacity building, disaster mitigation & preparedness and information dissemination. It is hoped that the organisations and agencies concerned with shelter development will be forthcoming and join hands with the Council to bridge the gap by allowing for the development of the policies and the strategies that will provide real and lasting contribution in the task of recognising, encouraging and ensuring fullest participation of all the stakeholders in the housing and human settlement sector.

आर.के. सेली  
(R.K.Celly)

### CONTENTS

From the Desk of Executive Director	2
PURA - A Model for Infrastructure Development	6
Industrial Workers Housing	15
Cities – Magnets of Hope	16
Tsunami Mitigation and Preparedness in A&N Islands	20
MoU with Government of Bhutan	25
Sanitation for all	26
Cities and its Migrants	32
Know your Wood based Panels	36
Urban Aspirations	48
International Expert Group Meeting	50
Training Programme on "Field Level Applications"	51
Teamwork in Construction Projects	52
Safety and Security of Tall Buildings	54
Workshops on Building Byelaws	57
Field level Application under VAMBAY	58
Retrofitting of Kupwara Hospital	60
Retrofitting of MCD Schools	62
Capacity Building Programmes	63
Construction of Bamboo Demonstration Structures	64
Bamboo Mat Production Centres	65
शहरी गरीबों के लिए बुनियादी सेवाएं हेतु दिशानिर्देश	66
World Habitat Day 2005 Celebrations	68
Publications of BMTPC	70
Films Produced by BMTPC	71



**KOFI ANNAN**  
*Secretary - General*  
**UNITED NATIONS**

**B**y the year 2050, some 6 billion people representing two-thirds of humanity will be living in towns and cities. Never before in history has the world witnessed such rapid urbanization. Neither has it witnessed such a swift rise in the absolute numbers of people migrating. The two phenomena – migration and urban growth — are strongly linked, mainly because the majority of people on the move go for the bright lights of the city.

As we reflect on the theme of this year's observance of World Habitat Day — “Cities, magnets of hope” — we must also bear in mind that cities can also be places of considerable despair. Never before has the world witnessed such a large proliferation of urban slums. Today, 1 billion people, or 1 of every 3 urban dwellers, live in slums. If municipalities and governments fail to manage urban growth and migration sustainably, this number is expected to double in the next 30 years.

Almost everywhere, cities are the destinations for people escaping poverty, conflict and human rights violations, or simply those looking for ways to build better lives. While many migrants head to the North, South-South migration also presents tremendous challenges. Major cities such as Dakar, Jakarta, Johannesburg or Rio de Janeiro, to cite just a few examples, are having trouble accommodating new migrants when so many long-standing citizens are already struggling.

These and other challenges came into sharp focus at third session of the World Urban Forum held in Vancouver, Canada in June 2006. That meeting made it clear that UN Member States, along with non-governmental organizations, the private sector and citizens all over the world, need to galvanize their strength as never before in the quest for sustainable urbanization and inclusive cities. On World Habitat Day, I urge all involved to work in partnership to manage one of the key challenges confronting humanity in the 21st century.

Kofi Annan



**Anna Kajumulo Tibaijuka**  
*Under-Secretary-General of the United Nations and  
Executive Director,  
UN-HABITAT*

**E**very year on the first Monday in October we use World Habitat Day to reflect on the state of the world's growing cities and our planet's rapid and irreversible urbanisation. We worry not only whether we can manage this growth, but how we can do it positively in a way that makes cities inclusive, welcoming places for all.

As populations increase and more and more people migrate, cities lure us to their bright lights. Like moths to a flame, we also worry about getting burnt. How many more people will end up in the developing world's growing slums? Will there be jobs, shelter, water, electricity, health services, for all? Will we be able to cater for their basic needs even if we cannot do the impossible and meet the aspirations of all?

Rapid and irreversible. Those are the trends today of the greatest rates of migration and urbanisation the world has known.

According to the latest UN research, international migrants numbered 191 million in 2005: 115 million lived in developed countries, and 75 million in developing countries. Half of these people on the move, it is noted, are women.

As we reflect on the theme of World Habitat Day 2006, *Cities, magnets of hope*, I wish to draw your attention to some new facts about the urban world in which we live. These have just been published in our latest *State of the World's Cities 2006/7* report: Some time during the course of next year, demographers watching urban trends will mark it as the moment when the world entered a new urban millennium with the majority of people living in towns and cities for the first time in history. The year 2007 will also see the number of slum dwellers in the world reach the 1 billion mark – when on average one in every three city residents will be living in inadequate housing with none, or few basic services.

It is still unclear how this will influence government policies and actions, particularly in relation to Millennium Development Goal 7, Targets 10 on water and sanitation, and 11 aimed at improving the lives of slum dwellers.

But it is important to understand that the growth of cities is not just a phenomenon of migration from rural to urban areas. It also entails international migration – people seeking a better life in other countries both in the north and in the south. Whether they are fleeing conflict, disasters

or simply seeking a better life somewhere else, the number of people on the move today is greater than ever before.

It is very difficult to stop the flow of people into cities and towns. Urbanisation is one of the most powerful, irreversible forces in the world. It is estimated that 93 percent of the future urban population growth will occur in the cities of Asia and Africa, and to a lesser extent, Latin America and the Caribbean.

Migration too is one of the great irreversible forces, and one likely to grow. Frequently discussions on how to manage it are steeped in controversy and rancour. This is in part because policy making and coordination at the international, national and municipal level is lacking.

Some countries complain about the brain drain, but there is also the fact that the remittances immigrants send home could be far larger in financial terms than gross overseas development aid or foreign direct investment. Thus, it is a question of striking a balance.

Cities make countries rich. Countries that are highly urbanised have higher incomes, more stable economies, stronger institutions. They are better able

...contd. on pg.14





**KUMARI SELJA**  
*Minister of State (IC) for  
Housing & Urban Poverty Alleviation  
Government of India*

**T**he UN Habitat has declared '**Cities: Magnets of Hope**' as the theme for World Habitat Day, 2006. This reminds us of the rapid migration of people into cities witnessed all over the world.

Cities are living, breathing barometers of economic, social and cultural progress of a Nation. They are hubs of much of national production and consumption and socio-economic processes to generate wealth and employment opportunities. When they work well, they are powerful magnets of new hopes, businesses and incubators for creativity, innovations and jobs.

BMTPC has been working for the development and promotion of cost effective and innovative housing technologies, vital for providing affordable houses for poor and common man in urban and rural areas. Their efforts have created lot of awareness among the stake holders and public about the new and alternative housing technologies and its application in construction sector.

I am happy that BMTPC is bringing out a special issue of "**Building Materials News**" on the occasion of World Habitat Day on 2<sup>nd</sup> October, 2006 to highlight the issues related to development of cities.

I wish the publication all success.

A handwritten signature in black ink, appearing to read 'Selja', with a long horizontal stroke extending to the right.

(Kumari Selja)

# PURA - A Model for Infrastructure Development



*Dr. P. S. Rana\**

## Introduction

**T**he world population projections indicate that India's total population will almost double during the next century. During the third decade of the next century, India will become the most populous country of the world. Whatever efforts are made for controlling the population growth, the next three decades are the most crucial for planning and development of human settlements and provision of the required infrastructure.

Although the rate of urbanisation in India has been quite moderate during this century due to a low level of urbanisation, and large population base there has been a rapid growth of urban population. Over the last 50 years, the urban population has been doubling itself every twenty years. In spite of such a rapid growth rate, the urban population accounted for 27.78 per cent of the total population in 2001. The past experience clearly indicates that Economic Growth and Urban Development go hand in hand. Therefore, the rate of urbanisation in India in coming decades is likely to increase. This will put an un-

precedented demand for growth of urban areas.

In India and most of the developing countries, the urban development is mostly uncontrolled. The development planning and control mechanisms in our cities are either absent or so ad-hoc that the unplanned urban extensions are being added to each city without any infrastructure. Transport as well as other service Infrastructure try to keep pace with the development resulting into a vicious circle which leads to perpetual scarcity and shortage.

## Urban form and cost of infrastructure

Regarding transport, it is a known fact that the road-based systems have been the most traditional, most conventional and most convenient modes of transport over the ages. Once a paved/unpaved road is available, the choice of vehicle, time of journey and destination is quite flexible. However, with development of other specialised means of transport, more efficient and more cost effective systems such as railways, pipelines and communication are now available for certain spe-

cialised needs. To get the maximum out of these specialised systems, certain prerequisites are to be fulfilled through a coordinated effort. For example, for local travel in a small town walk/cycle are most cost effective but with increase in travel distance or density of travel, these modes are no more convenient or cost effective. On the other hand for short distance and low density, railways are very expensive. Railways become cost effective only for mass movement.

The rail-based systems in urban areas are highly capital intensive and the cost is much higher than road-based systems in the early stages. However, when the traffic volume along a particular corridor increases, the cost for road based systems increases exponentially.

Establishing a fresh set of rail based infrastructure, although more efficient than any road based solution, is highly capital intensive and involves large amount of difficult land acquisition. On the other hand, if existing rail corridors were utilised for guiding future urban development, the system would be efficient as well as cost effec-

\* **Chairman & Managing Director**  
Housing & Urban Development Corporation (HUDCO), New Delhi



tive. The corridor consisting of railway, pipeline, highway, H. T. power line and communication lines would form the infrastructure spine.

### Satellite towns vs. corridor concept

Although incremental cost of accommodating additional population in an existing city are generally lower for small increments as compared to setting up a new town. In the long run, the congestion costs overtake and the overall cost becomes very high. Fig. 1 illustrates that the cost of expanding a city beyond 'Y' are higher. It also indicates that a new town will be cost effective after it attains the population level 'X'. In other words the optimum size of the city lies between 'X' and 'Y'. The exact values of 'X' and 'Y' will depend on various parameters. However, a safe range of 1 to 3 lakh can be taken well within this range. Various studies have suggested different forms and structures for a town in this range. Prof. P.V. Indiresan has recommended an annular city based on a circular bus route. For minimizing local travel, he suggests a mixed land use along a ring road with a hollow core for energy efficiency and ecological balance. Another alternative could be with a high-density core surrounded by medium and low density development with each town having its own character. The flexibility of shape and structure for such a medium city is unlimited based on local geographical, cultural and economic parameters.

It seems impossible to control the growth of cities, particularly large ones due to their



**RANJIT ISSAR**

*Secretary*

*Ministry of Housing & Urban Poverty Alleviation  
Government of India*

It is indeed befitting that this year's World Habitat Day focuses on the theme "Cities - Magnets of Hope".

The city development is the master key to the process of urbanization involving transformation of rural characteristics of people, their activities and their settlements to urban environment. A significant positive relationship between urbanization and economic development is well established. This relationship is attributed to such factors as rapid industrialization, commercialization, increase in productivity, employment generation and improvement in access to various factors of production, markets and other infrastructure facilities.

Lack of suitable land, competitive institutional housing finance and access to affordable building materials are major barriers that affect the speed and quality of our housing development programmes, especially for low and middle income groups in the cities. Lack of availability, accessibility and acceptability of appropriate building materials at affordable prices is a challenge that confronts the housing sector. The role being played by the Building Materials and Technology Promotion Council under the aegis of the Ministry of Housing & Urban Poverty Alleviation is vital in this context. I am sure, BMTPC, in coming years, would intensify their efforts to ensure that the cost-effective and environment friendly building technologies are adopted widely in various housing programmes and projects by the prospective users, entrepreneurs and construction agencies.

I am glad to know that the council is bringing out a special issue of "Building Materials News" on the occasion of the World Habitat Day. I do hope that the publication, will focus on the needs of the fast changing housing and human settlement scenario and will catapult the various agencies involved in the housing sector to take advantage of cost-effective new materials and technologies.

I extend my best wishes to the council for success in their efforts.

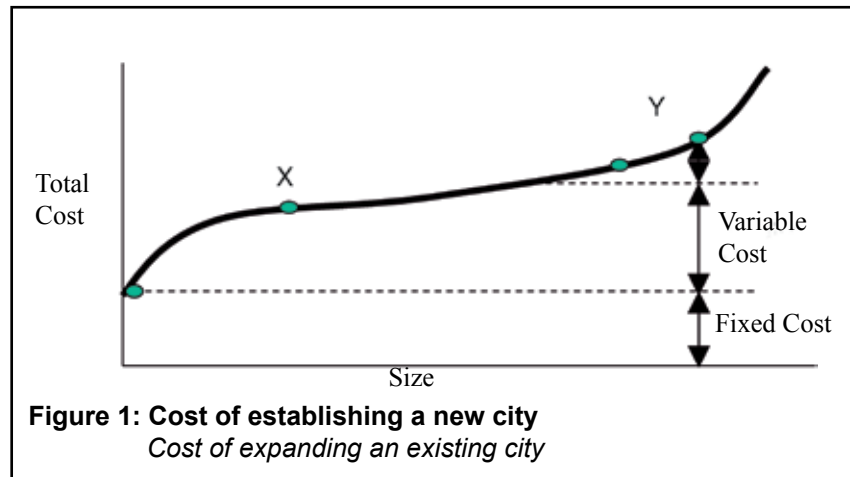
*Ranjit Issar*  
(Ranjit Issar)

own momentum and economic forces. A via media has been attempted in several countries by developing satellite towns around large metropolitan cities. The concept has not lived up to expectations. In my opinion, this concept cannot be cost effective and generally proves counter-productive in achieving the laid down objectives. Several towns developed along the same corridor will be more cost effective than developing satellite towns in different directions. By this approach, high-density corridors along railways will be conducive for high capacity rail systems.

### National Capital Region of India – A case study

The Government of India in 1961 set up a board to look after the need of the National Capital Region (NCR). Further, the Town and Country Planning Organisation started work on the preparation of Regional Plan in late sixties, which ultimately led to the creation of NCR Planning Board by parliament enactment and concurrence of adjoining states of Haryana, UP, and Rajasthan. NCR now covers an area of more than 30,000 sq. km. consisting of about 13,500 sq. km. from Haryana, 10,000 sq. km. from UP, 5000 sq. km. of Rajasthan and about 1500 sq. km. of Delhi at the centre.

A regional plan was drafted in 1989 with a perspective year 2001. This report was aimed at reducing the pressure of population on Delhi and achieve a balanced and harmonised development of the region. At the time of preparation, Delhi had about 9.5 million of population



and about 40% of Delhi's area was built-up (almost three times of what it was in 1960).

The plan envisaged that in 2001, the 11 million projected population of Delhi would be housed in less than 43% of Delhi's area and another two million will choose adjoining towns within NCR instead of coming to the heart of Delhi.

Delhi's population has reached 14 millions in 2001 and expected to be about 20 millions by 2011. Either the projections underestimated the growth rate or the theory of arresting migration in the adjoining NCR towns did not materialise. Probably both are valid explanations.

### Existing Scenario of NCR

Officially, latest documents and reports from the NCR Planning Board argue that the problem has essentially been of relationships. The core Delhi extracts economic surplus of the NCR's periphery and whatever development takes place in the periphery mostly reflects the expanding needs of the core. Several other reasons have been put forward such as the tax differentials and availability of

better social and physical infrastructure, which has influenced the decision of people locating industries and trading houses. Added to these is the fact that Delhi, being the national capital, is government's and bureaucracy's headquarter and place of final decision making.

While many factors have been attributed to the rapid growth of Delhi over the last decades, its transportation network is blamed for assisting and accelerating this growth. This is so as Delhi is a hub where five National Highways (India's arteries for regional traffic) and eight rail transport corridors converge. These rail lines serve 350 passenger and 40 goods trains per day with just three main termini. Delhi also has a permanent container depot and several other custom houses and warehouses.

Existing policies of the NCR Planning Board continue to be based upon the induced growth of eight Priority Towns at the periphery of the region. This involves integrated townships centred on core economic activities to be relocated out of Delhi as part of its dispersal strategy.



Higher order social facilities are also proposed to be dispersed. Major infrastructure works such as expressways, widening and laying of new rail lines are proposed in all directions to serve these dispersed activities. These capital intensive works will have to be taken up in all directions as the Priority Towns which they are meant to serve are spread all over the region.

Since transportation is a network type of service, it will be more efficiently utilised if it is provided in an aggregated manner. Urbanisation provides this level of aggregation, necessary for the efficient provision of transportation services.

Through corridor planning, we can accentuate this aggregation and, in addition, match the density pattern of the population with the density pattern of transport infrastructure, ultimately resulting in lesser distance to travel. The next section elaborates this idea in the context of National Capital Region of India.

### **Sustainable Urban Transport In NCR**

Cost of development, operation and maintenance of four basic infrastructure networks, namely, railway, highway, pipeline, power grid and communication are highly sensitive to the location and structure of cities. A spinal type of linear corridor development along the existing rail lines in the NCR would prove to be the most cost effective and environment friendly pattern for urban development of the region than the existing strategy



**PANKAJ JAIN**

*Joint Secretary (Housing)*


*Ministry of Housing & Urban Poverty Alleviation  
Government of India*

In pursuance of the decision of the General Assembly of the United Nations the first Monday of October is celebrated every year as the World Habitat Day the world over. The theme of this year is "Cities - Magnets of Hope".

Some of the chief forces driving urbanization today are shifting of jobs from agriculture to industry and the concentration of economic opportunities in the urban areas. Urbanization is associated with higher incomes, improved health, higher literacy, improved quality of life and other benefits. Yet along with the benefits of urbanization come environmental and social ills. With urbanization the concentration of people is increasing in cities, so is the demand for basic necessities like food, energy, drinking water and shelter. This results in poor quality housing, lack of water supply and sanitation facilities and lack of proper waste disposal facilities leading to spread of communicable diseases.

The Building Materials & Technology Promotion Council, functioning under the aegis of this ministry, has been making concerted efforts to promote and popularise cost effective, environment-friendly and energy-efficient technologies in the housing and building sector. I would request that the Council further intensify its efforts to ensure speedy dissemination of innovative concepts and technologies in the implementation of housing programmes.

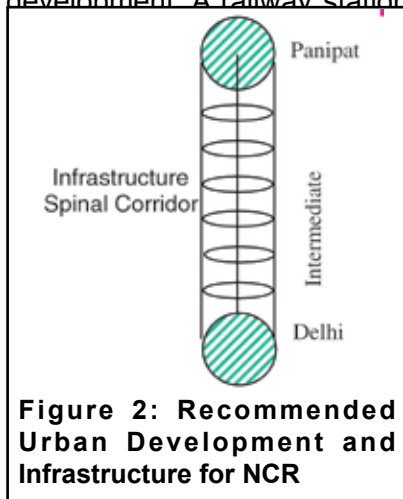
I am happy that the BMTPC is bringing out this special issue which proposes to focus on the role of technology in our efforts to combat the housing shortage in the country.

  
(Pankaj Jain)

of having priority towns all over the region.

This available infrastructure and its potential must be exploited to the maximum extent. Corridors with high growth potential can be identified and prepared for future urbanisation. Even if one corridor out of eight rail line spreading out from Delhi is developed, it will be enough to take care of future growth. A typical corridor of about 100 km connecting Delhi with a major town would be ideal for this purpose. The corridor consisting of railway, pipeline, highway, H. T. power line and communication lines would form the infrastructure spine as shown in Fig.. 2.

A corridor width of 4 to 5 km on either side of the spinal corridor should be reserved for planned and guided urban development. A railway station



every two km can be developed as a centre supporting a population of about two lacs. Initially, these towns may function as the dormitory to the major cities at the ends of the corridor and later developed into self-contained towns for most of the functions. The series of such towns will function as complimentary and

supplementary to each other providing the economy of scale for all types of specialised activities that a mega city can support. At a gross density of 10,000 persons per sq km i.e., 100 persons per hectare one such corridor of 100 km can support an urban population of one crore. This can easily take care of population growth of next 20 years.

The infrastructure spine of 100 km length supporting a population of about one crore will generate the demand volumes justifying high capacity systems and also ensure their optimum utilisation. The unidirectional tidal flows which are common in suburban commuter systems will be balanced due to the presence of major cities at either end and the inter town movement along the corridor. This would. However necessitate a four-track system to meet the high demand volumes and the operational necessities to provide differential speeds.

By confining the width of the corridor the rural hinterland is available within a couple of km. The supply of various consumables produced in the rural hinterland (particularly the

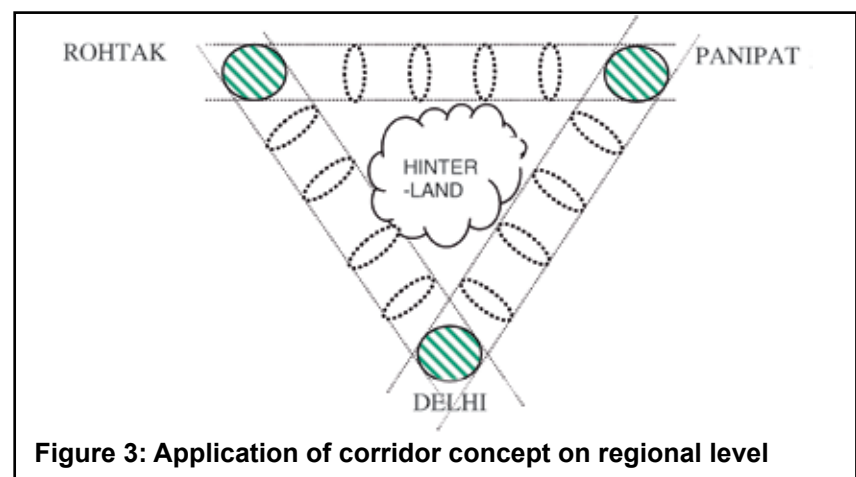
perishable items) and disposal of the various types of wastes generated in the town will be much more economical. This concept offers the advantages of a mega city as well as the benefits of a small town for maintaining ecological balance and environmental quality.

We can also extend this scheme to connect at least three towns in a triangular fashion so that the hinterland trapped inside the triangle gets mobility from the triangular urbanisation and also serves it as its immediate hinterland. (Figure 3).

Three sides of this triangle will not only form high-density urban areas but also high capacity infrastructure spines. As one goes towards the centroid of the triangle, the density as well as capacity of transportation links will start decreasing, making way for more land-intensive uses such as horticulture, arboriculture, poultry etc. These areas will help serve the urban areas on the triangle sides.

### Primate City Syndrome

Rural Migration results in concentration of urban population in one or a few cities



**Figure 3: Application of corridor concept on regional level**



(Primate City). The trend in the growth of cities and its slums can be gauged by the fact that while the total population growth is 2%, the urban population is growing at 3%, large cities at 4%, slum population at 9% and slum population in large cities at more than 30%.

Thus, there is a need to arrest migration from rural areas and small towns to large cities and encourage reverse migration to rural areas through creation of jobs, improving the quality of life, providing basic amenities and improved access to city. This will lead to **in-situ urbanization** of select rural locations. This calls for providing Urban Amenities in rural areas besides providing employment and income generation avenues.

### Providing Urban Amenities in Rural Areas (PURA)

PURA was conceptualized by observing that a city generates large number of high-paid jobs in the non-farm sector, whereas the same size population distributed over a number of villages has fewer jobs to offer, and wallows in poverty. That difference occurs because the city has a large market the like of which villages do not support. Cities support large markets because they enjoy good connectivity, and villages have no such markets because of poor connectivity.

PURA (Providing Urban services in Rural Areas), as propagated by President Kalam in his Vision 2020, argues for the following five connectivities:

#### 1. Physical connectivity of



**DR. P.K. MOHANTY**

*Joint Secretary (JNNURM)*

*Ministry of Housing & Urban Poverty Alleviation  
Government of India*

Cities have been regarded as engines of growth, more so in the face of globalization and liberalization of economies. However, with the growth of cities themselves, there has been a constant and consistent rise in the disparities between the poor and the affluent. Shelter and basic amenities have been key issues where such disparity has been exhibited.

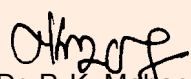
While efforts have been made to level out disparities by adding to the housing stock, traditional methods of planning for shelter have not been very successful in ensuring sustainable development for the people, especially for the poor. This has been particularly applicable to cities that have a population of over one million and are still growing at a high rate.

The Millennium Development Goals (MDGs) envisage a paradigm of inclusive development and growth with social equity. One of these goals envisages the reduction of the number of people living in slums by half by 2015. The Government of India, in its Tenth Five Year Plan had also set similar targets.

The 74<sup>th</sup> Constitutional Amendment Act envisages certain powers to be devolved on urban local bodies with regard to planning for socio-economic development, urban poverty alleviation and upgrading of slums. However, the same have not been implemented in true spirit.

In order to enable cities to usher in an era of good governance, the Government of India has launched Jawaharlal Nehru National Urban Renewal Mission, which is a reforms-driven and fast track project aiming at planned development of identified cities with focus on efficiency in urban infrastructure/services delivery mechanism, community participation and accountability of urban local bodies towards citizens. It focuses on pro-poor and gender sensitive approaches to achieve the MDGs and Plan targets.

I am pleased to learn that the BMTPC is bringing out a special issue of Building Materials News on the occasion of the World Habitat Day. I do hope that the efforts of the Council will catapult the various agencies involved in the housing sector to take advantage of cost-effective new materials and technologies.

  
(Dr. P. K. Mohanty)

roads and transport.

2. **Economic connectivity** of banking, commerce, insurance and warehousing.
3. **Knowledge connectivity** of schools, colleges, and vocational education.
4. **Societal connectivity** of hospitals, recreation centres, places of worship.
5. **Electronic connectivity** that encompasses the entire economic space.

The key issues here are that PURA should be a bankable, commercial venture, infrastructure is less expensive in rural areas and small towns than in large cities, and that a sizeable market is needed to make PURA viable.

Thus, the PURA project would involve selection of a cluster of villages linked together by a ring road, which would in turn be connected to a larger town/ city by a highway / expressway. This would take care of the first connectivity, physical connectivity. HUDCO has already committed to provide venture capital for the construction of the ring-link roads, run frequent bus services on the ring road and to develop a modern habitat on either side of the ring road to a width of 200-500 metres. The quality of transport will be as good as, or even better than, in cities. With these inputs, a population of nearly 50,000 will be connected immediately with scope for substantial expansion.

### Use of existing Rail Corridors

The most cost effective, efficient and environmental friendly

transport system is provided by having rail as the basic mode and walk, cycle, rickshaws etc. feeders. Since development of new rail-based transportation network in the existing cities requires substantial capital investment it would be much cost effective to develop new urban centres along the existing rail corridors.

### Implementation of PURA

The implementation of PURA is the biggest challenge in the life cycle of PURA plan owing to its complexity, multiple stakeholders, inter sectoral inputs and composite dynamics of rural – urban governance. A PURA Plan ideally should have Implementation Plan, Economic Plan and Structure Plan as its core documents.

#### Implementation Plan

The major components of an implementation plan for PURA would be:

- Acquisition of land for the ring road by the state government
- Authorization by the state government allowing HUDCO and other venture capitalist to construct ring road
- Benefiting the PURA development by channelising and converging the rural development plan funds in the PURA habitat
- Development of land for modern habitat by the state government or development of land by the venture capitalist
- Habitat Development by the potential industrial house or HUDCO or other real estate agencies

- Facilitation by the state government or PRIs in land pooling from the farmers.

Sub plans for the above components should be made as part of implementation plan. During all these processes, it may be worthwhile to note that no financial support is sought from the state government.

### The Economic Plan

The Economic Plan would include identification of local resources / skills and activities; identification of two or three key investors as anchors; and ascertain industry ancillarization/ outsourcing / forward-backward linkages. While identifying anchor Investors, efforts should be made to involve such enterprises which can create at least 1000 non-farm jobs, which can further open opportunity for another 5000 jobs through multiplier in household and informal sectors.

### The Structure Plan

The Structure Plan would encompass the following:

1. Utility Infrastructure: Water supply, Sewerage and drainage, low cost sanitation, solid waste management, transportation, power.
2. Social Infrastructure: Health, education, community halls, parks/ playgrounds, sports infrastructure.
3. Commercial Infrastructure: Shopping centers, market complexes, office buildings, trade and business centers, theatres

Such a well knit structure plan would form a base for integrated socio-economic and



spacio-functional physical development plan.

### Institutional Framework

As part of HUDCO's Initiative, HUDCO and state government nominated agency may come together and set-up an SPV (in a Mission mode) to be called as PURA Development Agency (PDA). Depending on the local situation in the state, PDA may be given the status of a Development Authority with a mandate to perform Municipal functions (like CIDCO of New Mumbai); and the Chief Executive of the PDA could be a professional on a Five year contract. Another major responsibility of the PDA would be to prepare an Economic Plan, Structure Plan and an Implementation Plan. The models for governance of PURA regions would be participatory in nature with appropriate representation of various stakeholders.

### Land Acquisition for PURA

Based on response from farmers and in association with State Government, Pura Development Agency would adopt one of the following area development modes: land pooling, partly pooling and partly acquisition, or land acquisition.

PDA would use the pooled land for constructing developmental activities and the investment may be recovered by renting/ selling of the developed land, whose value would multiply several times. Thus, PDA's effort in the land development would be to enhance the commercial value of land by creating good environment for investors

to take advantage.

### Financing and Resource Mobilisation for PURA

Financing of PURA projects and resource mobilization for PURA should be through public private partnership and PURA should be a bankable, commercial venture. The sound principles of commercialisation and privations be appropriately incorporated in PURA.

### Commercialisation

Infrastructure and habitat development in a PURA settlements would involve seed capital and recurring investments in operation and maintenance. This would be possible through introduction of commercial principles in recovering the cost from the beneficiaries through a host of user pay instruments. The principles of "user pay", "abuser pay" and "polluter pay" needs to be utilised to ensure cost recovery.

### Privatisation

The private sector needs to be brought in the development and provision of infrastructure and habitat in a PURA Project. The private sector participation could help in bringing technical and managerial expertise, improving operating efficiency, large-scale injections of capital and greater efficiency in use of capital and increased responsiveness to consumer needs and preferences. The various options for involving the private sector could be Service Contracts, Management Contracts, Leases, Concessions, BOT, BOO, ROT etc

### Resource mobilisation options

Initial investment for a PURA project would come from the venture capitalist who would finance the construction of ring road, development of land and development of modern habitat. The further investment requirements could be met by PDA through various innovative options of resource mobilization. Mechanisms such as take-out financing, consortium financing, sub-ordinate debt, cash-flow financing and securitisation of receivables have been considered for resource mobilisation in infrastructure sector and could be opted for financing of PURA.

HUDCO has already committed to provide venture capital for the construction of the ring-link roads, and to develop a modern habitat on either side of the ring road to a width of 200-500 metres.

### Options for PURA

PURA could be developed on various models, such as:

**1. General PURA Model:** as envisaged by Prof. PV Indiriesan, PURA is initiated by an injection of venture capital for:

- Ringing a loop of villages by a road, and linking that road to a nearby city.
- Running fast and frequent bus services on those roads.

PURA aims to make all five connectivities mentioned earlier economically viable.

### 2. Project-based and Industry-based PURA

Every mega project needs re-

settlement and provide potential and new opportunities. Projects such as Hydel Projects, Steel Towns, Large Rehabilitation Projects, New Mega Industrial Projects, SEZs and Food Processing Industries provide basic jobs and create multiplier effect for other related employment opportunities.

The industrial houses from these anchor industries have to be attracted to the PURA concept in the planning stage itself. This would help the industry players help in designing an appropriate form of PURA habitat as per their business requirements and provide land at lower prices for other related activities. The local resources should be appropriately identified and used in supporting the industrial requirements while planning, implementing and supporting a PURA project. This concept has maximum potential to provide integrated development.

### 3. Coastal PURA - Based on Sea based activities

The coastal belt of Nagapattinam District (Tamilnadu) including Karaikal (Pondicherry) indicates a linear development of small fishermen villages over a length of 100km. The average size of a hamlet is around 300 people i.e. 50 DUs.

Many of the settlements are located in the vulnerable zones and, at places, only 50 to 100 m from the coast line. There is a total lack of improved rural/urban facilities.

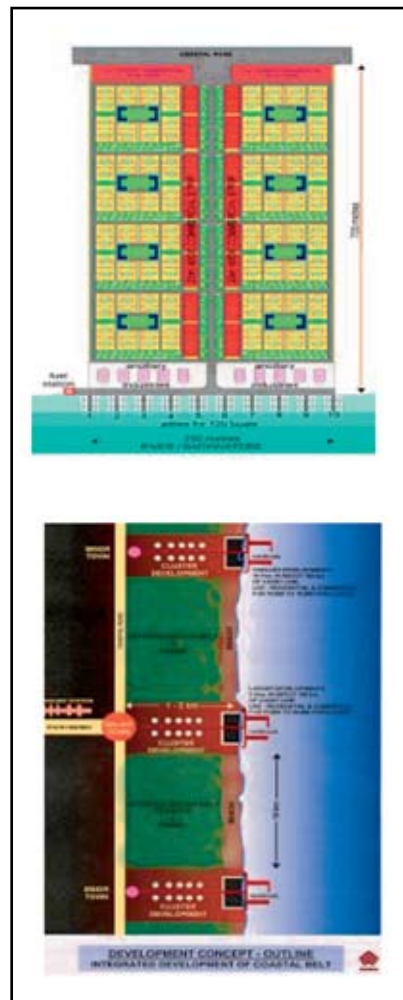
Removed from the coast, fisherman would be like a fish out of water. Thus, rehabilitation

of fishermen beyond Coastal Regulation Zone raises serious issues relating to their very livelihood.

The important question that emerges is whether the rehabilitation can be utilized as an opportunity for the development of appropriate habitats, which are safe and sustainable.

This calls for an integrated regional developmental pattern with emphasis on the linkage between rehabilitation sites and new nodes, wherein upgraded facilities can be provided.

Thus, a PURA based model can be used to effectively take care of all the issues mentioned above. Moreover, this model can be modified to suit different conditions of coastal areas in other states of India.



### Conclusion

The essence of PURA is change, a change from the prevailing cynicism that rural development can be sustained only by charity. In parallel, urban attitudes too, that urban slums are inevitable, rural-urban migration is unstoppable, should also be given up. PURA needs a Vision to realise that urban amenities do not need congested, dirty cities.

...contd. from pg.4

to withstand the volatility of the global economy than those with less urbanized populations. Urban-based economic activities account for up to 55 percent of Gross Nation Product (GNP) in low-income countries, 73 percent in middle-income countries and 85 per cent in high income countries.

And major contributors here are the migrants who helped build many of the world's greatest cities, the people who had the courage to pack up and move. We need to look at ways of making our cities inclusive places able to provide for all.

Instead of building fortresses, we need to build more bridges.

*Anna Tibaijuka*  
(Anna Tibaijuka)

# Industrial Workers Housing by DSIDC – BMTPC's Technical Support

**O**n the request of Delhi State Industrial Development Corporation (DSIDC), the Council is providing Technical support and guidance for construction of 3164 houses for Industrial workers in Bawana Industrial Township, New Delhi. The cost of a house worked out to Rs. 350 per sq.ft. The materials used in the construction of the houses are flyash bricks in rat trap bond, RCC planks and joists, ferrocement shelves, sunshades and steps. The construction of houses is completed.





# Cities – Magnets of Hope



**Dr. Bindeshwar Pathak\***  
Ph.D., D.Litt.

**C**ities, while on the one hand are the magnets of hope, they, on the other are tools of despair. Again, while on the one hand they are distant dreams to live in, on the other they are nightmares of frustration. I should like to rephrase the famous lines saying cities represent the best of life combined with that which is worst of life.

There has been rise and fall of cities. They have represented the pinnacle of culture and glory and yet they have vanished; at times, leaving some traces and at times disappearing totally beneath the oceans. In our country we have the examples of Mohan-jo-daro and Harappa as also Dwarka, lying nearly three hundred feet under the waters of an Ocean.

History tells us that the cities have grown around citadels which were havens of safety and forts of resistance against the invaders. They were a source of power and dominance over the surrounding areas. They were the halting points on the

outskirts of the empires. Another geographical factor which has played a part in the growth and establishment of cities has been water. Nomads rested nearby and fell a prey to temptations of opportunities as also indolence. The desire to go any further declined. Rivers and growth of cities have mixed inextricably. We do not have to go far to see the truth of this in cities like Calcutta, Varanasi, Allahabad in our country. It is not only the banks of rivers in which the seeds of cities were sown but also on shores of oceans which attracted people.

Gradually, people were lured to develop centres of trade and commerce and the coast lines were dotted with cities. With trade and commerce was combined employment potential. Arts added colour and patterns of handicrafts and variety of literature gave finishing touches to the process of thought which emanated from the cities. Often with collapse of cities civilizations vanished and with disappearance of rivers cities disappeared. Migration of

people occurred. People migrate from rural to urban areas giving up shelter and protective and congenial environment of the village life. And they do so only to sleep on the pavements of the cities, facing uncertainties and displacement of a settled life. What impels them to do so? It is their expectations that they too will earn their bread, shall have greater security and be able to shift away from the intense heat and intrusive focus that a person is subjected to in a village. In a city they seek and find happiness of anonymity. They seek freedom to live life on their own terms which can give them happiness. The suffocation of moving in a groove unable to change the patterns of life imposed upon them in a village gets discarded. They see variety combined with freedom of choice.

Their hopes are only heightened and aroused further when as pavement dwellers they see the light in a room of a flat on the fourteenth storey of a building and dream that they too will one day own such a flat. In the morn-

\* **Founder, Sulabh Sanitation & Social Reform Movement**  
Sulabh Gram, Mahavir Enclave, Palam Dabri Road, New Delhi – 110 045 (India).  
Tel.: (+ 91-11) 25032617, 25031518, 20531519; Fax: 25034014, 20536122  
E-mail: [sulabhacademy@vsnl.net](mailto:sulabhacademy@vsnl.net) / [sulabh1@nde.vsnl.net.in](mailto:sulabh1@nde.vsnl.net.in)  
Website: <http://www.sulabhinternational.org> / [www.sulabh.toiletmuseum.org](http://www.sulabh.toiletmuseum.org)

ing when they see the children of the well to do being herded in a limousine to be sent to school they too aspire that one day they too shall have the means to provide such luxury to their children. The pavement dweller sees the rich and educated with one child and two refrigerators which kindles a hope in him. He is ashamed to have left behind five of his own children in his village. He is motivated not to have any more, so that he can afford a piece of cake to be shared by all in his family. Congregation and concentration of people arouses the desire amongst the deprived to ape those more fortunate, more privileged. It is a basic instinct at times tinged with jealousy. The power of the magnet only increases when people hope to take advantage of institutions of higher learning available in a city and a chance to avail of multifarious opportunities available in a city.

A magnet, as has been said, inevitably draws people and yet this drawing, this attraction is combined with the darker side of life in cities. Those who come to cities to eke out their living have tales to recount of shattered hopes and despondence. They hawk wares as if hawking shares of a blue chip company. The artist creates an object of beauty, an exquisite painting which does not get sold. The city does draw a cancer patient under the hope of cure but there are thousands more stricken with cancer of diseases due to filth and squalor of slums. A large number sink in quagmire or get lost in the dark alleys of crime. If the cities have a shine

of affluence they also have blankets of poverty drawn over millions.

Slum is a universe apart, an alien world devoid of almost all features of city life, most specially sanitation. It is the place where all our social ills come together, the place where all our sins are paid for. Slum is now and is likely to remain poor countries' most dramatic and intractable social problem in future. For, here are concentrated the worst housing, the highest unemployment, and the greatest density of the poor people; the highest crime rate, worst sanitation and the most serious threat to established social order. Slum is, therefore, a microcosm of deprivation, economic decline and of social disintegration of a country. It is a symbol and summation of the dark side of society.

The growing slum is also a sign of chaotic and unplanned process of economic advance, characteristic of migration to cities in search of jobs, education and healthcare. Related to these is the persistence of sharp class division between manual and non-manual workers, the educated and the uneducated and of deep inequalities in wealth and income – all of which are manifest in the marked segregation of middle-class and working class areas.

Although such people are scattered all over the world, but are found in high concentration in city slums. The slums are, therefore, much more than of mere local interest. It is also the

place where mini-revolutions are shaping up which may, one day, turn city life into a nightmare. The phenomena of declining industry, decaying house, and abandoned people may spread like cancer, growing more and more malignant every day. The slums are, in sum, the constant reminder of what the future urban life in poor countries will look like if right policies are not adopted right away. Tomorrow may be too late.

Ironically enough such poverty exists at a time when we are in the midst of an international economic revolution. The process of globalization has been driven by cities and towns that serve as national and regional engines of economic growth. Since time immemorial, cities and towns have been the centers of technological and cultural creativity and human development. Indeed, today cities and towns form the frontline in the development of the international economy.

The rich want to live in big cities to be near the seat of power, political and financial, and to be able to advance their prospects as well as those of their business firms. This is where all the big jobs, contractors' orders, markets, expertise, permits, licenses and finance are available. Their wives want to move around in the glittering social world of metropolis. They have sons to settle in good jobs and daughters to marry off in rich families. They need the presence of a large number of rich and spending people among whom they can also flaunt their

wealth. By merely living in big cities, one acquires property whose escalated value may be more than the earning of one's life-time. The increasing price of real estate is another allurements for the rich and enterprising people to move to large cities. In consequence, the poor and resourceless are constantly pushed into slums.

In the 12 metropolitan towns whose population increased to 42 million from 30 million a decade ago (a rise of at least 40 per cent), at least half the people have no access to even public toilets. About 60 per cent are not served by sewers. Only 217 of about 5,000 towns and cities in India have underground sewerage of sorts, that too not for the entire towns. As the cities expand, the distance between the home and work place lengthens. The average for Mumbai is 17 km while for Delhi it is 15 km. People travel between 50 to 120 km to reach their work places and back home, spending 4 to 6 hours a day on travelling alone. In rain, the slums virtually float on water. Piped drinking water is a rarity. If at all it is there, there may be a tap for 200 families. The average space occupied by a slum family is 4.33 persons in 133 sq. ft. in Mumbai. At places, one finds 12 persons living in a 180 sq.ft. tenements or huts made of bamboo mats. Patients lie on the floor; schools function in shacks or in stinking lanes with no open space for children to stretch their legs.

These are the cities set up lately. A large number of others describe such cities as engine

of growth and refuge of the jobless, being flushed out from the countryside after being made surplus. They bring their poverty with them and seek a meagre living in metropolitan cities. Conditions in most major urban conglomerations in India are much the same. In the cities like Bangalore, Delhi, Mumbai and Calcutta, where the population has increased by 50 per cent in ten years, it may be worse. The population growth during this period in major cities was: Jaipur 60 per cent, Pune 50 per cent, Ahmedabad 45 per cent, Delhi 44 per cent, Hyderabad 43 per cent, Mumbai 33 per cent, Chennai 34 per cent, Calcutta 30 per cent and Bangalore 76 per cent (1994).

The magnet of hope is intimately connected with the state of sanitation. No wonder ancient civilisations, including Indus, Egyptian, Assyrian and Babylonian, were marked by well-planned houses. Techniques of disposal of human excreta are indicative of the stage of cultural development. In primitive agricultural societies, the techniques were simple and open defecation was the practice. In such a situation, there seemed to be direct relationship between culture and habitat. Low density of population, availability of open places for defecation gave rise to social orientation in favour of defecating in the open. Physical endowments tended in such circumstances to influence the culture of sanitation. Thus, ancient rural India did not have an enclosed place for defecation inside the house. Women also used secluded places either sur-

rounded by trees or covered in part by crops of raised ground. The night-soil thus deposited on the surface of the earth got converted into soil without creating the problem of disposal. With the coming in of modern civilization, provision for specific places either inside or outside the house was made for defecation. It was only after the emergence of towns, big cities and industrial areas during the Mughal period, and which got further impetus during the British period, that the problem of human waste disposal acquired urgency. It is to be noted that growing awareness for improved sanitation has led to adoption of a number of steps in the post-Independent India. Improvement in the living conditions through better sanitation provisions have received importance in the national policies as well as programmes of the international agencies.

Cities today are a blend of people some of whom have everything but are few in number and of those who are marginalized but are many. There is a constant struggle and conflict between attempt by the former to exclude the latter and effort by the latter to be included in the brackets of the former. It is a continuous process where some at the higher level descend down to the lower levels and some, at the lower levels ascend to the higher ones. To make the magnets more powerful and yet attractive one cannot do better that recapitulate the ideas of Camus.

"We must make common cause against the poverty and



to use Camus' phrase, we must build the drawbridges to open the fortress in order to break the cycle of poverty. We have to find collective and individual ways and means to improve the conditions of the urban poor. We need to fight to tackle not only the most tangible symptoms of poverty but also some of its root causes. We need to stop excluding the urban poor from the benefits of urban life. In other words, the challenge is how to include the poor in the future of our cities, towns and villages".

"Unfortunately, what we are seeing too often in the world today is the tragic result of exclusion. Exclusion traps the poor because they have no access to land, basic services, shelter, factors of production, and em-

ployment. They also lack any political participation or representation in the major economic, social cultural and political institutions. Those who are excluded cannot share our dreams with us; instead they live in a world of nightmares. Growth of cities leads to creation of problems. But simultaneously concentration of people in a limited area makes problem identification easier. Solutions can be thought of and applied. Closer supervision is possible. Dispersal of problems in isolated habitation makes solutions more difficult. No doubt, life away from cities has lesser complexities is hassle free, but is combined with fewer opportunities in the field of education, health and entertainment. It is these amenities and facilities which are the particles

of a powerful magnet that a cities is. It enables hopes to be fulfilled, aspirations satisfied. The growth of cities is inevitable and if the cities are beset with problems it will not be right to come to the conclusion that satellite towns and others afar will replace them. They too with time will grow into cities. Cities are magnets of hope mixed with revulsion toward their seamier side but since hope springs eternal in human breast, it is just as well that cities grow and we might as well accept this in good grace.

## Affordable Housing Project

West Bengal is to take up Rs.900 crores project to build affordable houses for low and middle income group at the satellite township of Rajarhat. The project will have 20,000 dwelling units spread over 150 acres and house a population of one lakh. In comparison, it would take just 20 such projects to equal the areas of Kolkata. Out of the total, 12,000 units will be for the LIG segment and 8000 for MIG. Kolkata would need 90,000 dwelling units per year to meet the demand as by 2025, another 10 million population would be added to the Kolkata municipal area, says West Bengal Housing Minister, while giving the details of this project at the inauguration of property fair, "Home Front."

Source : NBM&CW, January, 2006



# Tsunami Mitigation and Preparedness in Andaman & Nicobar Islands



**J.B.Kshirsagar\***



**Pawan Kumar\*\***

## 1. Introduction

**2**<sup>6<sup>th</sup></sup> December, 2004 was a black day in the history of disaster particularly for India. An unknown and unfamiliar word 'Tsunami' became well known to each and every Indian. The Tsunami was caused by an undersea quake measuring 9.0 on the Richter scale, recorded as the most intense quake in the last 40 years. It caused huge displacement of ocean water and the subsequent Tsunami traveled across the Indian Ocean with frightening speed. With almost no warning, Tsunami hits the shores of 12 nations from Malaysia to Kenya. About 2,00,000 persons in 8 countries perished in few hours, and over 1,00,000 went missing. Many more had their homes and livelihoods swept away in the coastal areas of Indonesia. A & N Islands, coastal areas of Andhra Pradesh, Tamil Nadu, Kerala and Pondicherry bore the brunt of the calamity in India.

History records the occurrence of Tsunami in the different parts of the world as shown in Table 1:



**Verdant Island in Andaman & Nicobar**

**Table 1: Tsunami in History**

S.N.	Period	Places affected	Remarks
1.	July 21, 365	Alexandria, Egypt	1000 people killed
2.	November 1, 1775	Portugal, Spain & Morocco	-
3.	August 27, 1883	Java & Sumatra	36,000 people killed
4.	June 15, 1896	Japan	26,000 people killed
5.	December 17, 1896	California	-
6.	January 31, 1906	Tumaco & Colombia	15009 people killed
7.	April 1, 1946	Hilo, Hawaii	159 people killed
8.	May 22, 1960	Chile	1000 people killed
9.	March 28, 1964	Alaska	107 people killed
10.	August 16, 1976	Philippines	5000 people killed
11.	July 17, 1998	New Guinea	2000 people killed
12.	December 26, 2004	Asian Countries	12,400 people killed in India

## 2. Relief Measures

\* **Chief Planner**, \*\* **Assistant Town & Country Planner**  
 Town & Country Planning Organization  
 (Ministry of Urban Development, Govt. of India)  
 E-Block, Vikas Bhawan, I.P.Estate, New Delhi-110002  
 E mail : jbkshirsagar@gmail.com, pawan612@yahoo.co.in



(A) Just after Tsunami, Govt. of India took various immediate relief measures such as:

**i. Rescue of Victims:** 207 relief camps were opened for 46,000 people; 14,000 people were air lifted to Port Blair, 5700 people were evacuated to the mainland, and 2000MT relief material was transported to different islands.

**ii. Ex-gratia for Victims:** Ex-gratia were disbursed to next of kin of all dead/missing persons and orphans at the rate of Rs. 2.00 lakh; widows and unmarried girls above 18 years of age were paid ex-gratia at the rate of Rs. 1.00 lakh.

**iii. Intermediate Shelters:** 9565 Intermediate shelters were constructed for more than 45,000 Tsunami affected families in a period of four months to ensure that they had a roof over their heads before the onset of monsoon. About 15,000 MT of material for construction of shelters were transported to different islands despite constraints. Andaman PWD was responsible for the construction of these intermediate shelters.



Intermediate Shelter along with Access Paths of Bamboo

**iv. Shops & Counseling Centre:** 60 fair price shops were opened in different islands. Special relief cards issued. Child help line service, Trauma counseling services were set up.

**ii. Rajiv Gandhi Relief Package for Tsunami:** Under this package, Rs. 821.88 crore was sanctioned for Tsunami affected areas. This included payment of ex-gratia as well revival of economic activity. In addition, an enhanced compensation package for Crop loss at a cost of Rs. 70.28 crore was also sanctioned. This consists of com-

pensation of Rs. 90,465 per hectare for loss of plantation crops i.e. coconut and arecanut and Rs. 22,231/ha for loss of paddy/vegetables.

(B) Restoration of Damaged Infrastructure

**i. Power Supply:** 10 powerhouses were restored out of 20 powerhouses damaged and 18 were constructed. 30 MW out of 37 MW capacity destroyed was restored immediately. In 58 relocated isolated settlements, where intermediate shelters were constructed, power supply was given by extension of lines and generator sets.

**ii. All Weather Roads:** Intermediate shelter sites, developed after Tsunami, were connected with all weather roads. 142 km roads have been restored and repair / reconstruction work on 308 km is under progress.

**iii. Water Supply:** Drinking water to all affected areas was restored immediately. Rain-water harvesting structures were provided in intermedi-

Table 2: Houses Damaged in Tsunami affected Islands

S.N.	Islands	DUs. Damaged
1.	Little Andaman	2000
2.	Car Nicobar	5000
3.	Teressa	400
4.	Chowra	250
5.	Katchal	1100
6.	Kamorta	700
7.	Nancowrie	200
8.	Trinket, Kondul, Little Nicobar & Pillomillo	200
9.	Great Nicobar	1200
10.	Andaman District	2950
	<b>Total</b>	<b>14000</b>



ate shelters.

**iv. Shipping Schedule:** It was maintained from the day of tsunami. In fact, the frequency of inter-island and mainland-island ships was increased. Temporary jetties were constructed in Tsunami affected islands.

### (C) Social Services

Timely, preventive measures were taken to prevent outbreak of disease. In fact the incidence of malaria now was lower than the pre-Tsunami period. All health sub centers were made functional immediately. Schools were re-established in temporary structures. Textbooks, notebooks, stationary and uniforms for school children were provided.

### (D) Livelihood Plan

**i. Employment:** The UT administration has assured at least one daily wage job per affected family for 1 year. 6313 families have been identified for support after door-to-door survey. 22 lakh man days of employment were generated by 15<sup>th</sup> December 2005.

**ii. Tourism:** Efforts have been made to revive tourism, media campaign launched for "Brand & Confidence Building". Permission to visit the islands in lieu of Home leave travel concession helped in reviving the inflow of tourists.

**iii. Agriculture:** In the agriculture sector, the policy of buy back from farmers for coconut seedling /seed nut, banana suckers, arecanut & tapioca seedlings resulted

in an income of Rs.45 lakhs. In addition, farmers benefited through procurement of co-pra, which increased from Rs. 65 lakhs in 2004-05 to Rs. 3.75 crore in 2005-06. Multiple cropping, organic farming and vegetable cultivation were introduced.

**iv. Fisheries:** 2300 fishermen were affected. Out of the 1703 boats lost/damaged, 1392 have been repaired / replaced.

### 3. Permanent Settlements: Planning Approach

Shri Anil Baijal, IAS, Secretary (Ministry of Urban Development) Govt. of India took the initiative and evinced keen interest to ensure that the Layout Plans for Permanent Settlements in A & N Islands are taken up in accordance with current town planning norms and that these settlements come up as model town ships, catering to the requirements of all facilities and amenities like schools, shopping, health centers, open spaces, Govt. and Semi Govt. establishments, etc. He suggested that the plans for Permanent Settlement should taken in account of topography, socio-economic

characteristics, forest resource, etc. and above all be responsive to the needs and requirements of the local community keeping in mind future requirements.

Town and Country Planning Organization (TCPO), Ministry of Urban Development, Govt. of India was assigned the role of preparing the permanent Settlement Plans at 72 locations in various islands. TCPO teams initially visited some locations for reconnaissance to identify sites for new locations for permanent settlements based on the following parameters:

- Tsunami affected / inundated areas up to 10 m contour level along the seashore. New location of permanent settlements sited above 10 m contour levels or 3 m above the high tide line, whichever is higher.
- Approach – Sites near existing PWD road / PWD Jeepable road.
- Water Supply – Dependable source of water supply in the form of wells or APWD water supply line in the vicinity.
- Coconut Trees are the main source of income for tribal

**Table 3: Material Specifications in Construction**

S.N.	Components	Materials
i.	Structure	Fabricated Steel Structure
ii.	Walls	
	• External Walls	Timber Planks Paneling
	• Kitchen Walls	Light weight(aerated) concrete blocks of 200/100 mm. thick
	• Toilet walls	Light weight(aerated) concrete blocks of 200/100 mm. thick
iii.	Internal Partitions	Processed bamboo board
iv.	Flooring	C.C. flooring
v.	Doors& Windows	Processed bamboo board/bamboo jute composite
vi.	Roof C.G.I. Sheets	

people. The new location of villages therefore results in the least felling of the coconut trees.

- Existing village sites affected by Tsunami to be used for large-scale plantation of casuarina, cashew and coconut plantation. Casuarina and cashew should be planted all along the beach area and rest of the area should be coconut grooves.
- Higher order facilities to be planned as per the changed locations of the villages keeping in view the strategic location, accessibility and population concentration of each village.

The layout plans are based on the concept of small clusters of dwelling units planned around an open space to enhance its utility. School, shopping centre, health center, anganwadis, community center and church have also been provided in accordance with the discussions held with the Local Administration and Village Captains/ norms and standards. Plot Size of 20 mt x 12 mt (Twin D.U.s.) is pro-

vided with front, rear and side set back to ensure adequate light and ventilation and also to cater future expansion. 6mt and 3 mt access roads are proposed according to requirement and site conditions. The Layout Plans include provisions for rainwater harvesting pits and garbage dumps.

For Car Nicobar, plots are not envisaged for Machan type design. The residents have asked for a house on stilts, which are being provided. Attempt has been made to accommodate as many as dwelling units in each tuhet depending on land availability. For tuhets having large number of families more than one site has been selected for locating dwelling units. Similarly, smaller tuhets having few families have been merged and located on one site to avoid any further clearing land.

#### 4. Tsunami Preparedness

Coastal areas of India are vulnerable to Tsunami, earthquake, cyclonic winds, storm surges, flooding by incessant rain, etc. Planning of tsunami

prone areas and design of tsunami resistant structures require both structural and non structural measures to mitigate the effects of tsunami and preventive design solutions. It also requires a long term and sustainable plan of development.

**i. Land Use Planning:** Designation of land use from tsunami / cyclone prone to tsunami / cyclone resistant is required. Existing zoning and other regulations need to be reviewed and updated. It is desirable to encourage development away from the coastline.

**ii. Location:** Location of settlements requires thorough analysis of distance from the sea, elevation above MSL, height of high tide line, maximum past run up of tsunami above the site elevation, expected depth and speed of tsunami waves, etc.

**iii. Protection of Existing Structures and Infrastructure:** It requires proper assessment of structural and non-structural elements, adoption of adequate techniques such as repair, retrofitting, strengthening, replacement, etc. for protection of existing structures and restoration of infrastructure and facilities.

**iv. Tsunami Resistant Design:** There is urgent need to frame Tsunami resistant design code and its mandatory inclusion in local building byelaws is required. The code may fulfill various safety measures under multi hazard environment.

**v. Special Provisions:** Tsunami is associated with phe-



Nicobari Machan Type House in A & N Islands

nomenon of inundation, currents, drawn down force, hydrodynamic forces, speed of waves, wave forces, etc. Hence specific provisions such as afforestation, ditches, slopes, etc. to reduce speed of tsunami waves, angled wall to deflect Tsunami waves, stilted buildings, etc. are required.

**vi. Evacuation Planning:** A proper tsunami warning system gives sufficient time for evacuation and hence evacuation planning is an important part of Tsunami planning. It requires awareness among residents about evacuation routes and areas. Horizontal evacuation includes provision of high ground, man made mounds, open space on natural mounds, etc. and vertical evacuation requires high rise buildings, proper connectivity between higher floors, etc.

### 5.0 Concluding Remarks

Tsunami is quite common in the Pacific Ocean, less in the Indian Ocean and least the

in Atlantic Ocean. However, Tsunami Early warning System is required to alert the people, local authorities, etc. The Govt. of India is setting up an Early Warning System for Tsunami and Storm Surges in Indian Ocean at the total cost of Rs. 125 crores. Additionally, a Centre would be set up at Indian National Centre for Ocean Information Services, Hyderabad on 24x7 basis. The system is scheduled to be operationalised by September 2007. It will be Tsunami Warning System for the whole country.

Recently, NASA has developed GPS Displacement Method by using global positioning software to determine whether an earth quake is big enough to generate Tsunami. This technology can be used to provide faster Tsunami warnings. This new method works by measuring the time radio signal from GPS satellite arrives at ground station located within few thousand kilometers of a quake. From this data, scientists can calculate how far the stations moved because of the quake.

They can derive earthquake model and its true size that is called moment magnitude. This magnitude is directly related to a quake's potential for generating Tsunami.

The use of GIS and aerial photography are necessary for mapping and these maps should be made available to local administration for urban planning on 1:1000 scale maps having contour of 1- 2 m intervals.

The Government should encourage programmes that promote community-based approach to Tsunami mitigation and vulnerability reduction. Community based disaster preparedness utilizes the resources within the community and neighbouring areas, which build capacity of the community. If it is associated with Panchayati Raj Institutions, it would be an important tool for the nation's programmes for disaster reduction.

## Social Security For Construction Workers

For the first time, the Delhi government has planned to extend social security to construction workers. Builders and Contractors now will have to pay an additional one percent cess on new properties and buildings to Government. The Building and other Construction Act, formulated in 1996, has come into force now. It aims to provide social security to building workers and electronic registration of all such workers. They would finally release this money from the buyers of the flats in buildings. The fund would be used to provide upto Rs.1,000 to women workers for maternity benefits, Rs.150 per month as pension beyond 60 years, a loan of upto Rs.50,000 for construction of houses and special allowance in case of a major disability. The scheme also provides for financial assistance for education of children of workers. Initially, the government would contribute a sizeable amount to this fund. All workers would be registered through all the 134 citizen services bureaus of MCD. They will have to contribute Rs.60 every three months for the scheme.

*Source : NBM&CW, January, 2006*



# MoU with Government of Bhutan

During the visit to finalize the Technical Cooperation between BMTPC and Standards & Quality Control Authority (SQCA) under the Ministry of Works & Human Settlements, Royal Government of Bhutan, SQCA evinced interest in the establishment of Technology Demonstration-cum-Production Centre in Bhutan for production of various precast building components for use in housing and building construction. Accordingly, a detailed feasibility report was prepared and approved by SQCA for setting up of the Centre. The Council participated in Construction Expo - 2005 and

organized Workshop on "Technology Options for Cost Effective and Earthquake Resistant Construction in Housing" in collaboration with SQCA from 29<sup>th</sup> September to 1<sup>st</sup> October, 2005 at Thimpu, Bhutan.

An MoU was signed by Secretary, Ministry of Housing & Urban Poverty Alleviation, GOI and Secretary, Ministry of Works & Human Settlement, Govt. of Bhutan on May 15, 2006 for establishing a Technology Demonstration cum Production Centre in Gyelposhing, District Mongar, Bhutan with the technical assistance from BMTPC.

A 3-days training programme was also organized on "Standards and Quality Control in construction" jointly by BMTPC and Standards and Quality Control Authority (SQCA), Ministry of Works & Human Settlements, Royal Government of Bhutan during May 16-18, 2006 which was attended by more than 50 engineers, architects & professionals from various Govt. Departments & private organizations of Bhutan. The training programme was inaugurated by Secretary (HUPA), GOI.



# Sanitation for all - Realizing the Dream Through Composites Materials and Technology Applications



**Dr. R. Gopalan\***

## Introduction

According to UN Human Development Report, India is the fourth largest economy in the world as measured by Purchasing Power Parity (PPP), with a GDP of US \$3.63 trillion. As calculated by the World Bank, India is the second fastest growing major economy in the world, with a GDP growth rate of 9.1%, as of the first quarter of 2006. However, despite these positive economic indicators, India continues to occupy an abysmal low position in the UN Human Development Index in which it is placed at No. 127 out of the total 177 countries surveyed. Our poor social indicators relating to sanitation, water supply, housing, health, primary education, infrastructure development etc. - have a combined negative impact and are responsible for pulling down the HDI ranking to such a low level.

## Sanitation - The Country's Biggest Problem

One of India's biggest problems and one that is a big blot on our social fabric is inadequate sanitation coverage. With one of the most densely populated

countries in the world, India has the lowest sanitation coverage. An estimated 700 million people have no toilets in their homes and are forced to defecate in the open - along roadsides, on farmland, in municipal parks and so on. In slums, particularly, there are no toilets at all. Many schools in rural India do not have toilets and this is one of the main reasons why girls dropout from school once they cross the primary level. The absence of toilets is devastating for women. It severely affects their dignity, health, safety and sense of privacy, and indirectly their literacy and productivity. To defecate women and girls have to wait until dark, which exposes them to harassment and even sexual assault.

According to Water Aid, a United Kingdom-based organization that focuses on water, sanitation and hygiene promotion in developing countries, India faces the "silent emergency of sanitation neglect". The economic cost of this neglect is enormous. According to a World Bank Report, the annual cost (health expenditure and productivity loss) is put at \$

9.7 billion - over 4 per cent of India's gross domestic product (GDP) in the mid-1990s. Yet, sanitation receives very little official attention and resources. A survey on public toilet facilities in 151 Mumbai settlements by Toilet Talk showed that over 1,480 persons used one toilet seat, though the target set by the municipality was one seat for 50 people.

## Sanitation : The Cause And Effect

The World Health Organization (WHO) defines sanitation as the safe management of human excreta and includes the provision of latrines and the promotion of personal hygiene. Studies show that the promotion of personal hygiene can reduce diarrhea disease by over 35 per cent, while the use of latrines can reduce it by over 40 per cent. Environmental sanitation is a broader term, encompassing excreta disposal, solid waste management, waste water disposal, vector control, and drainage.

A direct relationship exists between water, sanitation, health, nutrition and human well being. The World Health Orga-

\* **Director & CEO**

**RV-TIFAC Composites Design Centre**

Composites Technology Park, #205, Bande Mutt, Kengeri Satellite Township, Bangalore-560 060

Tel: 080-65997605, 28482768, 65581005 Fax: 080-28482771

E-mail: drgopal@blr.vsnl.net.in / www.compositestechologypark.com

nization (WHO) describes about 80 percent of all sicknesses and diseases in India due to lack of sanitation and pure water supply and consequential higher incidence of communicable diseases such as diarrhea, cholera, malaria etc. (Central Bureau of Health Intelligence, Min. of Health & Family Welfare, 1998- 1999). Thousands of school-going children die every year due to diarrhea and dehydration caused by poor hygiene.

### **Initiatives Taken by the Government of India**

The Government of India had introduced several years before the Central Rural Sanitation Programme (CRSP), with the objective of improving the quality of life of rural people and to provide privacy and dignity to the women. The programme provided 100 percent subsidy for construction of sanitary latrines. According to available statistics, the sanitation coverage in India has been increasing slowly since 2000. As per the report of Multiple Indicator Survey (MICS 2000), toilets are used in 37 percent households, including 19 percent in the rural areas, and about 35 percent (18 percent rural) households have an improved sanitation facility (flush toilet connected to sewage, pour flush toilet, pit toilet, improved pit toilet or simple pit etc.)

However, realizing certain weaknesses in the programme, the Government revised its strategies and the programme was restructured and a new Total Sanitation Campaign (TSC) was

launched recently in about 350 districts of the country with added emphasis on community-led and people-centered approach. According to Census Report of 2001, of the 138.2 crores rural households in the country, nearly 44 Lakhs have constructed household toilets under the total sanitation scheme. In addition, over 1,750 women's complexes, 41,854 school toilets and 5,238 angan wadi toilets have been set up.

In order to facilitate an efficient delivery system, 618 production centers/ rural sanitary marts (RSMs) have been set up as an important component of TSC project to promote school sanitation, hygiene education, and wider acceptance of sanitation by all people - young and old. The main aim of Rural Sanitary Marts is to provide materials and guidance needed for constructing different types of latrines and other sanitary facilities, which are technologically and financially suitable to the rural areas. Production centers are the means to improve the production of cost effective affordable sanitary materials.

### **Sanitation For All - How to Realize the Dream**

According to the WHO, given the technology used by the Government of India and the current rates of construction and population growth, it would take 200 years for every Indian to have access to a toilet.

However, thanks to the innovative technology developed at India's first Composites Technology Park which has been set up

at Bangalore by the Society for Development of Composites, with the support of Department of Science and Technology, BMTPC and Coir Board, Govt. of India, it is possible to realize the dream of providing sanitation for all over the next 10 years or so by building millions of lightweight, prefabricated, portable, ready-to-assemble-and-fix toilet units in urban and rural households, crowded public places like markets, railway and bus stations etc.

### **Advantages of Composites Materials and Technology**

Driven by the challenges of the aerospace and defence over the past 4 decades of the industries, composite materials and technology is making significant gains in a host of industrial and other socio-economic applications. Composites is a combination of two or more materials properties results in to a new class of materials with superior properties than those of the individual constituent materials: Glass fibre polymer composites (GRP), are generally used for sanitation application. However Glass / Bamboo / Coir hybrid sandwich composites that are recently developed are highly suitable for, low-cost sanitation. These Composite materials have several advantages such as:

- Lightweight
- High weight-to-strength ratio
- Dimensional stability
- Amenability to be engineered to any size and shape
- Resistance to chemical corrosion
- Termite / borer proof



- Moisture resistant, Impact resistant, Fire retardant, Low flammability
- Eco-friendly and excellent substitute to wood and timber
- Cost effective

### Pre-Fabricated Toilet Unit using Composites:

RV-TIFAC Composites Design Centre at Bangalore, established by the TIFAC, Department of Science & Technology, Government of India, during 1997 under its Technology Mission on Advanced Composites, with a mandate to design and develop low-cost, eco-friendly composite products, has successfully developed nearly 200 composite products using glass fibre polymer composite and natural fibre polymer composite using bamboo and coir fibre for several socio-economic applications such as rural development, housing, building construction, etc.

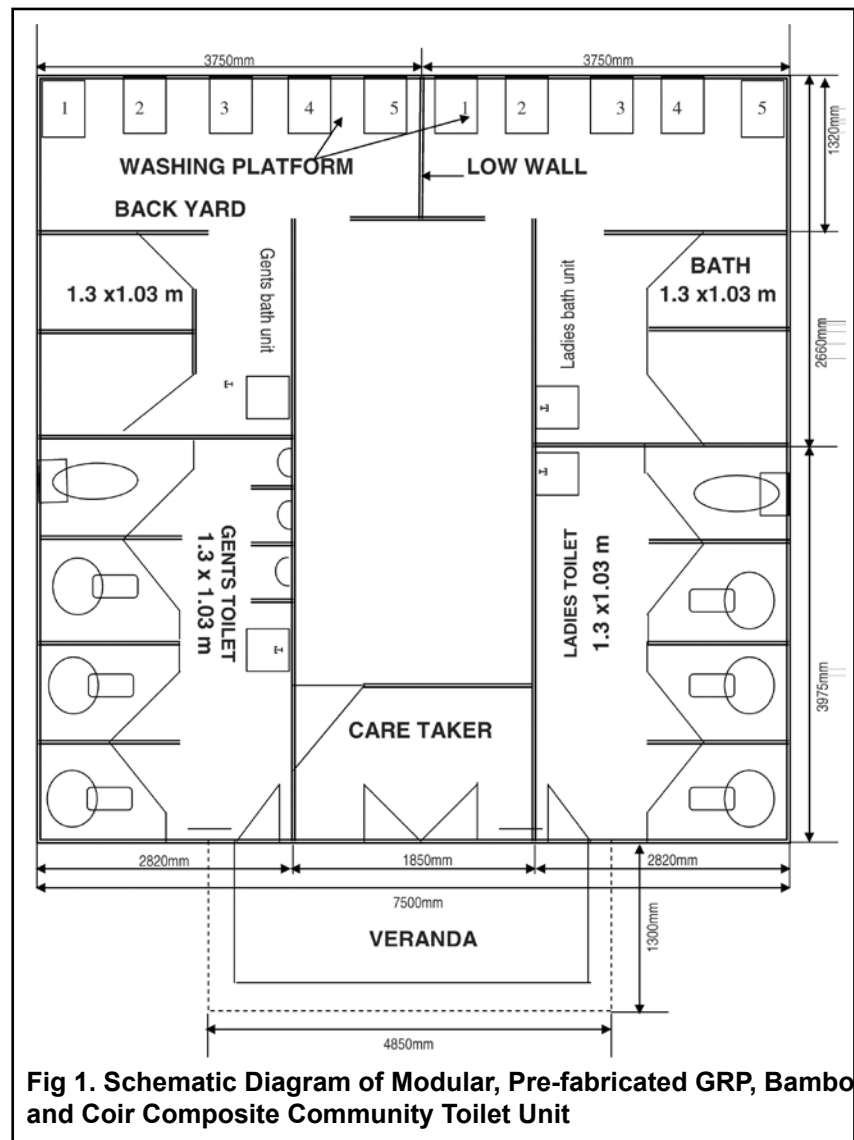
One of the innovative products developed by the Centre is a low-cost, prefabricated toilet unit, using Glass-Bamboo fibre sandwich composite materials in which the sub-components namely door shutters, wall panel, roof panel, etc., are pre-fabricated and then assembled and installed at the construction site. Three types of toilet units namely, Twin unit, Four-in-one unit (single and twin) and Community toilet unit were designed and developed. The prototype products were fabricated and installed at the Composites Technology Park, along with accessories including sanitary, mechanical and electrical fittings,

for demonstration and public display.

### Outlines of the Pre-Fabricated Composites Toilet Units

#### 1. Community Toilet Unit

A schematic diagram of the pre-fabricated GRP/ bamboo compo-sites community toilet unit is shown in Fig.1. Photograph of roofing panel, doors and wall panel used for construction of the composites



**Fig 2. Photograph Showing GRP-Bamboo Fibre Composites Pre-Fabricated Community Toilet Unit**

toilet unit are also shown in Figs. 2. The photograph of the prototype of pre-fabricated composite community toilet block developed and installed at the Composites Technology Park is shown in Fig. 3.

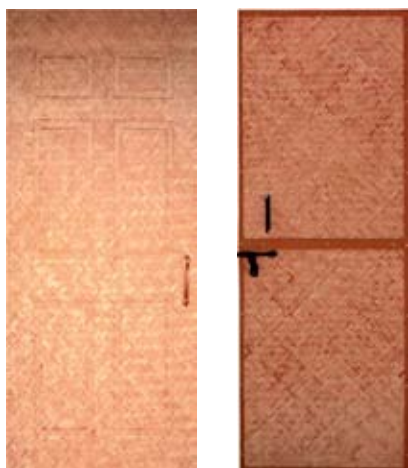
## 2. Twin Toilet Unit

Twin toilet unit consist of toilet + change room measuring 2440mm x 1220mm x 1969mm.

The photograph of the prototype of pre-fabricated composite twin toilet unit, developed and installed at the Composites

### Brief description of the community toilet block

• Overall dimensions	Length = 3965mm, Width = 2795mm, Height = 2136 mm
• No. of toilet	2 blocks, 4 Nos. of W/C, 4Nos. of Urinals and 2 Nos. of bath/shower and 5 Nos. washing stone.
• Fittings installed	WC, Wash Basin, Mirror frame
• Other items provided	Overhead tank, Buckets, Mugs, hand towel, etc.,
• Materials used	a. Mild Steel Pre-fabricated super structure b. Bamboo - GRP composite roof, wall panels and floor panels.
• Details of prefabricated composite parts	Wall panels, roof panel, WC, squatting pan, 'P' trap, pipes, Urinal, Urinal partition panel, wash basin, Mirror etc.,
• Fittings installed in each block	W/C squatting Pan – 4Nos, washbasin 2Nos. overhead tank 5000 liters-1 No, and water taps.
• Type of Construction	Modular: M.S. frame structure is pre-fabricated to suit the design of the toilet. Pre-fabricated composite parts described as above, are fixed with the M.S. frame by means of mechanical fasteners and also polymer seal, wherever necessary.



BAMBOO DOOR SHUTTERS



BAMBOO WINDOW SHUTTER



BAMBOO WALL PANEL



BAMBOO SANDWICH PANEL



BAMBOO STIFFENED PANEL

Fig. 3. Photographs showing the Bamboo Composites Products developed and used in the pre-brabricated toilet unit

#### Brief description of the twin toilet unit

• Overall dimensions	Length = 2440mm, Width = 1220mm, Height = 1969mm
• No. of toilet units	1 No. W/C. and one change room
• Fittings installed	1 western commode with Cistern, 2 GRP wash basins, 1 exhaust fan, 1 wall mounted fan, 3 lights, 2 towel rods with plastic curtain, 2 mirrors, 2 soap cases, 2 cloth hanger of stander make duly fitted suitably
• Materials used	a. Mild Steel Pre-fabricated structure b. Bamboo - GRP composite roof, wall panels and floor panels.

Technology Park is shown in Fig. 4.

### 3. Four-in-one Toilet Unit

Two types of Four-in-one toilet block namely single unit and twin unit are designed and developed. The schematic diagram of the four-in-one toilet unit is shown in Fig.5. The photograph of the prototype of pre-fabricated composite four-in-one single toilet unit developed and installed at the



**Fig 4. Photograph showing GRP-Bamboo Fibre Composite Twin Toilet Unit**



**Fig 6. Photograph showing GRP-Bamboo Fibre Composites Four-in-one (single unit) Toilet block**

Composites Technology Park is shown in Fig. 6.

### Advantages of Pre-Fabricated Composites Community Toilet Unit

The prefabricated composite community toilet unit offers the following advantages: -

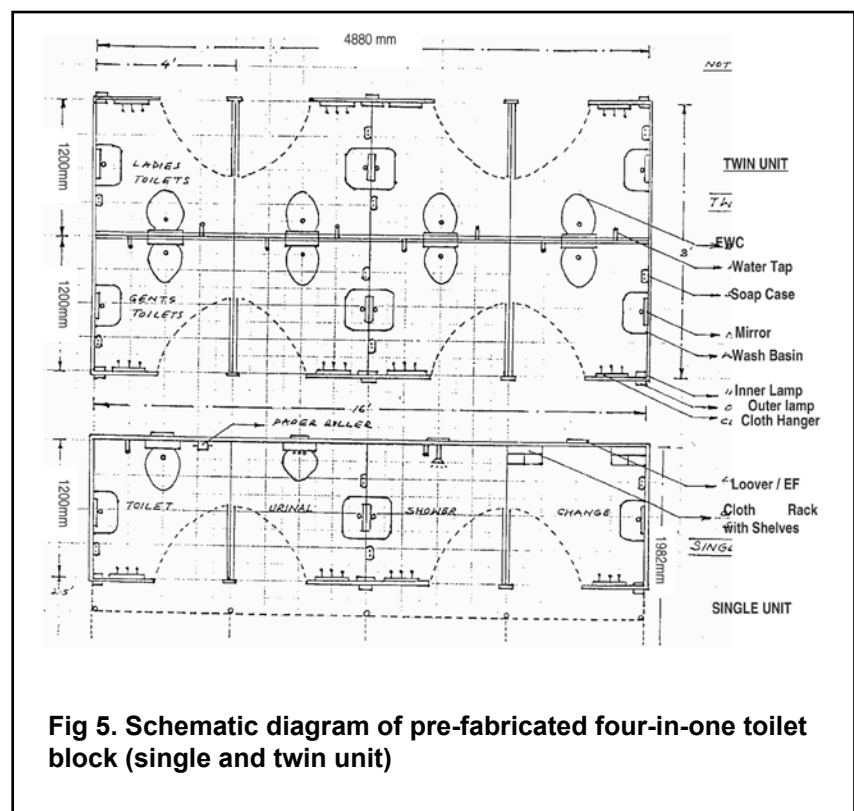
- Saves Time and Money: ready to use toilet unit can be installed in about 10-12 hours time.
- Design flexibility to meet

even complex shapes and sizes can be achieved

- The Fabrication of the sub-components at the works ensures uniform finish and high quality
- The toilet unit can be easily dismantled, shifted and installed at new locations if required with minimum cost and time.
- The composites toilet unit is eco-friendly, cost effective and highly durable

### Conclusions

Prefabricated toilet units made of GRP-Bamboo and Bamboo / Coir sandwich composites have tremendous potential for providing ready to use toilet units for each and every low-cost housing colony, especially in the rural areas which is otherwise considered to be a real challenge in terms of time and money. Several community toilet units, each designed to



**Fig 5. Schematic diagram of pre-fabricated four-in-one toilet block (single and twin unit)**



serve large groups of people could also be easily built at less time and cost.

Since the technology of glass – bamboo and coir sandwich composite construction for the community toilet unit is simple and does not involve heavy investments, it could be easily transferred to small scale entrepreneurs and technocrats in all parts of the country for localized

production and supply, thereby it also provide large-scale rural employment.

Concerted and co-coordinated efforts are required by the Governmental, non-Governmental agencies and also R&D institutions to solve the increasing sanitation problems by adopting the composite materials and technology.



### Visit of Standing Committee of Parliament on Urban Development to Green Houses constructed by BMT-PC at Leh in May, 2006



### 1st meeting of the Standing Committee of Parliament on Urban Development on 15-09-2006



## Cities – Magnets of Hope

### Cities and its Migrants



**Dr. M.L. Khurana\***

**T**he name city is given to certain urban communities by virtue of some legal or conventional distinction. It also refers to a particular type of community, the urban community, and its generic culture is often called 'urbanism'. In legal terms, in the United States, for example, a city is an urban area incorporated by special or general act of a state legislature. In Australia and Canada, city is a term applied to the larger units of municipal Government under state and provincial authority respectively.

As a type of community, the city may be regarded as a relatively permanent concentration of population, together with its diverse habitations, social arrangements and supporting activities; and having a cultural importance that differentiates it from other types of human settlement and association.

City is a dynamic entity in itself. In 1900, cities were home to just 9% of the world's population. Now a century later, about half the world's people live in cities. If the present trend continues, by 2025 cities will be home to two thirds of humanity.

To study a city is essential because city is a uniquely powerful form of human settlement. For centuries, the cities have been the heart, the lifeblood of various civilizations – the centre of economic, political and artistic events. Today cities are so much a part of our lives that they seem both natural and inevitable. In the larger perspective, cities are not a very new idea. Cities began to appear only 10,000 years ago.

#### Historical View

There is enough historical evidence to show that human settlements are found in rich tropical areas of the Indus, Nile, the Euphrates, the Tigris and the Yellow River. The obvious reasons were, favourable environmental factors, adequate water supply, ready materials for providing shelter and easy access to other people. Gradually these fertile tropical areas were used to raise their own food. This domestication of plants, or agricultural revolution is the single most important event in human history.

Over a period of some 5000 years, villages began and multiplied. Humans created per-

manent settlements where they raised crops and learned to domesticate animals for use in the fields or as a food supply. Permanent settlements also transformed patterns of social structure. These settlements were characterized by a complex pattern of division of labour. This was a radical shift from the social structure that prevailed earlier. Permanent settlements forced people to specialize in different tasks. It afforded people the opportunity to specialize not just in food production, but in religion, military affairs, trade etc. The process of specialization benefited everyone, the farmer gained the protection of the military and the value of the priest's greater insight into religious matters, while the priest and the soldier received the fruits of the farmers labour.

By 3500 BC urban population came to be distinguished by literacy, technological progress (in metal), social controls, political organizations etc. It was thus the first urban revolution. These urban settlements multiplied and their populations grew to sizes. The city's positive attributes and its ability to increase peoples' standard of

\* **Managing Director**  
**National Cooperative Housing Federation of India, New Delhi**

living resulted in migration of diverse groups to one centre. Also the cities were continually renewed with inventions, innovations and new ideas supplied by trade and people of different backgrounds. All the early cities were characterized by some combination of favourable ecological conditions, some sort of trade or food surplus and a complex social structure.

The early cities did not show any smooth progression of growth. There was discontinuity and change, rise and fall. Second, these cities were small and a population of about 10,000 was usual and even the largest settlements never went much beyond the quarter-million mark. Third, regarding the power structure, many early cities had a theocratic character – a fused religious and political elite in which kings were also priests. Everywhere the first cities were characterized by inequalities in power and benefits.

With the development of urban trade and craft during 5<sup>th</sup> to 11<sup>th</sup> Centuries cities became the stepping stones. The emergence of a complex and competitive commercial class at the centre of the on-going trade dominated from the 11<sup>th</sup> Century onward by craft guilds, contributed to a newly vibrant city life.

The period from the 12th Century until about the 16th Century was a period of general urban rebirth or renaissance. It was during this stage that the city gradually captured interest in art, literature and architec-

ture.

### **Urban Revolution: Rise of Modern Cities**

Cities were rapidly gaining prominence. Commerce began to replace agriculture and a new middle class began to rise to power. This class – the capitalist, was composed of shopkeepers, traders and manufacturers. The government officials and people got engaged in commercial ventures. As wealth increased in the cities, they began to attract more people. By the mid 17<sup>th</sup> Century, capitalism was making its mark. Around the beginning of the 18th Century, the industrial revolution had begun. The result was an explosion in the city's population. With the urban population enjoying more wealth, more efficient means of production and better health and sanitation conditions both migration and natural population growth were high. This influx, coupled with technological improvement and advances in health and sanitation services, created what is known as demographic transitions. De-population of rural areas as people moved to cities, many abandoning their farms in search of white collared jobs in cities also took place. These migratory trends have now gained so much prominence that it is the central concern of demographers.

### **Migration and its reasons**

Migration has been taking place since time immemorial for various reasons. Industrialization and post industrialization have only accelerated the pace and intensity of migration. Migration is not only concentrated

to certain regions, but is part of global trend of people moving from villages to towns and cities. It is part of international migration – people seeking a better life in other countries both in the north and in the south. It is very difficult to stop the flow of people into towns and cities. According to the International Organization for Migration (IOM), migration is considered one of the defining global trends of the early 21<sup>st</sup> Century with more and more people on the move today than at any other time in history. According to latest UN research, international migrants numbered 191 million in 2005, 115 million lived in developed countries and 75 million in developing countries.

South Asian countries are experiencing an explosion of rural to urban migration. Unemployment and agricultural interruption are push factors, the lure for better life and more money are pull factors. In South-East Asia, the percentage of foreigners is the highest in the region (about 5%), with very significant percentages in Singapore (33%) and Malaysia (7%). This is probably associated with the rapid industrialization that has occurred during the last few decades.

In India, industrialization has widened the gap between rural and urban areas, prompting the workforce to move to industrializing areas. In developing countries such as ours, the workforce shift has been dominated by the expansion of the informal sector. Seasonal workers are mostly absorbed



into the informal sector. Studies have shown that migration is an important economic strategy for poor households in several regions of India. The National Commission of Rural Labour concluded that uneven development was the root cause of seasonal migrants. Workers could be locked into a debt-migration cycle where earnings from migration are used to repay debts at home which in turn makes migration an economic necessity. In 1991, 39 million people migrated in rural-urban patterns of which 54% were female.

### City's Response to its Migrants

Cities are the destinations for people escaping poverty, conflict, human rights violations, or simply those looking for a change, for something better. A city is a provider of services to its citizens, which can be measured by the quality of its services (access to telephone services, water, sewerage or electricity); the reliability of such services over time (as measured by the quality of infrastructure services) and the degree to which a city involves its citizens in decision making; is responsive to their demands, and is well governed in general.

Cities are hubs of national production and consumption, are centres of economic and social progress and generate wealth and opportunity. According to UN Habitat's latest report 'State of the World's Cities 2006-07' says, that half of world's population lives in cities. In 1950, only one third lived in cities. Fifty years later, this rose

to one half and will continue to grow to two-thirds of the global population, or some 6 billion people by 2050.

People come to cities with hope and expectations and a desire to earn a better life. But to what extent, does the cities or the urban centres prove to be centres of development and hope. The large influx of population that enters the city, has direct or indirect impact on the infrastructure. The progressive degeneration of urban infrastructure, questions the fundamentals of the urban development concept. The Indian Infrastructure Report 2006, by Infrastructure Development and Finance Company Ltd., which focuses on urban infrastructure says such cities as Nagpur, Surat, Vijayawada with half a million population are growing at a daunting pace. If this growth continues, large chunks of the country are going to be urbanized over the next two decades. By 2006, more than half the population of States like Tamil Nadu, Maharashtra, Gujarat and Punjab would be living in urban areas.

But the most startling feature on which several debates have been launched is that most Indian cities are manifestations of unplanned growth and are managing more number of inhabitants than they can sustain. This results in congestion, noise, traffic jams, air pollution and major shortages of key necessities. Every major city in India faces the same proliferating problems of grossly inadequate housing, transportation,

sewage, electric power, water supplies, schools and hospitals. In such a situation, the migrant population adds to the burden of the cities. Migrants are exposed to large uncertainties whether it is the job or the dwelling place. The first and the foremost thing that a migrant looks for when he comes to the city is the living space and then a job. Most of them land in slums or makeshift shelters that promise no services be it the basic necessities of water or electricity or security of tenure or health service.

To add to their woes, the decentralized Government frameworks as in our country, local authorities have to cope with migrants and their problems. Lack of coordination among the many layers of Government in a city or metropolitan is the norm adding to their limited capacity to manage migration.

The growing migrants and the issues of urban segregation and poverty pose a fresh challenge to local authorities.

But this trend of migration cannot be curbed or controlled and will continue at its pace. The best possible option we have today is to manage migration. There are a few things which can be done to make our urban centres sustainable and also centre of development and hope.

- Cities should be made more friendly to newcomers. The private, public and cooperative sectors should work hand in hand to make provisions for the migrants.

As said earlier that housing is the foremost necessity for a migrant who comes to a new city. Provision of a secure dwelling place at affordable rate would give a sense of security and would also check the growth of slums and shanty dwelling places. Housing cooperatives, being member centered and member driven organizations provide affordable houses to its members with a clean and healthy environment. Housing cooperatives also build rental housing units and thus add to the national housing stock. Housing cooperatives should be promoted by Government in order to attend to the problem of housing shortage that our country is facing today.

- Developing rural hinterlands and providing them the facilities that are available to urban centres. This in a way would at least to some extent would bring down the migration rates.



## BMTPC Foundation Day – June 29, 2006



## Know your Wood based Panels used in Housing and Construction and their Testing



**C.N.Pandey\***



**K.Shyamasundar\*\***

**T**he wood based panel industry is well established in the country manufacturing wide variety of products meeting the requirements of National and International standards. The various products manufactured by the industry are as given below:

1. Plywood
2. Particleboard
3. Fibre board
4. Flush door
5. Panel doors
6. Block board
7. Compreg – compressed wood laminates
8. Laminated Veneer Lumber
9. Bamboo composites
10. Coir Composites

### 1. Plywood

Plywood has got several advantages over the natural wood. Ordinary wood has the tendency to shrink and swell at varying humidity and temperature conditions. Further, it has got certain other defects also, such as, knots, irregular grains etc. These defects are removed in plywood. It is dimensionally stable in changing atmospheric conditions due to cross lamination of the veneers. Plywood can be prepared in larger and requisite sizes also. Its appearance

can also be made more attractive. This is the reason that it is used for making furniture, packing cases, bodies of cars, buses and wagons. It is also used for making ships, boats, aircrafts, sports goods, textile accessories and for hundreds of other uses.

The quality of plywood is generally assessed by the quality of the glue bond. In Indian Standard Specification for general purpose plywood IS:303-1989, the glue bond requirements of Boiling Water Resistance[BWR], and Moisture Resistance[MR] grade plywood have been specified. Aircraft plywood (medium and high strength), marine plywood & structural plywood should conform to Boiling Water Proof [BWP] grade. Preservative treated plywood and fire retardant plywood should conform to BWR grade. Decorative plywood using plurality of veneers should conform to BWP and MR grades. Adhesive used in all plywood should conform to the requirements Indian Standard Specification for synthetic resin adhesives IS:848-1974.

In addition to glue bond requirements other mechanical strength tests, tests for preser-

ventions, tests for fire retardant are prescribed in their respective Indian Standard Specifications.

The methods of tests for all types of plywood are given in Indian Standard IS:1734-1989. Simple tests that can be carried out at site for plywood are water resistance test and knife test.

### Plywood as an engineering material

Plywood in short can be considered as a layered veneered, cross grained composite. Material Strength/stiffness, density and water resistance of plywood vary considerably depending upon species of individual veneer, their physical/mechanical properties (strength and density), thickness, number of layers, type of adhesive used to bond veneers and total thickness of finished plywood. In real sense there is hence great flexibility to alter design properties of plywood to meet specific end use areas. In practice however as bulk of plywood in this country is still used for mundane interior applications this advantage is not taken. A manufacturer generally uses such thickness and species of veneer as commonly available with a view to meet

\* Director, \*\* Scientist E  
Indian Plywood Industries Research & Training Institute, Bangalore



market demands, but often at the cost of sacrificing requirements as stipulated by national standards. For instance thin face veneer of 0.8 mm is often used resulting in low bending strength/stiffness and glue shear strength. In general, Urea formaldehyde resins are used to make MR (Moisture Resistant) grade and Phenol formaldehyde resins are used for making BWR & BWP grades of plywood.

Well made plywood is really a pleasure to use and exhibits high strength/stiffness and resistance to moisture. For many end uses bending deflection (stiffness) is more important than bending strength. Besides, specific strength/stiffness of plywood (strength & stiffness as compared to density of the material) is much higher than many materials like steel, aluminium, plastic, particle board, MDF (Table 1). Besides the shear strength of plywood perpen-

dicular to its plane (panel shear strength) and modulus of rigidity is very high. This fact which permits use of thin plywood as vertical or horizontal sheathing or "diaphragm". On the other hand shear strength of plywood in the plane of plies (glued surface) is low and to some extent it depends upon the adhesive used. This is often termed as "rolling shear strength". Still it is adequate enough for all demanding applications including structural uses. However, the rolling shear strength is greatly reduced if the bond quality is poor and because of use of highly extended adhesives. However in BWR and BWP grades of plywood this is not a problem. Glue shear strength of plywood is relatively high and adequate for structural applications.

By far the most versatile property of plywood as a panel

material is its ability to be joined by any type of fastener-nails, screws, staples, self tapping screws and bolts. It is practically split proof because of cross grain construction hence it is possible to space fasteners closely and nearer to the edges. This will always not be possible in case of reconstituted panel materials where predrilling will be necessary. It is possible to glue plywood to wood with the help of various types of adhesives- PVA, PF and PRF room temperature setting adhesives. Room temperature PF and PRF adhesive can be used for gluing plywood to wood for applications requiring high strength and durability. Thicker plywood can be easily nailed or screwed edgewise, (Fig.1) whereas particle board/fibre board require special type of fasteners and hardware. Panel edges of plywood require suitable protection by lipping and other devices.

**Table 1: Specific strength of selected materials**

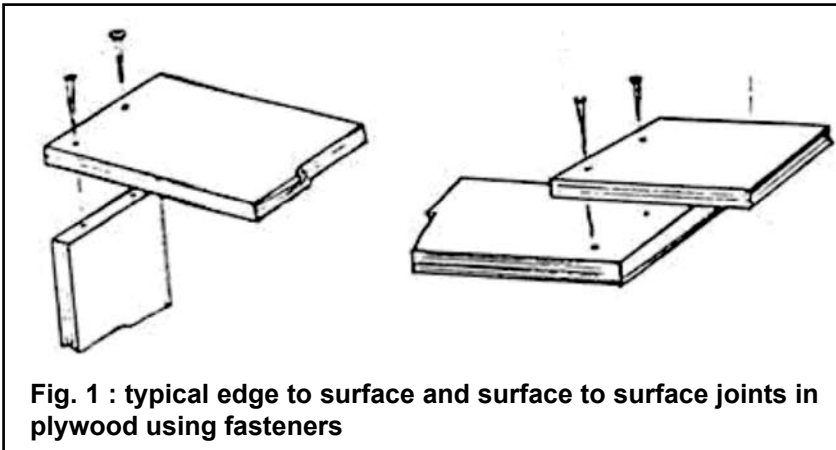
Material	Density	Bending deflection		Bending load	
	K/cm <sup>2</sup>	Modulus of elasticity K (kg/cm <sup>2</sup> )		Modulus of rupture (MOR kg/cm <sup>2</sup> )	MOR/D <sup>4</sup>
Mild steel	7.80	2,110,000	4.425	4650	76.4
Duraluminium	2.80	703,000	32.020	3860	492.3
Concrete	2.30	175,000	14,380	50	9.5
Polypropylene	0.9	14,066	19,295	492	607
PVC	1.4	35,164	12,815	984	502
HD Polyethylene	0.95	7,032	8,200	70	77
Hardboard (Tempered)	1.08	61,500	48,820	550	471
Particle board (medium density) hardwood	0.70	22,800	60,470	150	300
* Plywood (BWR or BWP)	0.60	75,000	347,222	500	1388
MDF (Fibre board)	0.70	25,000	72,886	280	571
Teak Wood	0.67	119,600	397,655	969	2136
Eucalyptus hybrid wood	0.74	100,800	248,757	866	1581

\*Based on minimum value. In fact MOE & MOR of plywood depend upon construction and species. For many species the values are much higher than minimum values.

Weather resistance and durability of plywood greatly depends upon type of species (its natural durability) used for veneer, type of adhesive and type of preservative used. Well made BWP & BWR grade plywood impregnated with water borne preservatives like CCA & CCB is very durable and can be safely used under severely exposed

ever, experience has shown that preservative treated plywood surface provides excellent surface for finishing with semi opaque and pigmented finishes. For other applications, plywood is generally finished with high or low pressure laminates and decorative veneers.

Summarizing it is seen that



**Fig. 1 : typical edge to surface and surface to surface joints in plywood using fasteners**

conditions as encountered in situations like marine application, concrete formwork, roof sheathing, cooling towers, etc. Like solid wood, plywood can be given preservative treatment after its manufacture.

Plywood can be prefinished with surface coatings or overlaid with metal sheets, resin impregnated papers, plastic laminates, RP etc. to further increase its strength, resistance to abrasion, impact of chemicals, weathering, etc. This may not be needed for many applications and should only be considered for special applications and to meet certain specifications. Further some overlays provide better surface for finishing plywood with paints and lacquer. In plywood because of the presence of lathe checks finishing may pose problem under exposed situations. How-

plywood is really a do-it-yourself material amenable to working methods as applicable to solid wood with the additional advantage of using already seasoned or dried material.

### **Types and Grades of plywood**

Over the years the Bureau of Indian Standards has brought out a number of standards of plywood for various end uses. In fact there are as many types or grades of plywood as required for a number of specific end uses. This is often confusing to a user or specifier and will be discussed in some detail here. Grades of plywood are mainly based in this country on end use requirements and the type of adhesive used in making plywood. Although grades of plywood is further based on types of face veneer or its ap-

pearance, in reality this is not as important as the type of adhesive used. In other words grades of plywood is mainly based on the type of adhesive used which determines whether the plywood is MR, BWR or BWP grade and the end use requirements further specify whether a type of plywood is used for general purposes, marine applications. Structural purposes, concrete shuttering, etc. For example in situations where plywood is required to withstand hazards of decay or insect attack, one might take precautions to guard against this attack by specifying preservative treated plywood. Such a situation often occurs when plywood is used under exterior conditions or exposed to weather. Similarly fire retardant plywood is specified for situations requiring protection against spread and penetration of flame for a specified limit of time. General purpose plywood can be practically used for all interior purposes like panelling, ceiling, door inserts, furniture, etc. Table 2 gives grades of plywood available in this country and their possible major end uses.

### **Some important areas of application of plywood**

Having discussed the properties and techniques of plywood it will be interesting to examine major areas where plywood is used at present. There are no detailed statistics available on this important aspect. Based on experience and demand, major end use areas for plywood may be broadly classified as follows. Furniture, building interiors including joinery, construction

**Table 2: Types and Grades of Plywood**

Type/Grade of plywood	Relevant Indian Standard	Bond quality/treatment	Strength criteria	End uses	Suggested applications
General purpose plywood	IS:303-1989	MR, BWR untreated	Glue shear strength	MR grade for internal uses like furniture, partitions, panelling, packaging etc. BWR grade for semi exposed areas, ceiling, drums and barrels, door panel inserts, vehicle seats and backs. floor underlay, etc.	BWR general purpose can be treated with fire retardant or preservatives to extend its use in construction, semi-exposed application, outdoor furniture, fire resistant ceiling, partitions, etc.
Decorative Plywood	IS:1328-1996	MR	Glue shear strength	Interior uses and dry l locations – furniture, panelling, partitions, ceiling, etc.	
Aircraft plywood (Medium density)	IS:709-1974	BWP	Glue shear strength. Flexibility in bending	Gliders, Trainer Aircraft parts, Aeromodels, etc.	
Marine plywood	IS:710-1976	BWP Preservative treated	Glue shear strength/ tensile strength	Marine applications, boats, sail, fishing, kayaks, dinghies, pontoons, etc.	Tanks for liquid chemicals, portable cabins and shelters for severely exposed conditions, structural applications
Shuttering Plywood	IS:4990-1993	BWP Preservative treated	Glue shear strength Modulus of Elasticity	Concrete form work	Structural uses, prefabs, outdoor furniture, kiosks, fascia, soffit, etc., grain storage silos
Structural plywood	IS:10701-1983	BWP Preservative treated	Glue shear strength, tensile. bending, compressive, shear strength, Modulus of Elasticity & Rigidity Modulus	For all types of load bearing applications and structural uses: web beams, underlay, stressed skin construction, arches, folded plates, grain storage bins, etc.	For any type of load bearing application - vehicle building, containers, foot bridges, shelter for disaster areas
Preservative treated plywood	IS:5539-1969	BWR/BWP	Same as BWR or BWP	Exterior uses - construction, cooling towers, etc.	Prefabs, cabins, kiosks, structural components, transport and vehicle building, shuttering, etc.
Fire retardant plywood	IS:5509-1980	BWR treated with fire retardants	Same as BWR	Interior uses - buildings, rail coaches, ship interiors, etc. where resistance to flame to spread and penetration is required	Partitions, panelling, ceiling, cubicles, door infills, etc



and structural, marine, packaging, industrial and vehicle building. A few of them which are of interest to civil engineers and builders are discussed briefly in this article.

#### **a) Building Interiors**

Panelling, ceiling, partitions, cubicles, counters, display, flooring are some of the major elements of the interiors of buildings. Although plywood/blockboard is widely being used for these purposes, many newly introduced materials are gradually replacing plywood/blockboard at least for some major uses. Decorative plywood and blockboard with decorative face veneers is still popular for paneling and partitions with Interior Designers. Interior of offices, shops, reception areas in buildings and banks are the main locations for wide use of plywood/blockboard. Prefinished and prelaminated and veneered particle boards are now being widely used in construction with aluminium framing for interiors. However, where resistance to moisture, decay and insects are needed preservative treated plywood and fire retardant plywood may be preferable to these newly introduced materials.

Another major use of BWR and BWP grade plywood is as panel inserts in panelled doors. BWP/BWR grade has also been suggested as face skin in hollow core flush doors. Somehow this type of door has not found favour with consumers. BWP/BWR or preservative treated plywood can also be used as panel inserts in doors for bath rooms and for exposed areas.

Exterior grade veneered particle board is now increasingly being used as an alternative to plywood.

An excellent application for plywood is as light suspended flooring which does not require heavy structural frame work or foundation. This is suitable for shops, offices, restaurants, hotels. Here plywood can act as base for carpets and floor coverings. Normally tongue and grooved (19mm thick BWR/BWP/structural) plywood is recommended for this purpose. Plywood is supported on wooden runners which can be supported by steel joists, masonry or RCC. Plywood subfloor can also be finished with parquette tiles as a wearing surface. Tongue and groove joint provides continuity in distributing concentrated loads. As self supporting partition systems, dividers, doors, it is possible to have sandwich panels comprising thin plywood skins (3 mm thick) with various light core materials- polystyrene, paper or aluminium honey comb, rigid polyurethane, etc. However, high cost of these core material has discouraged these developments. Probably a low cost core material made of ligno-cellulosic material or agricultural residue may be appropriate for sandwich construction. By using sandwich panels and construction systems it is possible to dispense with or minimize use of wooden frame work required for such applications.

Other suggested interior uses of plywood can be for stairs comprising of raisers, treads and stringers for any type of in-

teriors. This type of stairs being light can be constructed inside a building as an after thought, unlike RCC stairs which is heavy and requires proper support by beams and columns. Interior designers can make use of this possibility for houses, restaurants, etc.

#### **b) RCC construction**

One of the major uses of plywood is as a shuttering material in RCC construction. Plywood has replaced solid wood in this respect and is used as temporary support for casting slabs, columns/beams, RCC tanks, bridges, walls. High strength/weight ratio, easy workability, resistance to high humidity, alkalinity and possibility of number of repeated uses has made plywood popular with builders. Flexibility of plywood makes it suitable for curved forms also. As the modulus of elasticity of plywood is relatively high (80,000 to 100,000 kg/cm<sup>2</sup>) load bearing capacity based on permissible deflection of 1/180 to 1/240 is adequate for any type of form work. Plywood form work is designed to take concrete pressure in vertical form such as columns and walls and weight of poured concrete, men and machinery on horizontal form work.

Concrete shuttering plywood as per IS:4990-1981 is a preservative treated BWP grade plywood which can be considered as a structural plywood without assigning certain strength values. Normally shuttering plywood is used directly with suitable releasing agents. For fine architectural concrete finish

shuttering plywood also comes with resin impregnated paper film faces. Of course surface quality of shuttering plywood depends on thickness of face veneer and weight of resin overlay ( $80 \text{ gm/m}^2$  to  $120 \text{ gm/m}^2$ ). For high class architectural finishes plywood form work is preferred even to steel shuttering since fabrication of steel form work is more labour consuming and expensive than plywood form work. Fabrication of plywood form work can be carried out on site using simple carpentry tools and hardware. With proper care and maintenance shuttering plywood can easily give more than 20-25 reuses.

Efficiency of plywood form work depends upon how well it is supported and prepared with wooden members and are of proper thickness for a given purpose. Normally 12, 15 and 19 mm thickness plywood are popular among builders. In designing care should be taken to avoid excessive deflection which may result in uneven concrete surface.

Shuttering grade plywood and preservative treated plywood can also be used for a variety of constructional uses such as site offices, booths, soffits, fascias in sloped tile roof houses, stairs. They can also be used for heavy shelving, attics, lofts, and many other uses. Shuttering plywood has performed well as light weight roof sheathing. Of course joints in roofing should be properly detailed and surface protected with either bitumen mastics or membrane. The Designer should normally check with the manufacturer regarding strength data as regards bending strength (MOR) and Modulus of Elasticity (MOE) for using shuttering plywood in load bearing applications.

### c) Structural uses of plywood

In major plywood producing countries - USA, Canada and Australia - plywood is mainly used for load bearing applications and building construction. As already explained strength properties of plywood and its

tics make it particularly suitable for sheathing in wood framed houses. Here plywood is used as wall, roof and floor sheathing providing high overall rigidity to wood frames against wind and even earthquakes.

The efficiency of sheathing or diaphragm action depends upon how plywood is fastened to wood. As explained earlier plywood is either nailed or nail glued to wood. For our country where wood frame construction is not the usual way of constructing houses, use of plywood for structural purposes mainly for secondary elements like web beams, arch panel, folded plate roof, rigid frames, etc. may be considered (Fig.2). These components can be used either as roof supporting elements or roofing itself. Flexibility and high strength of plywood also makes it suitable for cylindrical bins for grain storage.

It is interesting to note that the bulk of structural plywood in the world is manufactured from softwoods, although mixed hardwoods are now being used

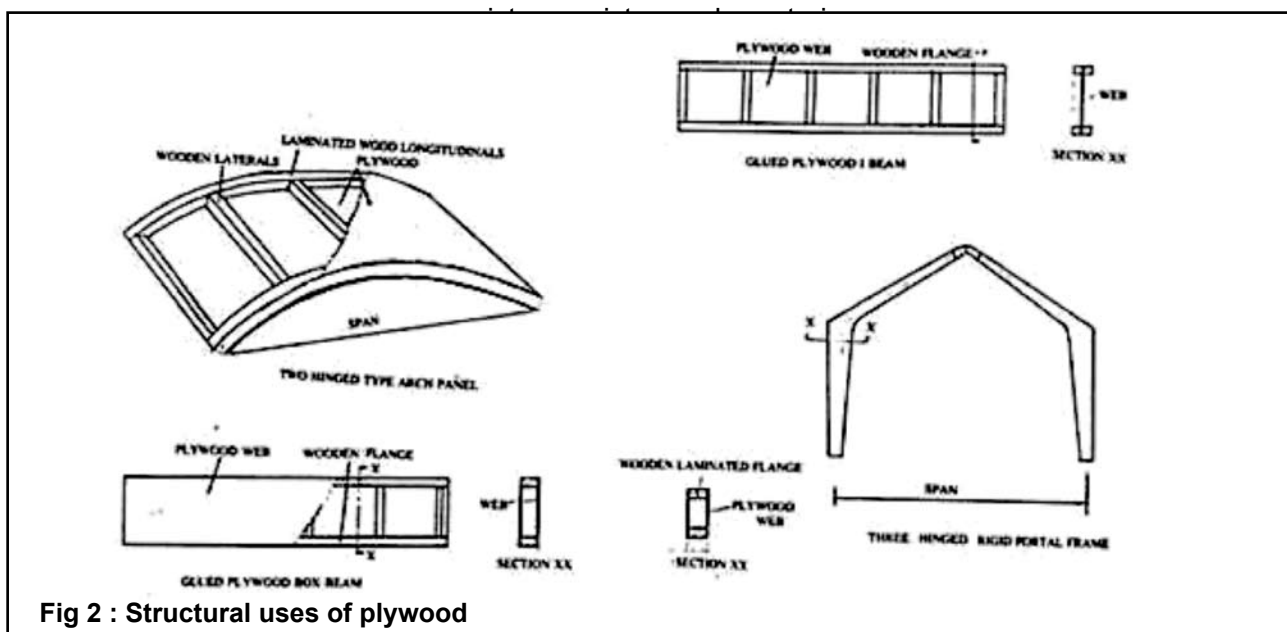


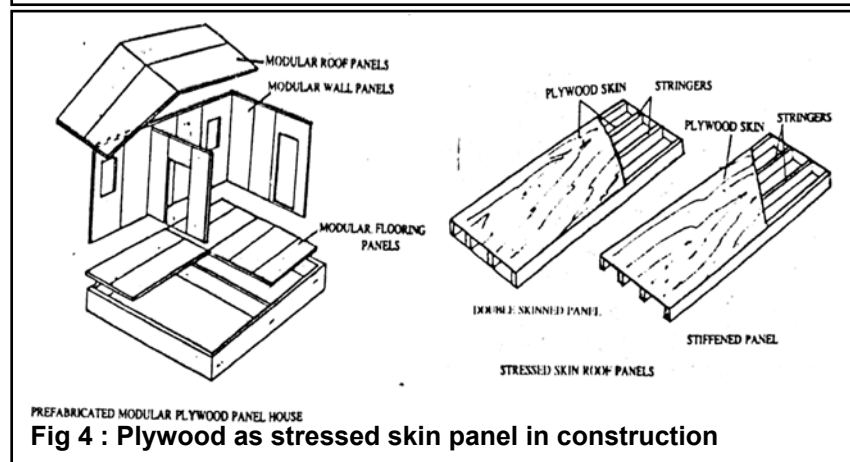
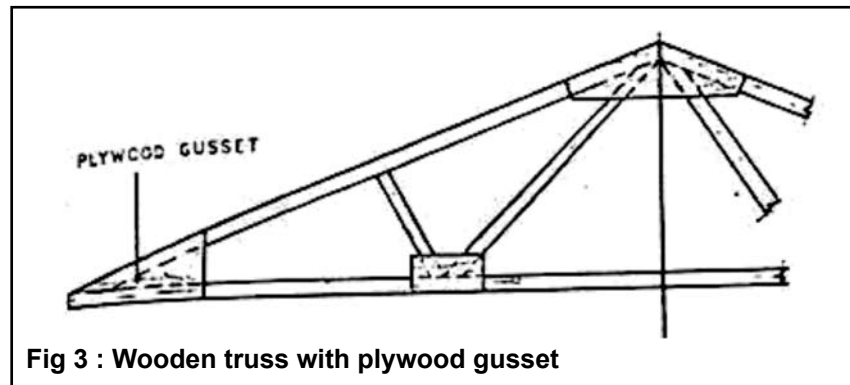
Fig 2 : Structural uses of plywood

in limited quantities. Obviously for us structural plywood has to be necessarily made from mixed hardwoods.

Studies carried at IPIRTI and experience gathered so far have amply demonstrated that BWR, BWP or shuttering grade plywoods are suitable for fabricating prefabs, and structural components like arch panels, web beams, rigid frame, grain storage bins, etc. (Fig.2). Nail gluing technique has been effectively employed for fabricating components. This type of construction generally termed glued plywood construction is effective as a means of conserving solid wood. For instance glued plywood web beam can be fabricated for spans up to 20m. At the same time they can be less bulky than nailed web girders resulting in saving of 40 to 50% in wood raw material. A 6 mm -thick plywood can be used for a grain storage bin to store 20 tons of grain. Plywood can also be used as splices and gussets in beams and trusses (Fig.3).

Further plywood has been successfully used as stressed skin panels (Fig 4) as wall and roof elements in prefabs, where 6 mm thick plywood is glue nailed to longitudinal wooden runners. The composite action between plywood and wood in these panels results in multiple T beam action (Fig. 4) leading to considerable saving of wood raw material.

Use of preservative treated plywood with edges properly sealed in glued plywood structures makes them practically



maintenance free. Besides structural grade plywood, which has definite assigned strength values, shuttering, marine and BWP grade plywood can also be used in construction. Present experience has shown that preservative treated and shuttering grade plywood have given more than 15 years of trouble free service. Normally use of plywood for roofing requires further protection with membrane or mastic coatings. Either PF or PRF room temperature setting adhesive can be used for fabrication of glued plywood structural components.

Generally the high cost of structural plywood and shuttering plywood has made their use limited to certain types of construction like kiosks, portable cabins, web girders, etc. However, the real potential for

structural plywood is for large span structures like arches, beams, folded plate roofing, rigid frame and this has yet to be exploited. The light weight of glued plywood structural systems makes them particularly suitable for disaster-prone areas, corrosive environments and structures requiring minimal foundation as is required for terrace constructions. For instance plywood houses can be built on existing terraces without requiring foundation.

There is good potential for structural plywood if production of BWR & BWP grade plywood is increased in place of moisture resistant or general purpose plywood/blockboard. Then the Engineers and Architects can make use of these materials for constructional uses in areas like North Eastern regions, An-



damans, Himachal Pradesh and Kashmir where wood construction is prevalent and accepted. It can also be used for earthquake prone areas. Minimum strength requirements of plywood for structural purposes are given in Table 3.

## 2. Particle board

The properties of particle-board upon various factors such as nature of wood species, wood with bark or debarked wood, type and size of particles, type and amount of binding agents, structure of particle-board, pressing conditions and surface quality etc. By suitable combination of these variables, the properties of the board could be changed according to the requirements. In many uses particle board can easily substitute solid timber and plywood because it is a flat rigid material which does not warp and crack due to moisture changes and has reasonable strength. Its surface is smooth and the screw and nail holding properties are satisfactory. Besides the adequate physical properties, the large panel size in which it is produced promotes economy in design.

The major uses of particle-board are as core material in furniture, store fixtures and laminates and as flooring under lay in construction, sink tops and sliding doors. It is widely used in the manufacture of cabinets for T.V. sets, loud-speakers, tape recorders etc. Sound absorption and reflection characteristics of particleboards are particularly suitable in this end use. Greater quantities of particle boards are also used in the

**Table 3 : Minimum strength requirements of plywood for structural purposes (IS:10701-1983)**

Property		Strength requirements (N/mm <sup>2</sup> )	Suggested permissible stress (N/mm <sup>2</sup> )
Tensile strength	Along	54	18
	Across	34	11
Compressive Strength	Along	34	11
	Across	29	10
Modulus of rupture	Along	49	16
	Across	29	10
Modulus of elasticity	Along	7355	7355
	Across	3923	3923
Panel shear strength		125	40
Modulus of rigidity		588	588
Rolling shear strength		3	0.6

*Permissible stress have been arrived at on a tentative basis by giving a factor of safety of 3 for all properties except property 7, where a factor of safety of 5 has been used. For properties 5 and 6 no factor of safety is used.*

automobile construction, sports goods, packing cases, and for various specialized uses. Types and Grades of particle boards are given in the Table 4.

For all types of particle boards internal bond strength in dry and after cyclic tests are very important. Other tests that can be easily done if site to assess the quality of particle board are water absorption and thickness.

Tensile strength test and bending strength test are the other two important tests prescribed for particle board. Some special tests prescribed for

prelaminated particle board are cigarette burning, abrasion and resistance to steam. Methods of tests for particle board are given Indian Standard specification IS:2380-1977.

## 3. Fibre board

Fibre boards are of three types viz.,

- Fibre insulation board
- Fibre hardboard
- Medium density fibre board

The requirements of various types of fibreboards are given in Table 5.

Tests are similar to that of particle board and IS:2380-

**Table 4 : Types and Grades of particle boards**

S.N.	Types of Particle boards	Relevant Standard as per BIS	Grades
1.	Particleboard for medium density	IS:3087	FPT-type I & IIFPS
2.	Veneered particleboard	IS:3097	Grade I & II
3.	Cement Bonded particle board	IS:14276	-
4.	Prelaminated particle board	IS:12823	Grade I & II, Type 1 to 4
5.	High density particle board	IS:12823	BWR & MR grades
6.	Prelaminated Cement Bonded particle board	IS:14276	Type 1 to 4

1977 is referred to method of testing.

#### 4. Flush door

BWP grade resin is used for all types of flush doors. Flush doors are made in different sizes and thickness depending on the size. Flush door of different types are given in Table-6.

Methods of tests for flushdoor are given in Indian Standards specification IS:4020. There are 17 tests which simulate almost all kinds of abuses which a flush door may under go in rea use.

Some of the tests that can be done at site are (i) resistance to water- end immersion & boiling (ii) knife test and (iii) Impact indentation.

#### 5. Panel doors

Panel doors are doors assembled consisting of rails stiles and infill.

Plywood, particle board/ Veneer particle board, Cement bonded particle board, Prelaminated particle board/ prelaminate MDF are used as infill. Indian standard specification IS:1003 Part I, 2003, covers the requirements of panel door. Rails and stiles are tested for species and moisture content in general and when non durable species are used spot test is carried for preservative treatment. Performance tests/type tests are carried as per Indian Standards methods of tests for door shutters. IS:4020, except end immersion, glue adhesion, knife test and varying humidity test.

#### 6. Block boards

**Table 5 : Types and grades of Fibreboard**

S.N.	Types of fibre boards	Relevant Standard as per BIS	Grades
1.	Fibre insulation board	IS:3348	Density $\leq 0.48\text{gm/cc}$
2.	Medium hardboard	IS:1658	0.35 to 0.8 gm/cc
	Standard hardboard		> 0.8 gm/cc
	Tempered hardboard		> 0.8 gm/cc
3.	Medium density fibre board	IS:12406	Grade I & II
4.	Prelaminated Medium density fibre board	IS:14587	Grade I & II, Type 1 to 4

**Table 6 : Types of Flush doors**

S.N.	Type	Indian Standard Specification
1.	Solid core, plywood face [dec/com]	IS:2202- Part 1
2.	Solid core, particleboard/hardboard face [dec/com]	IS:2202- Part 2
3.	Cellular and hollow core, plywood face [dec/com]	IS:2191- Part 1
4.	Cellular and hollow core, particleboard/ hardboard face [dec/com]	IS:2191- Part 2
5.	Moulded raised high density fibre skin panel door	Heavy/light duty

Block boards are classified as MR or BWP grade depending on the type of adhesive used and commercial or decorative depending on the type of face veneers.

Construction of block board – Block board is a board having a core made up of strips of wood not exceeding 30mm in width, which may or may not be glued together and the core is glued to two or more veneers on either side with grain direction of core and veneers running at right angles to one another.

Treatment of battens is compulsory if non durable species are used.

End uses of block boards include furniture, cabinets, floor

underlay, counters, table tops. It can also suggested for treads and risers in stairs, mezzanine floor underlay computer room flooring etc.

The requirements of Block board and their testing are given in Indian Standard Specification IS:1659. As in the case of flush door water resistance test & knife tests can be carried out at site to assess the bond quality.

#### 7. Compreg

This is a specialty grade densified laminate which is resin impregnated and highly compressed. Three types of Compreg are made for different applications viz. electrical, chemical and general. Requirements for these materials are given IS:3513 Part I, II and III

respectively.

## 8. Laminated veneer lumber

A structural composite made by laminating veneers 1.5mm to 4.2 mm thick with suitable adhesives and with the grain direction of veneers in successive layers along the longitudinal direction of the composite.

Indian standard specification IS:14616-1999 is prescribed for LVL. CPWD has formulated their own specification for LVL. Requirements of CPWD are given in TADS:15 (2001)-Table 1. CPWD Requirement of LVL door shutters are given in TADS:15(2001)-Table 4.

However glue shear strength test prescribed in Table 1 of CPWD specification cannot be carried out on LVL. It has to be substituted by knife test as give IS:14616.

## 9. Bamboo composites

These are new generation of ecofriendly energy efficient and biodegradable wood substitutes which also generates employment for tribals and women. IPIRTI has played a big role in

development of these composites and their use in housing. Table 7 gives the type of bamboo composites.

## Use of Bamboo Composite Materials in Buildings

BMB and BMVC are useful for many engineering applications like web beams, stressed skin panels, roofing in combination with wood. It can be also used as gusset for joining bamboo elements in trusses (Fig.3 ). In combination with sawn timber, it is similar to structural plywood and BMB is characterized by high shear strength and rigidity modulus.

Bamboo composite panel material will be useful in development of bamboo building technology as it can be used as sheathing, gusset, web, skins etc. It can also be combined with wood for prefabricated constructions and components (Fig. 5). High modulus of rigidity of BMB should be of interest to designers involved in quake and wind resisting structures.

Further use of BMB in combination with bamboo depends upon its availability and cost. However, they can be certainly

useful in small quantities as web or gussets, door infills and skins as demonstrated in IP-IRTI- TRADA building system (Fig. 6).

Another exciting composite product is the Bamboo Corrugated Sheet (BMCS) as roofing material. The product was developed in India and China. In India it was developed jointly by BMTPC and IPIRTI and being produced industrially on limited scale. It is characterized by good flexural and impact strength, stiffness, ductility and the material has been recently standardized. The material has been used in several houses/buildings as roofing and has great potential for mass housing. Designers and engineers are looking at Bamboo composites as future building material in combination with either bamboo or other building materials. The material is well suited for earthquake resistant structure as was demonstrated recently by full-scale prototype tests at CPRI (Bangalore) under a collaborative project with TRADA (UK).

## 10. Coir composites-Novel

Table 7 : Types of bamboo composites

S.N.	Type of bamboo composite	Specification	End uses
1.	BMB [bamboo mat board]	IS:13958	Paneling. Partitions, ceilings, panel and flush doors, storage, furniture, trans-portion, craft work etc. – good substitute for plywood less than 6mm
2.	BMVC [bamboo mat veneer composites]	IS:14588	Substitute for general purpose plywood, more than 6mm
3.	BMCS [bamboo mat corrugated sheet]	IS: 15476	Roofing, walling and structure
4.	Bamboo laminate	Under preparation	Flooring, furniture, frames etc.
5.	Bamboo mat overlaid bamboo strip board	To be formulated	Flooring, wall panel, roofing – good substitute for plywood of thickness more than 6mm



## Eco-friendly Building materials

Various composite material using mainly coir with or without veneer (from plantation timber like rubber) as reinforcement and synthetic resin as binder have been developed by NATU-RA FIBRE TECH PRIVATE LTD. (Formerly NATURA Division of DUROFLEX), Bangalore in commercial scale. For the first time in the world such development of coir composite boards in commercial dimensions is done. The coir composites can be used for substitute of plywood, conventional MDF, hard board, block board etc. Coir composites can be used for various like doors, windows, partitions. The more use of these Eco-friendly coir composites which are mostly made of renewable sources saves environment by saving cutting of trees.

### Types of coir composites

- Coir veneer board – IS:14842
- NFRP (Natural fibre reinforced panel) – coir mdf, coir hardboard
- Coir overlaid block board
- Coir laminated veneer lumber (CLVL)

### Advantages of coir composites

The advantages of coir com-



Fig.5 : A joint with MS bolts and BMB



Fig 6 : Use of BMB for Doors, Windows & Gussets (TRADA/ IPIRTI System)

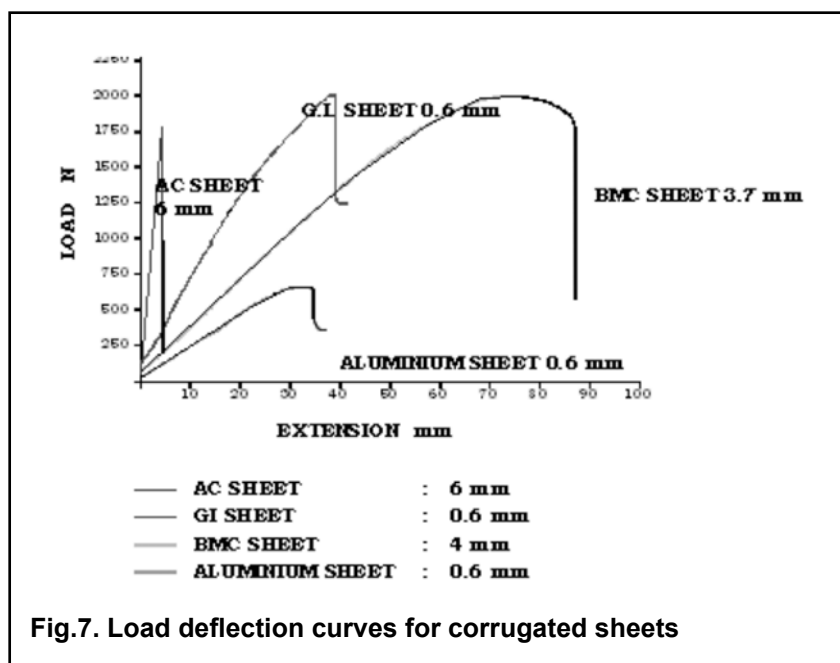


Fig.7. Load deflection curves for corrugated sheets

posites are listed below:

1. 100% wood free product prevents felling of trees (veneer used is from rubber plantation timber).
2. mostly biodegradable
3. coir and jute are agro-base materials - provide more jobs in rural areas
4. coir is available throughout the year
5. termite and borer resistant
6. CMDF has better screw and nail-holding properties compared to MDF due to longer fibre length.
7. flame retardant due to phenolic resin used as binder

Table 8 : Comparison of load bearing strength of BMCS & other roofing sheets

TYPE	THICKNESS mm	WIDTH mm	MAX.LOAD N	LOAD BEARING CAPACITY N/mm	WEIGHT OF SHEET(1.05 M x 1.8 m) Kgs.
Bamboo Mat Corrugated Sheet(4-Layers)	3.7	400	1907	4.77	7.2
G.I. Sheet	0.6	400	1937	4.84	7.7
Aluminium Sheet	0.6	405	669	1.67	2.9
ACCS	6	330	1800	5.45	15.85

### Application of coir composites as building materials

Application	Types of coir composites				
	COIR VENEER BOARD	COIR MEDIUM DENSITY FIBRE BOARD	COIR HARD BOARD	COIR BLOCK BOARD	COIR LAMINATED VENEER LUMBER
1. DOOR					
a) SHELTER	X	X	.....	X	.....
b) PANEL	X	X	.....	.....	X
c) SANDWICH	X	X	.....	.....	.....
2. WINDOW					
a) SHELTER	X	X	.....	X	.....
b) PANEL	X	X	.....	.....	X
c) FRAME	X	.....	.....	.....	X
3. WALL PANELS	.....	X	X	.....	.....
4. FALSE CEILING	.....	X	X	.....	.....
5. PARTITION	X	X	.....	X	.....
6. COT					
a) TOP SHEET	X	X	.....	.....	.....
b) FRAME	X	.....	.....	X	X
7. ALMIRAH/WAREDOBE	X	.....	.....	X	X
8. SOFA SET	X	X*	X*	X	X
9. DINING SET	X	X*	X*	X	X
10. DRESSING TABLE	X	X*	.....	X	X
11. KITCHEN CABINET	X	X*	.....	X	X
12. COMPUTER TABLE	X	X*	.....	X	X
13. TV STAND/SHOWCASE	X	X*	.....	X	X
14. FLOOR TILES**	X	X	.....	.....	.....
15. ROOF TILES**	X	X	.....	.....	.....
16. LOW COST/ EMERGENCY/ HOUSE	X	X	.....	.....	.....

NOTE: X - CAN BE USED, X\* - CAN BE USED PARTIALLY, \*\* - UNDER DEVELOPMENT

8. boiling water resistant due to use of phenolic resol
9. due to resin rich jute layer outside. interior surface need not be painted
10. very good appearance due to oriented jute layer and can be used without painting attractive natural look if finished with clear primer and lacquer
11. can be finished, painted, polished and laminated like wood products
12. normal carpenter's tools can be used
13. clear cut edge

#### 14. antifungus

Coir composites have been approved by Indian Railways. central and stale PWD and accepted by general market. Government of Karnataka is putting up a plant of coir composites under co-operative sector. At current rate of production of coir in India the industry utilizes only around 30% of the annual yield of coconut husk in the country as per statistics of Coir Board. Hence high potential exists to use balance 70% of husk. To make our planet greener, more and more people should use

and develop coir composites which will considerably reduce deforestation.

#### References:

1. Techniques and trends in end use applications. H.N.Jagadeesh, 1992, Wood News, Vol.2, [Jul-Dec]21-26
2. Development and applications of bamboo building technology – A perspective, World Bamboo Congress, February 2004.
3. Coir Composites – Novel

... contd. on pg.56

# Urban Aspirations



**R.Liberhan\***

Is it chaos or order that we perceive, when we are in the middle of our cities? The answer depends on what time of the day you experience the city. Before 9 a.m. and after 9 p.m., relative quiet descends on our cities, while in between there is a bustle associated with a frenetic pace. Is this how it is meant to be. Does the sense of chaos lend vibrancy to urban living? Are there adequate spaces where you can retreat into yourself and gather your wits? Or is the pace inescapable?

I guess, part of city dwelling is to be part of the pace of the city. Even if you are not a part of the race that all of us seem to run without perhaps being conscious of it, we are still an integral part of the pace of the city. The pace affects our aspirations, our ambitions, our leisure, infact the whole of idea of being in love with being here (the city). Perhaps sometime back, we did hear of, "its nice in Poona", its great in Bangalore, "it's a lovely life in Chandigarh etc. to now, when the common refrain seems to be 'life is hell here', "it is not like old times here", at al.

What happened? Too many

people, too much commercialization, too little infrastructure, no power, no water, no this, no that...a litany of woes which is common to all our cities. Who is responsible? All of us we let 'them' do it to 'us' and 'we also did it to ourselves'.

So is redemption possible? Can we turn the corner and reclaim the outdated sentiment, 'it is nice to be living here'. The answer will depend upon the whole gamut of initiatives that need to be taken and the principal driver of these initiatives will be local government of the cities. The process of getting through the 73<sup>rd</sup> and 74<sup>th</sup> amendment, a whole new set of hopes appeared on the horizon.

In 1989, Rajiv Gandhi said, "A wide chasm separated the largest body of the electorate from a small number of its elected representatives. This gap has been occupied by the power brokers, the middlemen and rested interests ----- with the passage of this bill; the Panchyats would emerge as a firm building block of administration and development-----

However, the 73<sup>rd</sup> and 74<sup>th</sup>

amendment happened, three years later in 1992. The amended Article 243-G now reads:

*'The Legislative of a State may, by law, endow the panchyats will such power and authority as may be necessary to function as institutions of self-government and such law may contain provisions for the devolution of powers and responsibilities.....*

So now, where is the magic that was to be generated by the amendments and the follow up actions? In state after state, elected representatives are frequently, even in the perceptions of their members are accountable to the bureaucrats rather than the electorate. The experience of the corporators across a wide spectrum seems uniform. There is a general reluctance to transfer 'power to do' in substance, even though in form, it appears to have been done. The financial powers are transferred in a very limited way because obviously with financial powers goes the power of patronage, which the state level politician wants to keep for himself. The body of human resource available with the local

... contd. on pg.53

\* Director  
India Habitat Centre, New Delhi



# VIPs at BMTPC's Display





## International Expert Group Meeting on “Appropriate Technologies for Sustainable Buildings”

An International Expert Group Meeting on “Appropriate Technologies for Sustainable Buildings in Developing Countries” was organized in cooperation with International Centre for Science & High Technology (ICS), Trieste, Italy and International Centre for Advancement of Manufacturing Technology (ICAMT-UNIDO), India at Bangalore during November 7-9, 2005.

The event was attended by seven International participants from six countries namely; Italy, Tanzania, Sri Lanka, Pakistan, Bhutan, Nepal and 30 national participants from all over the country as well as 10 local participants from Bangalore.

The International Expert Group Meeting was inaugurated by Principal Secretary (Housing), Govt. of Karnataka on 07 November, 2005 and Special Technical Session on 08 November, 2005 was chaired by the then Secretary (UEPA), Government of India. The event was fully supported by ICS-UNIDO with BMTPC playing the role of nodal coordinating and implementing agency for organizing this event including identifying and inviting resource persons, participants and other technical support. The International Expert Group Meeting culminated in form of a series of action points.



# Training Programme on “Field Level Applications of Appropriate Building Materials and Construction Technologies”

A Training Programme was organised on “Field Level Applications of Appropriate Building Materials and Construction Technologies” from 23-25 February, 2006 at Building Technology Park, Avas Vikas Limited, Jaipur jointly in co-operation with AVL, Jaipur and International Centre for Advancement of Manufacturing Technology (ICAMT-UNIDO), India.

The programme was organized with an objective to provide training on field level applications of various cost-effective construction technologies including pre-fabricated building components to the petty contractors, masons & workers, who were not so well versed with the cost effective building materials and construction technologies. Thirty participants actively participated in this three days training programme. Necessary toolkit was also given to them during hands on training.





# Teamwork in Construction Projects

*Arun Kumar Tiwari\**  
*J.K.Prasad\*\**

**T**he construction team is often thought as comprising the architect or engineer (design team), owner (owner representative), and contractor (builder). The design team produce the construction documents for the owner. The owner can be public or private entity that provides the project requirements and funding for design and construction. The contractor typically builds a unique project in a very competitive environment. These team members share the common goal of constructing a project, but because of conflicting and competing interest a project may suffer from a lack of team work.

The construction process is a very complex environment for the owner, design team and the contractor. The owner desires the best value and highest quality for their money. The design team strives to achieve this for the owner and is under the constraints to operate a successful business. The contractor works in a very competitive market where profits margins are low and risks are high.

It is necessary to build team work in construction industries for dealing with various works entrusted to it in an efficient

and effective manner. The tasks to be carried through inputs of professionals of different disciplines. Teams can effectively deal with such tasks by evolving more creative solutions through discussion, taking decisions and working in a co-ordinated manner for accomplishing the task.

## **The major attributes of successful team functioning are:**

- Creating environment suitable for teamwork.
- Building team for accomplishing tasks.
- Cultivating art of decision-making and problem solving through interaction.

An organization needs personnel of different levels of experience and skills to make it possible to have proper team functioning.

## **Capable individual**

This is the first stage of employee when an individual begins his career, and makes productive contribution through talent, knowledge, skills and sound work culture.

## **Competent Manager**

After having experience of group functioning, the individual organizes people and resources towards effective and efficient

pursuits of the predetermined objective.

## **Effective Executive:**

An effective manager vigorously pursues a clear and compelling vision of the organization with commitment and stimulates the group to achieve higher performance levels. The team needs certain working facilities in the environment, which help in getting the optimum output. Too much hierarchy is counter productive. The teams have to be provided with necessary resources like good office space, requisite staff etc. They should have reasonable authority to implement the team decisions. Direct interaction of the team manager with the client could be productive in terms of having first hand knowledge of the requirements of customer.

## **Duties, Rights and Responsibilities:**

An important function of every team member is to understand their individual & organizational duties, rights and responsibilities. This avoids problems by everyone on the team clearly understanding what is required of them. Team members must understand their legal responsibilities not only for their protection but to avoid unnecessary miscommunication

\* Dy. Chief, BMTPC; \*\* Chief, BMTPC

and expenditures.

### Team Communications:

Good team discussions depend on how well the team members are able to communicate with each other. By understanding others and conveying your thoughts you will help in breaking communication barriers. A guideline for practicing open communications are:

- Be willing to express yourself and your views fully.
- Avoid becoming angry or annoyed when another person's view differs from yours.
- Be willing to change your views as new information becomes available.
- Think win-win by seeking to find common ground on issues.
- Practice pro-active listening.

Pro-active listening is exploring others' ideas rather than debating their ideas. There are five steps in practising pro-active listening:

- Encourage the person to communicate their ideas.
- Observe & and listen to what the other person thinks, feels, intends and does.
- Check out what the other said by using open-ended questions.
- Acknowledge by paraphrasing and playing back what the other said without judgement or problem solving.
- Interpret what they said and watch and listen, or ask for verification, that you correctly interpreted their ideas, thoughts and views.

A team approach in decision making is of significance. When

team members are involved in problem solving and decision making, they readily accept the final decision and feel ownership and shared responsibility toward goals of the organisation.

Teamwork plays an important part in bringing up synergy in problem solving. Teams can supply more creative solutions and help in contributing to prosperity of the organization. Successful teamwork requires practice and effort both on the part of the managers and the employees which contribute all successful management of complex issues in organisation.

... contd. from pg.48

bodies is differentially talented but vested with limited and a average career profile, the good ones do it come, and if they do, they do not stay.

The real rub of the problem is, how do we compel states to give the spirit of the amendments empowering local governments a substantive soul. This is not merely an issue for a political contest. It is a needed reality. The pace of urbanization demands attention to local services being delivered efficiently, regularly and affordably. A resource less local body cannot meet these challenges. It is not merely a question of organizing the services, it involves a whole host of responsibilities of

planning, foresight, combining technology with economics, and meeting anticipated volumes with increased availability of resources.

The larger issue is to do with making our cities human. By their very nature, urban spaces have a degree of detachment from human emotions. Cities are in a way wrapped as opportunities of diverse kinds, and that is why migrations are happening. Individuals come to realize their hopes and dreams. Hence, city developments have to cater not only to real estate growth, but facilitate evolution of institutions, which encourage growth of individual excellence and its pursuit through different

forms. Cities must create assets for its citizenship and not bank on a unidirectional concentration of increasing real estate values. The heritage, the dreams of every city, being unique in nature, needs to be reflected in the growth profile, and its ambitious must be shared by its inhabitants. The philosophical paradigms of city development must revolve around these basic features, and we in India have to start now, otherwise the decay seen today will only consolidate faster than we think.

# Safety and Security of Tall Buildings in Cities

**Akash Mathur\***  
**I.J.S.Sidhu\*\***

**T**he pressure of fast growing urbanization has led to the construction of tall buildings in cities all over the world starting from Chicago and New York. The construction of tall buildings has been fairly recent in India, say from early fifties. As of today, 45 storied *Shreepati Arcade* in the city of Mumbai is the tallest building in India followed by many other buildings in different cities of the country. The unfortunate collapses of the world's tallest buildings i.e. Twin Towers at New York has raised serious questions about the safety and security requirements of skyscrapers. According to several reports, less steel and more fire-resistance concrete in the core of the Twin Tower could have saved the lives to much extent. There was no fireman's lift and refuge floors. In fact, the firemen running up the staircase were said to have delayed the evacuation. It is high time to reconsider certain aspects of design criteria for tall buildings. It is always possible to have tall buildings which are safer and can be protected from damages.

The upcoming 101 floor Shanghai World Financial Centre has a reinforced concrete core with a dedicated fire lift

and refuge floors at every 15<sup>th</sup> floor. Refuge floors contain no furniture and designed to be totally fire proof so that they can harbor people in the middle of an evacuation. It is ironical that refuge floors are considered as conservative measure.

In India, the construction of high-rise buildings is under strict scrutiny after the collapse of multi storied residential apartments in Gujarat earthquake on 26th January 2001. The tall buildings in Delhi were reported to sway like pendulum and cracks were observed during this earthquake. A vast majority of these structures do not have proper reinforcement detailing despite of having codal standards. As regards the safety against the fire, most of the buildings do not have adequate fire fighting installations. The safety and security of building is generally compromised with other factors such as quantity, quality & cost.

The major issues as regards the safety & security of tall buildings have been the structural collapse due to sudden unforeseen impact of forces followed by instant fires. In the past, the design of tall buildings for safety has been dealt by simply assuring compliance with

the minimum requirements of the legally enforceable building codes and zoning ordinances. However, code minimums are not necessarily related to optimal performance. With the accumulation of knowledge & research in building design and performance, including development of CAD, allowing for more intelligent design, the code requirements need serious review and upgradation.

The various standards and codes available for building design and construction do not carry any legal status in India and cannot be enforced. This has led to the construction of tall buildings at one's own wish and thereby endangering lives of millions of people. The safety and security of tall buildings is of great concern to the community at large, as well as to the owners and users. How they are built and used is another matter of interest. There should be laws to force owners, builders and designers to recognize, appreciate & implement the safety requirement in the design. The design in conformance with the codal requirements and acceptable professional design standards is the need of the hour.

In the Indian practice, low-rise apartments and residential

\* Field Officer, BMTPC; \*\* Chief, BMTPC



buildings are built with load bearing brick walls taking care of vertical and horizontal loads like wind and earthquake. Framed buildings in reinforced concrete are used for apartment and office buildings and these work out economically viable for eight to twelve storey. In certain coal-field areas, where open-cast mining methods are used, blast loading becomes important to include in the design of buildings. Reinforced concrete frames are then provided in all buildings in such areas for safety and also for control of cracking in masonry filler walls. For hi-rise buildings, shear walls and shear cores in reinforced concrete are to be provided in addition to frames in order to effectively resist wind and earthquake forces in an economical manner. Worldwide it is a common practice to construct skyscrapers using steel, however in India the use of concrete works out to be cheaper.

The basic element of any tall building is its structural system. A structural system suitable for low rise buildings is not suitable for high rise buildings since hi-rise buildings are governed more by lateral forces than gravity. The safety and security of tall buildings is achieved by adopting an appropriate structural system for a given building and efficient structural design. The building architecture must permit and cater to the basic needs of the structural design. At the same time the structure also must allow and meet functional and aesthetic aims of the building.

The building configuration

i.e. the size, shape and proportions of three-dimensional form of the building is very important from the safety and security point of view. The configuration also includes the location, shape and approximate size of major structural elements, since these are often determined by the architectural concept of the building. In general, configuration depends upon

- Building planning & function
- Urban design and planning requirements
- Aesthetic of the building

It is stressed in all the codes of the world that all high-rise building envelopes must have a simple symmetrical and regular configuration. A few favorable & unfavorable geometric configurations in plan and elevation are well known. Whether, the configuration is regular or irregular, it will have resistant system. To resist lateral forces, three types of resistant systems in vertical plane are used: shear walls, braced frames and moment resisting frames. In horizontal plane, diaphragms generally used are formed by floor and roof slabs of the building.

Correct choice of structural system is very important before designing of the critical sections of members accurately to ensure the safety and security of building. In Indian context the following structural systems are in use for tall buildings:

- Reinforced concrete frames, provided in two principal directions are effective in resisting both the vertical as well as horizontal loads. The brick walls are regarded

as non-load bearing filler walls only. The spacing of frames varying from 4m to 7m is closely related to the function of the building. The finishes and the portioning should be light in weight. This is important for multistoried buildings to reduce the dead load. The reinforced concrete walls are avoided even for lift-wells in such cases to avoid undesirable centers of rigidity, which interfere with the distribution of the horizontal load to various frames. This kind of structural system is in vogue for buildings up to twelve storeys in India. The proper sizing of columns and beams and also the proper orientation of columns are of paramount importance to ensure safety of buildings against external loads such as earthquakes, and wind.

- Straight deep reinforced concrete walls may be provided at the ends of a building with lift wells and/or staircase wells in the interior. In general shear walls shall be so arranged in plan so as to attract as much vertical load as practicable for which the nearby columns are to be omitted and the loads brought to shear walls by means of long-span beams. These walls may be used to interact with frames to resist horizontal loads. This system is used for 10 to 20 storied buildings.
- A shear core housing lifts, toilets and other services may be placed preferably at the centre of the building. The core may be utilized to interact with frames to

resist the lateral loads. In case of stiff core, it is likely to resist full lateral load and the frames are designed only for 25% of horizontal load as recommended by Indian codes. This system is suitable for 15 to 40 storeys in the upper range of storeys (say 25 to 40 storeys), the core may require to be assisted by other shear walls either in the interior or on the periphery of the building.

There are in general, two systems for foundations of buildings; viz. Shallow foundations and Deep foundations. Shallow foundations consist of isolated footings, combined footings, strip footing and rafts. These are mainly used for supporting low-rise structures on normal soils. Isolated footings with ties in two principal directions are the most economical foundation system. In case of overlapping of isolated footings, the combined/ strip footings are provided. Raft foundations are required when strip footings overlap each other. Most of tall isolated structures are provided with raft foundations in India. These rafts can be solid or even annular rafts. Some tall buildings are also supported on piles. The piles are expensive but are essential for restricting settlement. Deep bored or driven piles are in vogue. The layout of the piles should be as closely knit as possible to have economical pile caps. Plinth beams are also provided in both the principal directions to tie all the caps and to support brick walls. In metropolitan city of Mumbai, most of the tall buildings rest on rock

either directly or through bored cast-in-situ piles. In Delhi, such buildings rest on both types of piles taken down to hard sandy strata available at an average depth of 20m to 25m below ground level.

The council on Tall Buildings and Urban Habitat stressed that actions should be taken to improve the response of buildings in an effort to minimize loss of life during any emergency-natural or otherwise. The grey areas which require immediate attention are emergency egress requirements, integrated automated building controls, and redundancy in all building systems, better building security and the development of a performance-based national building security code.

The review of various structural systems foundations and building configuration practiced in India and also keeping in view the safety provisions of tall buildings, the following conclusions are drawn to help improve the safety and security of tall buildings particularly in India:

- The building codes should be given legal status and there should be laws to enforce the codal provision
- Buildings should be of regular geometry in plan and in elevation. The presence of irregularities, however, are to be adequately designed and taken care of
- These security & safety measures of super tall building should be planned and designed since inception
- Education and training should be given to the

operators and occupants of the tall structures about building security, emergency procedures and evacuation systems on regular basis.

- There should be a national and international guidelines/ codes on emergency egress requirements and building security
- Integrated automated building controls systems should be introduced in conventional design procedures.

---

... contd. from pg.47

eco friendly building materials, Tommy Mathew and P.K.Bagachi, Natura Fibretech Pvt.Ltd., Bangalore 560027.



# Technical Workshops on Building Byelaws

The Council provided technical inputs to the Expert Committee for Preparation of Model Town and Country Planning Legislation, Zoning Regulation Development Control and Building Regulation/Bye-laws for Safety against Natural Hazards set up by the Ministry of Home Affairs, Govt. of India.

Based on the Committees inputs, State Level Workshops on Model Town and Country Planning Legislation, Zoning Regulations, Development Control, Building Regulations/Bye-Laws for Natural Hazard Zones of India are being organised by BMTPC in various States/UTs. Through these workshops State Govts. are being assisted to modify their existing Building Byelaws.

So far, Technical Workshops have been organised in the following States:

- **Assam**
- **Arunachal Pradesh**
- **Bihar**
- **Chhattisgarh**
- **Himachal Pradesh**
- **Manipur**
- **Meghalaya**
- **Tamil Nadu**
- **Tripura**
- **Uttar Pradesh**





## Field level Application of Cost Effective Building Material Technologies under VAMBAY

**M**inistry of Housing & Urban Poverty Alleviation has entrusted BMTPC with Construction of Demonstration Houses using Cost-Effective Building Materials and Disaster Resistant Construction Technologies under Valmiki Ambedkar Awas Yojana (VAMBAY) - *now merged with JNNURM*. Presently, Under this project, demonstration houses are being constructed in five states as mentioned below:

- 70 Demonstration houses in Nagpur, Maharashtra
- 100 Demonstration houses in Dehradun, Uttaranchal
- 100 Demonstration houses in Bilaspur, Chhattisgarh
- 70 Demonstration houses in Kudulu, Karnataka
- 100 Demonstration houses in Trichi, Tamilnadu

Earlier the Council has successfully completed construction of 252 demonstration houses under VAMBAY in Bangalore, Karnataka.

The salient features of each of these projects are summarized in the following paragraphs.

### Nagpur (Maharashtra)

The Demonstration Housing Project at Nagpur, Maharashtra comprises of 70 dwelling units having Ground +1 structure with built up area of each unit as 16.84 sqm and future expandable area of 8.17 sqm. The project consists of 10 blocks, each block having

7 dwelling units. There are 4 dwelling units on ground floor and 3 dwelling units on first floor. USP of the project is that all the occupants on the first floor will also get future expandable area in the form of open terrace. Land for this project has been allotted by Nagpur Improvement Trust. Plot area allotted was 5127.30 sq. mts.

The project is a live example of field level application of cost effective building materials. Some of these are:

- i) Under-reamed piles for foundation
- ii) Solid/Hollow blocks using flyash/gypsum for Masonry
- iii) Filler slab for floor/roof
- iv) Precast RCC door frames
- v) Wood alternate door shutters
- vi) RCC lintel and tie beams at ground level for earthquake resistance

Cost of individual dwelling unit is Rs.50,000/- as per the

sanctioned amount under VAMBAY Scheme. This does not include the cost of infrastructure which will be provided by State nodal agency.

### Dehradun, Uttaranchal

In Dehradun, 100 houses are being constructed at three different locations. This project is special in a way that the houses will be allotted to lepers who were living in dilapidated kuccha houses at the same location. The area of each DU is approx. 18 sqm and the cost per DU is Rs. 45,000/-. Cost effective technologies which have been used in this project are as follows:

- i) Precast RCC plank and joist for roofing.
- ii) Solid concrete blocks for walling
- iii) RCC door frames
- iv) Precast elements like Chajjas, shelves etc.



### Bilaspur (Chhattisgarh)

In Bilaspur, 100 houses are being constructed for slum dwellers. There is row type housing in this project with 12 Dwelling Units (DU) in one Block, 8 DUs at Ground Floor and 4 units at First Floor. By providing this design, open expandable space has been provided to occupants on First Floor. Cost per DU is Rs. 40,000/-. Most of the technologies and building elements used in this project are precast. These are:

i) Flyash Bricks for walling

ii) Precast RCC Beam and curved planks for roofing.

iii) Ferrocement Stair Case

iv) RCC Door Frames

v) Precast RCC chajjas etc.

### Kudulu, Karnataka

There are 70 Dwelling Units having Ground +2 structure with built up area of each unit as approx. 200 sft. Cost per DU is Rs. 60,000/-. Cost effective technologies which have been used in this project are Solid CC Blocks for walling and Precast RCC Door and window

Frames.

### Trichi, Tamilnadu

There are 100 dwelling units of single storey designed in cluster approach. Built up area of each dwelling unit is approx. 200 sft. Cost per DU is Rs. 40,000/-. Cost effective technologies which have been used in this project are Solid CC Blocks for walling and Precast RCC Door and window Frames.





# Retrofitting

## of Sub-District Hospital in Kupwara, Kashmir, J&K for Safety Against Earthquakes

**A**n earthquake of magnitude 7.6 (Richter Scale) hit on 8<sup>th</sup> October, 2005 with epicenter located at Muz-zafarabad in Pakistan, just near the LOC, only 140 km from Srinagar in Kashmir. The impact of earthquake was so intensive that it caused extensive damages in the State of Jammu & Kashmir and mainly in Baramula and Kupwara districts of Kashmir valley.

BMTPC represented the Ministry of Housing & Urban Poverty Alleviation, Govt. of India, in the Central Team to have on the spot assessment of the situation in the wake of earthquake in Jammu & Kashmir. During the visit, Sub-District hospital in Kupwara, which has suffered damage due to earthquake, was visited by BMTPC official along with Dr.A.S.Arya, National Seismic Advisor, GOI. It was observed that the hospital had number of deficiencies in so far safety against earthquake are concerned. During the discussion with Divisional Commissioner, Srinagar and Dr.A.S.Arya, it was suggested that the hospital being a lifeline building could be taken for seismic strengthening by BMTPC to demonstrate the retrofitting techniques for safety against earthquakes.

**Sub-District Hospital Build-**

**ing**

The main building of the hospital has two wings, the front one being longish and the rear one being squarish. It has two story brick masonry construction in cement mortar of a reasonably good quality. RC bands exist in all the walls at lintel level in upper and lower storeys, and a couple of feet below the eave level in the upper story of the rear wing where the wall is approximately 4.5m high. In the front wing, the front and rear walls have a series of windows separated only by narrow piers which are nothing but cross walls.

### Damage

In the recent quake cracks developed in several parts of the front as well as rear wings, notably in the (a) brick piers in between the windows, as well as in the (b) tall walls flanking the staircase. Almost all these cracks classify as Grade 2 damage. Most of these cracks, however, were through out the thickness of wall. Thus the strength of these walls had substantially decreased on account of damage.

### Vulnerability

Although, on account of the bands the walls have adequate resistance against bending stresses that could result from





the out of plane seismic forces, there were other in-built vulnerabilities as listed below:

- No vertical reinforcement in the walls that could impart ductility to the main external walls.
- None of the openings in front and rear wings is encased in RCC. Openings could easily develop diagonal or racking shear cracks in the corners of the openings.
- In the front building in north and south exterior walls there is practically no shear wall on account of large windows.
- In the surgical wards the rooms are large and walls are in excess of 5m length.
- The timber deck of the attic that sits on the masonry

walls in the front wing is flexible since it has mere decorative false ceiling at the underside. The rear wing has good timber plank floor in attic. But the deck is simply placed on top of the walls and anchored to timber wall plates, which in turn do not have any positive connection with the walls, since no RC bands exist at that level.

### Retrofitting

It was felt important to retrofit the building to ensure seismic performance level of Building Type-D. This called for the following improvements.

- Installation of vertical reinforcement in all corners.
- Encasement of all openings with seismic belts made

of welded wire mesh and rebars attached to walls.

- Installation of eave level seismic belt on one face of all walls and on both faces of walls having length greater than 5m.
- Anchoring of roof deck to walls using MS angle brackets or other suitable options
- Improving the diaphragm action of the roof deck of the front wing by installation of diagonal bracing on the top of the bottom chord of roof.

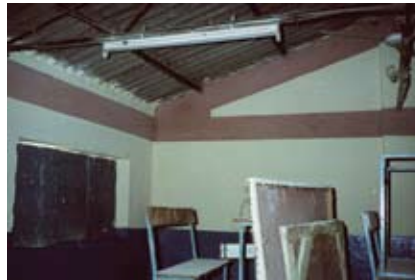
The retrofitting of the Hospital building was undertaken by BMTPC through its network partner NCPDP, Ahmedabad.



## Retrofitting of MCD School Building

In most of the disasters resulting from earthquakes, the inadequacy of the buildings, to stand up against the seismic forces is the single most cause of the loss of life and loss of property. In recent earthquakes, number of lives were lost under the debris of the buildings that collapsed in the quake. It is certainly important to ensure that the new structures are adequately strong. But even more important is to strengthen or retrofit the existing structures, especially the public buildings like schools, community centres, primary health centres, anganwadis, etc. as also the place of work. The mitigation measures in the form of retrofitting could significantly reduce chances of collapse in an event of future earthquake thus saving human lives.

Keeping this in mind, BMTPC has taken lead to carry out the retrofitting of a 12 MCD school buildings, one in each 12 Municipal wards in Delhi, so that the awareness could be generated among the people as well as various government agencies about the need and techniques of retrofitting. With the help of MCD Officials, schools have been identified for retrofitting. To begin with, seismic strengthening and retrofitting of MCD School building at Indian Airlines Colony, Vasant Vihar was initiated and the work has been completed. During the retrofitting local MCD engineers and contractors were also trained.



**Before Retrofitting**



**After Retrofitting**



# Capacity Building Programmes



With the emergence of new building materials, advancement of technologies and the need for disaster resistant construction to mitigate the effect of natural disasters, it is important that working professionals regularly update their knowledge and understanding of subjects. Realising this need of capacity building of professionals, BMTPC has continued its efforts in organizing structured training programmes on following related subjects for working professionals on regular basis:

- *Earthquake Resistant Buildings*
- *Concrete Mix - Design and Quality Control*
- *Water Proofing and Damp Proofing*
- *Quality Assurance in Construction*
- *Use of Chemical and Mineral Admixtures for Concrete Construction*
- *Seismic Retrofitting & Repair of Buildings*
- *Repair, Maintenance & Rehabilitation of Buildings*

Faculties for these training programmes are well known experts from academic institutions as well as practising professionals. More than 300 professionals, in last one year, both from leading public and private organizations like CPWD, PWDs, Railways, NTPC, GAIL, Cement Industry and Construction Agencies, etc. attended the training programmes.

The Council with IIT Roorkee has also started Short Term Certificate Training Course on "Earthquake Resistant Design and Construction including Repair and Seismic Retrofitting".



## Construction of Demonstration Structures using Bamboo based Technologies in Mizoram and Tripura

BMTPC has undertaken construction of 10 demonstration structures, each, using bamboo based technologies in Mizoram and Tripura. These includes houses, OPD buildings, Library buildings, Picnic huts, Schools, etc. The cost of construction is considerably reduced by 25% to 30% using bamboo based technologies for different types of structures as compared to conventional construction. During constructing various types of structures local contractors, masons, artisans were provided training on use of bamboo in building construction. The specifications used are:

- Treated bamboo columns and beams,
- Ferrocement walls using bamboo grid reinforcement,
- Treated bamboo trusses, rafters and purlins,
- Bamboo mat board in wooden frames for door shutters,
- Bamboo mat corrugated roofing sheets,
- Locally available wood for door & window frames
- IPS flooring, etc.







## Bamboo Mat Production Centres

BMTPC, in cooperation with Cane & Bamboo Technology Centre (CBTC), Guwahati and State Governments, is establishing two Bamboo Mat Production Centres each in the States of Assam, Tripura, Mizoram and Meghalaya. The main objectives of Bamboo Mat Production Centres are to provide uninterrupted supply of bamboo mats to the manufacturing units of bamboo based building components for increasing the productivity, quality, to provide training in mat production process and to create employment opportunities in the North Eastern region. In the first phase, the Council is setting up Bamboo Mat Product Centres at Kowaifung, Tripura; Sairang and Bualpui, Mizoram and Sokhar Nongtluh Village, Meghalaya. The Council has already completed establishment of Bamboo Mat Production Centres at Kowaifung, Tripura and Sairang, Mizoram.

The Council in cooperation with CBTC is also providing training on bamboo mat production to the artisans from each Bamboo Mat Production Centre. The production capacity of each production centre will be 300 mats per day. It is estimated that the each Centre will be able to produce the mat at present at the rate of Rs.35 per mat and would be able to sell at the rate of Rs.45 per mat. This will provide employment generation of nearly 150 women/men per day i.e. 45,000 women/men days per year per Centre. Besides the above, the Centres can also generate income by supplying bamboo sticks made out of bamboo waste, to the artisans for making handicraft items. The mats produced by Bamboo Mat Production Centres are likely to be utilized by various manufacturers who are producing Bamboo Mat Corrugated Roofing Sheets, Bamboo Mat Boards etc.

# शहरी गरीबों के लिए बुनियादी सेवाएं (बीएसयूपी) हेतु दिशानिर्देश

**व**र्ष 2001 की जनगणना के

अनुसार 285.35 मिलियन लोग शहरी क्षेत्रों में रहते हैं। यह देश की कुल आबादी का 27.8% है। स्वातंत्र्योत्तर काल में भारत की आबादी में तिगुनी वृद्धि हुई है जबकि शहरी आबादी में पाँच गुणा वृद्धि हुई है। बढ़ती हुई शहरी आबादी के कारण शहरी गरीबों की संख्या में भी वृद्धि हुई है। वर्ष 2001 के आकलन के अनुसार स्लम आबादी के 61.8 मिलियन होने का अनुमान है। स्लमवासियों की हमेशा बढ़ती संख्या से शहरी बुनियादी सेवाओं तथा अवस्थापना पर अत्यधिक दबाव पड़ता है। तेजी से हुई शहरी वृद्धि के परिणामस्वरूप पैदा हुई बड़ी समस्याओं से निबटने के लिए चुनिंदा शहरों में मिशन मोड पर परियोजनाओं को कार्यान्वित करने के लिए एक सुसंगत शहरी करण नीति/कार्यनीति बनाना आवश्यक हो गया है।

प्रत्येक चुने गए नगर के लिए 20-25 वर्षों के लिए (जो प्रत्येक पांच वर्ष में अद्यतन किया जाएगा) नियोजित शहरी परिपेक्ष्य ढांचा तैयार किया जाएगा जिसमें धनराशि की आवश्यकता पूरी करने की नीतियों, कार्यक्रमों व योजनाओं का विवरण दिया जाएगा। इस परिपेक्ष्य योजना के बाद विकास प्लान तैयार किए जाएंगे जिसमें प्रत्येक पांच वर्ष की योजनावधि के लिए सेवाओं सहित भू-उपयोग को शहरी परिवहन तथा पर्यावरण प्रबंध के साथ एकीकृत किया जाएगा। इस संदर्भ में शहर को मिशन राशि लेने से पूर्व नगर विकास योजना (सीडीपी) तैयार करनी होगी। चुने गए शहरों के लिए धनराशि नामित राज्य नोडल एजेंसी को जारी की जाएगी

जो बदले में राज्य सरकार, अपनी स्वयं की राशियों, कार्यान्वयन एजेंसियों की राशियों और वित्तीय संस्थानों/निजी क्षेत्र/पूँजी बाजार की राशियों और विदेशी सहायता से अतिरिक्त संसाधन जुटाएंगे। मिशन के तहत सृजित विभिन्न परिसंपत्तियों के परिचालन और रखरखाव के लिए एक आवर्ती कोष का गठन किया जाएगा।

## मिशन के लक्ष्य

मिशन के तहत शामिल नगरों में शहरी गरीबों को बुनियादी सेवाओं के समन्वित विकास पर अधिक बल देना।

शहरी गरीबों के लिए किफायती कीमतों में टेन्डोर की सुरक्षा, बेहतर आवास, जलापूर्ति, सफाई सुविधा सहित बुनियादी सेवाओं का प्रावधान और शिक्षा, स्वास्थ्य तथा सामाजिक सुरक्षा के लिए सरकार की पहले से विद्यमान सार्वजनिक सेवाओं की सुपुर्दगी सुनिश्चित करना। इस बात का ध्यान रखा जाएगा कि शहरी गरीबों को उनके व्यवसाय स्थल के समीप आवास मुहैया कराया जाए।

परिसंपत्ति सृजन और परिसंपत्ति प्रबंध के बीच प्रभावी सामंजस्य स्थापित करना ताकि शहरी गरीबों हेतु नगरों में सृजित अवसंरचना सेवाओं के सही ढंग से रखरखाव के अलावा ये सेवाएं समय के साथ-साथ स्वपोषित भी बन सकें।

शहरी गरीबों के लिए बुनियादी सेवाओं की कमियों को पूरा करने के लिए पर्याप्त धनराशि का निवेश सुनिश्चित करना।

शहरी गरीबों के लिए उपलब्धता पर विशेष ध्यान देते हुए नागरिक सेवाओं और सुविधाओं को बढ़ाना।

मिशन की अवधि वर्ष 2005-06 से आरम्भ होकर सात वर्ष होगी। इस

अवधि के दौरान मिशन चुनिंदा शहरों का सुस्थिर विकास सुनिश्चित करेगा। ग्यारहवीं पंचवर्षीय योजना के शुरु होने से पूर्व मिशन के कार्यान्वयन के अनुभव का मूल्यांकन किया जा सकता है और यदि आवश्यक हो तो कार्यक्रम को अंशांकित किया जा सकता है।

## मिशन के घटक

शहरी गरीबों के लिए बुनियादी सेवाओं संबंधी उप-मिशन में निम्नलिखित को शामिल किया जाएगा:

(क) स्वीकार्य घटक:

- (i) स्लमों का समेकित विकास अर्थात्, चुने गए शहरों के स्लमों में आवास तथा अवस्थापना परियोजनाओं का विकास करना।
- (ii) शहरी गरीबों के लिए बुनियादी सेवाओं के विकास/सुधार/रखरखाव वाली परियोजनाएं
- (iii) स्लम सुधार तथा पुनर्वास परियोजनाएं
- (iv) जल आपूर्ति/सीवरेज/जल निकासी, समुदाय शौचालय/स्नानघरों इत्यादि से संबंधित परियोजनाएं।
- (v) स्लमवासियों /शहरी गरीबों/ ईडब्ल्यूएस/एलआईजी श्रेणियों हेतु किफायती लागत पर मकान।
- (vi) नालियों/बरसाती पानी की नालियों का निर्माण एवं सुधार।
- (vii) स्लमों का पर्यावरणीय सुधार एवं ठोस कचरा प्रबंधन।
- (viii) पथ प्रकाशन।
- (ix) नागरिक सुविधाएं, यथा समुदाय हाल, बाल देखभाल केन्द्र इत्यादि
- (x) इस घटक के अंतर्गत सृजित संपत्तियों का प्रचालन व रखरखाव



(xi) शहरी गरीबों के लिए स्वास्थ्य, शिक्षा और सामाजिक सुरक्षा स्कीमों का एकीकरण।

(ख) अस्वीकार्य घटक

निम्नलिखित से संबंधित परियोजनाओं पर विचार नहीं किया जायेगा :-

(i) ऊर्जा

(ii) दूरसंचार

(iii) मजदूरी रोजगार कार्यक्रम एवं स्टाफ घटक

(iv) नए रोजगार अवसरों का सृजन

**सुधारों की कार्यसूची**

शहरी नवीकरण की संशोधित कार्यनीति का मुख्य उद्देश्य है शहरी प्रशासन में सुधार सुनिश्चित करना है ताकि बढ़ी हुई साख और नए कार्यक्रमों तथा सेवाओं का विस्तार शुरू करने के लिए बाजार की पूंजी प्राप्त करने की क्षमता के साथ शहरी स्थानीय निकाय (यूएलबी) और पैरा स्टेटल एजेंसियां वित्तीय रूप से सुदृढ़ हो जाएं। इस बेहतर परिप्रेक्ष्य में, विभिन्न सेवाएं उपलब्ध कराने के लिए सरकारी-निजी सहभागिता मॉडल भी व्यवहार्य हो जाएगा। इस उद्देश्य की प्राप्ति के लिए, राज्य सरकारों, शहरी स्थानीय निकायों तथा पैरा स्टेटल एजेंसियों द्वारा सुधारों की कार्यसूची का कार्यान्वयन स्वीकृत करना अपेक्षित होगा। प्रस्तावित सुधार की मुख्यतः दो श्रेणियां होंगी: -

(i) अनिवार्य सुधार

(ii) एच्छिक सुधार

**समझौता ज्ञापन (एमओए)**

राज्य सरकार एवं शहरी स्थानीय निकाय/पैरा स्टेटल पहचान किए गये सुधारों को कार्यान्वित करने के लिए अपनी प्रतिबद्धता दर्शाते हुए भारत सरकार के साथ एक समझौता ज्ञापन का निष्पादन करेंगे। समझौता ज्ञापन में सुधार की प्रत्येक मद के संदर्भ में प्राप्त किये जाने वाले विशिष्ट मील पथरों का उल्लेख होगा। केन्द्रीय सहायता प्राप्त करने के लिए समझौता ज्ञापन

पर हस्ताक्षर करना एक आवश्यक शर्त है। इस त्रिपक्षीय समझौता ज्ञापन को विस्तृत परियोजना रिपोर्टों (डीपीआर) के साथ प्रस्तुत किया जाएगा। केन्द्रीय सहायता सुधार प्लेटफार्म के लिए सहमति व्यक्त करने वाली राज्य सरकारों और शहरी स्थानीय निकायों/ पैरा स्टेटलों को केन्द्रीय सहायता मुहैया होगी।

**राष्ट्रीय शहरी नवीकरण मिशन के परिणाम**

सात वर्षों की मिशन अवधि के पूरे होने पर यह उम्मीद की जाती है कि शहरी स्थानीय निकाय/ पैरा स्टेटल निम्नलिखित परिणाम प्राप्त करेंगे:-

- सभी शहरी सेवाओं और शासन कार्यों के लिए आधुनिक और पारदर्शी बजट, लेखांकन, वित्तीय प्रबंध प्रणाली डिजाइन की जा चुकी होगी तथा अपना ली गई होगी।
- आयोजना और शासन के लिए पूरे शहर के लिए कार्य ढांचा स्थापित किया जायेगा तथा यह प्रचालित हो जायेगा।
- सभी शहरी गरीब लोग बुनियादी स्तर की शहरी सेवाएं प्राप्त कर सकेंगे।
- बड़े राजस्व दस्तावेजों में सुधार लाकर शहरी शासन और सेवा आपूर्ति के लिए वित्तीय रूप से आत्मनिर्भर एजेंसियां स्थापित की जायेगी।
- स्थानीय सेवाएं और शासन इस प्रकार संचालित किया जायेगा जो कि नागरिकों के लिए पारदर्शी और जिम्मेदार हो।
- ई-गवर्नेन्स अनुप्रयोगों को शहरी स्थानीय निकायों के मुख्य कार्यों में शुरू किया जायेगा जिससे सेवा आपूर्ति प्रक्रियाओं की लागत और समय में कमी आयेगी।

**जवाहर लाल नेहरू राष्ट्रीय शहरी नवीकरण मिशन (जे एन एन यू आर एम) के तहत शहरी गरीबों को बुनियादी सेवाएं (बी.एस.यू.पी.) हेतु उप मिशन के कार्यान्वयन में निर्माण सामग्री एवं प्रौद्योगिकी संवर्द्धन परिषद् (बी.एम.टी.पी.सी.) का योगदान**

इस मिशन के अंतर्गत परियोजना प्रस्तावों पर तत्परता से कार्यवाही करने के लिए एवं राज्य सरकारों और अन्य एजेंसियों के साथ कुशल समन्वयन करने हेतु शहरी आवास और गरीबी उपशमन मंत्रालय के तहत संयुक्त सचिव के अधीन एक मिशन निदेशालय का गठन किया गया है। प्रस्तावित परियोजनाओं के मूल्यांकन हेतु आवास एवं गरीबी उपशमन मंत्रालय ने बी.एम.टी.पी.सी. हडको व एन.बी.सी.सी. का चयन किया है। बी.एम.टी.पी.सी. इस कार्य को सक्षमता से करते हुए अब तक मध्य प्रदेश, आंध्र प्रदेश, गुजरात आदि के मिशन शहरों से आए कई परियोजनाओं का मूल्यांकन कर इसकी रिपोर्ट केन्द्रीय स्वीकृति एवं निगरानी समिति की समीक्षा हेतु पेश की है। इन मूल्यांकन रिपोर्टों को ध्यान में रखकर संबंधित मिशन शहरों को करोड़ों रुपये का केन्द्रीय अनुदान, केन्द्रीय स्वीकृति एवं निगरानी समिति द्वारा की जा चुकी है। इसके साथ-साथ परिषद् शहरी स्थानीय निकायों (यूएल.बी.) एवं राज्य सरकार के संबंधित अधिकारियों को परियोजना तैयार करने व इसे संशोधित करने में भी मदद कर रही है। बी.एस.यू.पी. से संबंधित कार्यशालाओं में भी परिषद् की काफी सक्रिय भागीदारी है।

## World Habitat Day 2005 Celebrations

The Council organised a State Level Painting Competition in MCD Schools on the theme saving environment, cleanliness, conservation of water and general awareness for celebrating the World Habitat Day - 2005. 24 MCD schools recommended by Municipal Corporation of Delhi, participated in the competition. The Council received a large number of paintings prepared by school children of MCD Schools. The best paintings were awarded cash prize and certificates during the celebration of World Habitat Day on 3<sup>rd</sup> October, 2005.

To celebrate the World Habitat Day, Council brought out the following:-

- Building Materials News highlighting issues related to the theme, "Millennium Development Goals and the City", of World Habitat Day
- A poster titled "Helping in Building Healthy Habitat" highlighting Schemes/Programmes of MoUE&PA.
- CD titled "Strengthening the Technological Base of Building Materials Industry" which includes BMTPC's Publications in detail.



Shri Prithviraj Chavan, Hon'ble Minister of State in the Prime Minister's Office and Kumari Selja, Hon'ble Minister of State (IC) for UEPA releasing the Poster titled "Helping in Building Healthy Habitat" highlighting Schemes/Programmes of MoUE&PA on the occasion of World Habitat Day on 3<sup>rd</sup> October, 2005



Shri Prithviraj Chavan, Hon'ble Minister of State in the Prime Minister's Office and Kumari Selja, Hon'ble Minister of State (IC) for UEPA releasing the CD titled "Strengthening the Technological Base of Building Materials Industry" which includes BMTPC's Publications in detail



Shri Prithviraj Chavan, Hon'ble Minister of State in the Prime Minister's Office and Kumari Selja, Hon'ble Minister of State (IC) for UEPA releasing the BMTPC's Newsletter



## State level Painting Competition organised by BMTPC for Class IV & V of MCD Schools on the occasion of World Habitat Day, 2005



**Prize Winning Painting by:** Suman Mamraj, Class V-A, MC Primary Girls' School, Srinivasapuri, New Delhi



**Prize Winning Painting by:** Hina Parveen, Class V, Nigam Adarsh Balika Vidyalaya, Pana Udyan-1, Narela, Delhi



**Prize Winning Painting by:** Mohammad Imtiaz, Class V-B, MC Primary Boys' School, Idgah Road, Old-II, New Delhi – 55



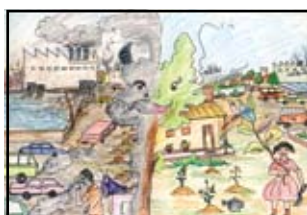
**Prize Winning Painting by:** Ritu, Class IV-C, Nigam Adarsh Balika Vidyalaya, Pana Udyan-1, Narela, Delhi



**Prize Winning Painting by:** Nisha, Class V-A, MC Primary School, Swaroop Nagar-I, Delhi



**Prize Winning Painting by:** Shabnam, Class V, MC Primary School, New Sanjay Amar Colony, Shahdra South, Delhi - 32



**Prize Winning Painting by:** Purusharth, Class V-C, MC Primary Co-Educational School, Rameshwar Nagar, Delhi



**Prize Winning Painting by:** Priya, Class IV-C, MC Primary Co-Educational School, Sector-15C, Rohini, Delhi-85



**Prize Winning Painting by:** Richa, Class V-C, MC Primary School, Swaroop Nagar-I, Delhi



**Prize Winning Painting by:** Priyanka, Class V-B, Nigam Adarsh Balika Vidyalaya, Pana Udyan-1, Narela, Delhi



**Prize Winning Painting by:** Kishen Kumar, Class IV-A, MC Primary Co-Educational School, Sector-15C, Rohini, Delhi-85



**Prize Winning Painting by:** Himanshu, Class V-E, Nigam Adarsh Vidyalaya (Boys), 28-Block, West Patel Nagar, New Delhi



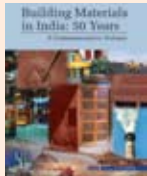
**Prize Winning Painting by:** Nikhil, Class V-B, MC Primary School, Nigam Adarsh Vidyalaya, E-Block, Naraina, New Delhi - 28



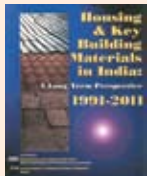
## Priced Publications of BMTPC



**DIRECTORY OF INDIAN BUILDING MATERIALS & PRODUCTS** (with information on Nepal & Bhutan) 2006  
550 pages, Rs. 1000 + 200 postage



**BUILDING MATERIALS IN INDIA : 50 YEARS** - 560 pages, Rs.1500 + 200 postage



**HOUSING AND KEY BUILDING MATERIALS IN INDIA - A LONG TERM PERSPECTIVE** - 98 pages, Rs. 700 + 75 postage



**INSTRUCTION MANUAL FOR APPROPRIATE BUILDING SYSTEMS**  
64 pages, Rs. 150 + 75 postage



**PRECAST BUILDING COMPONENTS**  
- 28 pages, Rs. 150 + 30 postage and packing



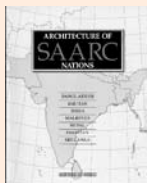
**BUILDING WITH COMPRESSED EARTH BLOCKS**  
28 pages, Rs. 60 + 30 postage



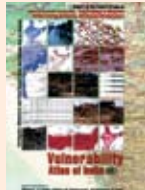
**STANDARDS AND SPECIFICATIONS FOR COST EFFECTIVE INNOVATIVE BUILDING MATERIALS AND TECHNIQUES**  
128 pages, Rs. 200 + 75 postage



**DIRECTORY OF CONSTRUCTION EQUIPMENT AND MACHINERY MANUFACTURED IN INDIA**  
- 684 pages, Rs. 1500 + 200 postage



**ARCHITECTURE OF SAARC NATIONS.**  
196 pages, Rs. 250 + 75 postage



**VULNERABILITY ATLAS OF INDIA (1997)** - Earthquake, Windstorm and Flood Hazard Maps and Damage Risk to Housing, 712 pages, Rs. 3000 + 200 postage - State and Union Territories-wise VULNERABILITY ATLASES - Rs.800 + 75 postage for each



**LANDSLIDE HAZARD ZONATION ATLAS OF INDIA** - Landslide Hazard Maps and Cases Studies, 125 pages - Rs.2500 + 200 postage



**MANUAL FOR REPAIR AND RECONSTRUCTION OF HOUSES DAMAGED IN EARTHQUAKE of Oct.91 in the Garhwal Region of U.P.**  
81 pages, Rs. 150 + 75 postage



**GUIDELINES FOR DAMAGE ASSESSMENT AND POST EARTHQUAKE ACTION - JABALPUR** (Three Parts)  
- Rs. 250 + 75 postage for each part



**GUIDELINES FOR DAMAGE ASSESSMENT AND POST EARTHQUAKE ACTION** (Two Parts)  
- Rs. 250 + 75 postage and packing for each part



**GUIDELINES FOR IMPROVING EARTHQUAKE RESISTANCE OF HOUSING**  
- 76 pages, Rs. 350 + 75 postage



**GUIDELINES FOR IMPROVING WIND/CYCLONE RESISTANCE OF HOUSING**  
- 50 pages, Rs. 200 + 50 postage



**EARTHQUAKE TIPS - LEARNING EARTHQUAKE DESIGN & CONSTRUCTION**  
- 58 pages, Rs.200 + 50 postage

## Promotional Publications of BMTPC

1. Areas of Activity
2. BMTPC Newsletters
3. Build Your Home with Earthquake Protection
4. Environment Friendly Building Materials & Construction Technologies
5. Guidelines for Cyclone resistant houses
6. Grah Nirman Mein Vishesh Savdhaniyan
7. Reconstruction of Earthquake Resistant Houses in Garhwal Region - Guidelines in Hindi
8. Retrofitting of Stone Houses in Marathwada Area of Maharashtra
9. Saste Makan: Vibhinn Vikalp Avam Suvidhain - in Hindi
10. Useful tips for House Builders
11. Strengthening Technological Base of the Building Materials Industry
12. Local Vegetable Fibres + Industrial & Mineral Waste for Composite materials
13. Machines developed by BMTPC
14. An Introduction to the Vulnerability Atlas of India
15. Performance Appraisal Certification Scheme
16. Catalogue for Machines
17. National Network on Building Technology
18. Green Houses for ITBP at Leh
19. Bamboo - A Material for cost-effective and disaster resistant housing
20. Corporate Brochure - in English and Hindi
21. Retrofitting of Hospital in Kupwara, Kashmir, J&K for Safety Against Earthquakes
22. Simple Ways to Earthquake Safety for Jammu & Kashmir - in English and Urdu
23. Bamboo in Housing & Building Construction - Initiatives of BMTPC

**Priced Publications may be obtained by sending Demand Draft, drawn in favour of BMTPC payable at New Delhi**

## Films Produced by BMTPC

### 1. MAKAN HO TO AISA 15 min.

Film on improving buildings in earthquake prone areas of Garhwal. This is an instructional documentary film in Hindi for imparting training in repair and reconstruction of damaged houses using local materials and earthquake proof structures.

### 2. ABHIVARDHAN 30 min.

Film on nature of damages and what needs to be done for making houses disaster resistant in the Uttarkashi region. The film focuses directly on the needs of households and artisans to reconstruct their houses using traditional techniques with a catalytic input of modern materials and design techniques

### 3. A BETTER WAY TO BUILD 25 min.

This film focuses on technology delivery system for cost-effective housing. It highlights the activities of Building Centres as technology transfer agents for improving housing delivery system at grass-root level. Building Centres are being set up in different parts of the country under a Central Scheme of the Ministry of Urban Affairs and Employment. Nearly 250 Centres have already been set up in different states and these are making useful contribution to promoting cost-effective innovative building materials and construction technology for house construction.

### 4. AASHRAY 28 min.

Film depicts the application of low cost building materials and technologies. It also gives guidance to common man to procure financial support and a house.

### 5. LESSONS FROM LATUR 20 min.

Film is a rapid survey of causes, nature and extent of damage due to the earthquake in Latur and Osmanabad districts of Maharashtra and Gulbarga district of Karnataka in September 1993. The film is available in Hindi, English and Marathi. The direct relationship between housing structure and materials used in affected areas and the enormity of the impact of the disaster have been reflected through illustration and interviews with affected people. Rescue, immediate relief and temporary rehabilitation have also been shown in the film. The film also discusses measures for constructing earthquake resistant buildings. Alternate layout plans for reconstruction of villages, retrofitting of existing structures which are disaster prone, different technological options and social tensions arising out of the process of resettlement/relocation, etc., are covered.

### 6. HOMEWARD BOUND 16 min.

This film was produced on World Habitat Day, October, 1993 on the UNCHS (United Nations Commission on Human Settlements) theme Women and Shelter Developments. The film covers significant contributions and achievements made by India by encouraging participation of women in shelter process in different parts of the country.

### 7. FLYASH UTILISATION 20 min.

Nearly 40 to 45 million tonnes of flyash is being generated annually as waste by 70 thermal power stations in the country. Apart from covering large areas of useable land it leads to environmental problems by contributing to air-borne

and sub-soil water pollution. The film shows various methods of utilising flyash to manufacture building materials. This can convert waste to wealth as country is facing severe shortages of building materials, especially for housing. The film covers various on-going activities of flyash utilisation through small, medium and large scale production of flyash-based building materials in different states.

### 8. SEISMIC RETROFITTING 20 min.

This film, in four parts, is a series of training films on the techniques of strengthening of houses in the earthquake affected regions of Marathwada in Maharashtra. This film was produced under guidance and direction of Dr AS Arya, Professor Emeritus (Earthquake Engg.), University of Roorkee.

- Part 1 Installation of headers
- Part 2 Reduction of weight on the roof
- Part 3 Installation of knee braces
- Part 4 Installation of seismic bands

### 9. A STITCH IN TIME 15 min.

This film is a capsule on the techniques of strengthening partially damaged houses in the earthquake affected Marathwada district of Maharashtra, India. The programme is an illustrated lecture by Dr AS Arya (Professor Emeritus, Earthquake Engineering and UGC Emeritus Fellow, University of Roorkee)

### 10. PHOSPHOGYPSUM-BASED BUILDING MATERIALS 14 min.

Phosphogypsum is generated as a by-product of the phosphoric acid based fertiliser industry. The interaction of ground phosphate rock with sulphuric acid produces 10- to 40 per cent free moisture along with phosphogypsum. Nearly 4.5 million tonnes is generated per year. Over 10 million tonnes has accumulated at plant sites. The fluoride contents of phosphogypsum causes land and water pollution. This film shows the various methods of utilisation of phosphogypsum in production of building materials for ceiling, partition walling, etc.

### 11. BUILDING THE FUTURE BLOCK BY BLOCK 28 min.

Film on the activities of various Building Centres located in southern India and the ways they are helping in promoting cost-effective technologies.

### 12. BUILDING CENTERS: DELIVERING TECHNOLOGIES TO THE MASES 15 min.

A brief film on the Rajasthan Building Centre, and the manner in which they are helping to develop and promote innovative building materials and cost effective technologies which have been adopted by the Centre in their construction.

### 13. IN SEARCH OF HOME 28 min.

A film on the theme of 'Home and the Family' on the occasion of World Habitat Day, 1994. It shows the poor civic amenities in substandard shelters and outlines the possibilities for improvement by using alternate cost-effective and eco-friendly building materials and technologies to convert a shelter into a home.

### 14. SHANKER BALRAM SEPTIC TANK 21 min.

This film in Hindi describes the method of constructing the maintenance free Shanker Balram Septic Tank for low cost sanitation. It also explains the advantages of this tank over the conventional septic tanks available in India. This was based on a rapid survey carried out by WordSmithy on behalf of BMTPC.

### 15. A SUCCESS STORY OF PLASTICS

### WASTE MANAGEMENT 25 min.

Plastics are being used in every walk of life and in the end results in wastes. This film shows various aspects of plastics waste management and the ways to recycle it.

### 16. ROOF FOR THE ROOFLESS 18 min.

A film on Gram-awaz 95 held during the India International Trade Fair 1995. The film shows shortage of housing in the country, various housing schemes launched by the Government of India and the cost-effective innovative building material and technologies for the rural poor.

### 17. TARA CRETE — A ROOF FOR MILLIONS 18 min

The film details the introduction, the manufacturing technology of Micro Concrete Roofing Tiles (MCR), the benefits of Tara Crete Roof, how to build with it and how much it would cost.

### 18. HOUSING AND INFRASTRUCTURE 18 min.

The film shows the various aspects of housing and cost-effective innovative building materials and technologies developed in India.

### 19. BUILD A SAFER TOMORROW 12 min.

The film covers the natural disaster preparedness and mitigation strategies covered in the Vulnerability Atlas of India prepared by the Council.

### 20. BUILD A SAFER TOMORROW ON CD ROM 12 min.

21. REKINDLING HOPE 12 min.  
The film shows the activities of BMTPC in the rehabilitation after Gujarat earthquake.

### 22. MICRO ENTERPRISES THROUGH BUILDING COMPONENTS PRODUCTION 15 min.

The film covers the activities of demonstration cum production units set up by the Council at various locations for generating employment and micro enterprises.

### 23. BMTPC - PROTECTING HOME AND LIVES 15 min.

A film on multifarious activities of BMTPC.

RS. 1000 EACH FILM + PACKING AND POST-AGE CHARGES RS. 100. TO PURCHASE ANY OF THESE FILMS, PLEASE WRITE TO BMTPC.



#### Published by:

BMTPC, New Delhi

#### For Further Details write or contact:

The Executive Director

Building Materials & Technology Promotion Council (Ministry of Housing & Urban Poverty Alleviation)

G-Wing, Nirman Bhawan, New Delhi OR  
Core-5A, First Floor, India Habitat Centre,  
Lodhi Road, New Delhi - 110 003

Tel.: 91-11-2463 8096, 2306 3367

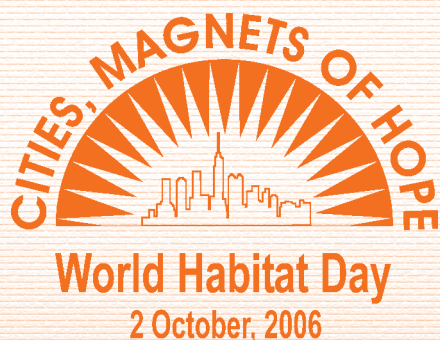
Fax: 91-11-2464 2849, 2306 1145

E-mail: info@bmtpc.org

bmtpc@del2.vsnl.net.in

Website: www.bmtpc.org





**The Building Materials & Technology Promotion Council (BMTPC) was setup in 1990 as an inter-ministerial apex organisation to develop and operationalise a comprehensive and integrated approach for technology development, transfer and investment promotion to encourage application of environment-friendly & energy-efficient innovative materials, manufacturing technologies and disaster resistant construction practices for housing and buildings in urban and rural areas.**

**The Council with its multi-disciplinary character is structured to promote investment and technology transfer nationally and internationally by networking its activities with institutions, centres of excellence and expert groups engaged in R&D, standardisation, housing finance, industrial promotion. The Council supports strengthening of SMEs in the building materials sector through development and promotion of eco-friendly and energy-efficient products, manufacturing technologies and appropriate support service to entrepreneurs.**

