

Member Country of



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Sustainable Construction Policy and Market

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THEME PAPER

INDIA

PREPARED BY



Construction Industry Development Council

(A body established by the Planning Commission (Now Niti Aayog) Govt. of India & Construction Industry)

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Theme Paper - India Sustainable Construction Policy and Market

Executive Summary:

The Indian construction industry, an integral part of the economy and a conduit for a substantial part of its development investment, is not only poised for growth on account of industrialization, urbanization, economic development and people's rising expectations for improved quality of living, it is also bracing for modernization that calls for improved productivity and higher competitive edge. Its main challenges are fast growth in response to increasing demand for goods and services; technological upgrading for speed, quality, cost reduction, and substitution of manual labour; modern management practices for greater profitability and a 'modern', clean image; and technical skills, financial strength and organizational competence to meet domestic and international competition and capture a part of the international market. The construction industry, steeped in traditional technology and largely informal labour practices, is in a hurry to change both its image and content.

Sustainable construction, it must be admitted, is neither the vision nor the immediate goal of its modernization thrust. It is growth, efficiency, productivity, greater share in the market and profit. Improved performance on the environmental front (reduction of pollution or substitution of high energy consuming materials), or on human aspects (better tools and working conditions for the construction workforce), is mainly a welcome by-product, useful in public relation rhetoric, not more.

India, the seventh largest country in the world, is a leading economy and home to over one billion people living in various climatic zones. The country's economy has been growing at a fast pace ever since the process of economic reforms started. Construction plays a very important role in its economy

- USD 1 Trillion investments for infrastructure sector projected during 2012-17

- USD 650 Billion investments in urban infrastructure estimated over next 20 years.
- 100% Foreign Direct Investment (FDI) permitted through the automatic route for townships, cities.
- Construction sector contributes towards 8% of the Indian GDP (at constant prices). Last five year estimates (2006-07 to 2010-11).
- Additional Fact: increased to 3.85 lakh crore (7.9% of the total GDP) in 2010-11 from 284798 crore (8% of the total GDP) in 2006-07.
- Additional Facts: Growth rate for GDP in construction 8.1%
- 100 Smart Cities and 500 AMRUT Cities will invite investment of 2 Trillion Rupees in the next five years.
- INR 62,009 Crore. would be invested under Swachh Bharat Mission (SBM) in urban areas.

SECTOR POLICIES AT PRESENT:

Smart Cities Mission; and Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

- Under 100 Smart Cities Mission, Smart Cities will be selected through a 'City Challenge Competition,' linking financing and ability to achieve multidimensional objectives of urban infrastructure development like adequate and clean water supply, sanitation and solid waste management, efficient urban mobility and public transportation, affordable housing for the poor, power supply, robust IT connectivity, governance, especially e-governance and citizen participation, safety and security of citizens, health and education and sustainable urban environment. Smart City mission will be implemented through Special Purpose Vehicles (SPV) to be managed by the state government.
- AMRUT will inculcate a project approach to ensure basic infra services such as water supply, sewerage, septage management, storm water drains, transport and development of green spaces and parks with special provision for meeting the needs of children. A minimum investment of over INR 2 lakh crore would flow into urban areas over the next five years (2015-16 – 2019-20) since States and ULBs would mobilize matching resources ranging from 50% to 66%.

The following has also been announced in the budget in relation to smart cities: -

To encourage development of 'Smart Cities', which will also provide habitation for the neo-middle class, requirement of the built-up area and capital conditions for FDI is being reduced from 50,000 sq. mts. to 20,000 sq. mts., from USD 10 Million to USD 5 Million respectively. To further encourage this, projects which commit at least 30% of the total project cost for low cost affordable housing will be exempted from minimum built-up area and capitalisation requirements. - A National Industrial Corridor Authority, with its headquarters in Pune is being set up to coordinate the development of Industrial Corridors with emphasis on Smart Cities linked to transport connectivity to spur growth in manufacturing and urbanization. - Master Planning of the Amritsar-Kolkata Industrial Corridor will be completed expeditiously for the development of Industrial Smart Cities in seven states of the country. The seven states to be covered in this project are Punjab, Haryana, Uttar Pradesh, Uttarakhand, Bihar, Jharkhand and West Bengal. - Master planning of three new smart cities in the Chennai-Bengaluru Industrial Corridor region, viz., Ponneri in Tamil Nadu, Krishnapatnam in Andhra Pradesh and Tumkur in Karnataka are to be completed. A Perspective Plan for the Bengaluru Mumbai Economic Corridor and Vizag-Chennai Corridor is to be completed with provision for 20 new industrial clusters. A proposed allocation of INR 40 Billion, to set up a mission on low cost affordable housing, will be anchored in the National Housing Bank. A proposed allocation of INR 1 Billion, to develop metro projects in Lucknow & Ahmedabad. INR 80 Billion has been allocated for the National Housing Bank with a view to expand and continue to support rural housing in the country. State governments concerned are purposed to be notified as sponsoring authority for metro rail projects covered under project import regulations, 1986. The norms for FDI in the construction development sector are being eased as well. Easing of norms has generated high interest levels from not just the foreign investors but also domestic players.

Swachh Bharat Mission (SBM):

- SBM aims at elimination of open defecation, eradication of manual scavenging, scientific Municipal Solid Waste Management, to effect behavioural change regarding healthy

sanitation practices, generate awareness about sanitation and its linkage with public health, capacity augmentation for ULBs to create an enabling environment for private sector participation in Capex (capital expenditure) and Opex (operation and maintenance). The mission outlay is INR 62,009 crores. It covers all 4041 statutory towns.

Heritage City Development and Augmentation Yojana (HRIDAY):

- HRIDAY aims to preserve and revitalise the soul of an Indian heritage city and reflect its unique character by encouraging aesthetically appealing, accessible, informative and secured environment and to undertaking strategic and planned development of heritage cities aimed at the overall improvement in quality of life with special focus on sanitation, security, tourism, heritage revitalisation and livelihoods retaining the city's cultural. It is a central sector scheme with 100% funding coming from Central Government. Initial Phase of the HRIDAY Scheme was launched in January, 2015 for a period of 27 months in twelve identified cities viz. 1) Ajmer 2) Amritsar 3) Amaravati 4) Badami 5) Dwarka 6) Gaya 7) Kanchipuram 8) Mathura 9) Puri 10) Varanasi 11) Velankanni 12) Warangal for development of the towns under the scheme with a total outlay of Rs. 500 crores.

The 12th five years plan projects an investment of 10% of the national GDP into infrastructure which equates to a staggering \$1 trillion or equivalently Rs.45 trillion.

INVESTMENT BOOST IN INFRASTRUCTURE THROUGH HIGHER PUBLIC FUNDING POSITIVE

Budgetary allocation: Total allocation for infrastructure has been increased by 1.5 times to INR 2.8 trillion (roads, railways and urban infrastructure the biggest beneficiaries).

Roads: Investments for development of national highways proposed to be hiked by 178% year-to-year to INR 85,607 crore. A major portion of this increase will be funded by INR 4 per litre increase in road cess on petrol and diesel.

Railways: Total outlay raised by 52%, in the railway budget 2015-16, there have been many announcements of PPP projects in areas of coastal connectivity, gauge conversion, dedicated freight corridors (DFCs) and the Mumbai suburban rail. Funding availability: An INR 200 billion National investment and Infrastructure Fund to be set up for infrastructure finance companies to raise debt. The budget also provides for issuance of tax free bonds for roads, railways and irrigation projects, and aims to rationalize the tax regime for infrastructure investment trusts.

Other measures: The government's intent to table a Public Contracts (Settlement of Disputes) bill will help speedy redressal of disputes in large public projects and create a conducive environment for PPP projects. At a time when private sector interest in infrastructure development is low, the increase in budgetary support holds the potential to kick-start capital investments in the economy. Moreover, the significant increase in public funding for the roads sector has the potential to boost execution of national highway projects by about 5,800 km annually and create a robust construction opportunity for road engineering procurement & construction (EPC) companies. The Union Budget 2015 has proposed that the National Investment and Infrastructure Fund will create additional funding resources for private developers, over and above the rise proposed in public funding. Moreover, rationalisation of tax regime for Infrastructure Investment Trusts may help free up private capital currently locked in completed projects.

Reasons to invest: An investment of USD 1,000 Billion has been projected for the infrastructure sector until 2017, 40% of which is to be funded by the private sector. 45% of infrastructure investment will be funneled into construction activity and 20% set to modernize the construction industry. The Indian government has undertaken a number of measures to ease access to funding for the sector. Construction activities contribute more than 10% of India's GDP. The construction industry in India has seen sustained demand from the industrial and real estate sector. An estimated USD 650 Billion will be required for urban infrastructure over the next 20 years. Housing for seniors has seen increased interest levels from corporates, the hospitality and healthcare industries over the last few years.

Drivers for Sustainability

GHG emissions, climate change and sustainability are at stake. It is estimated that GHG emissions would increase from 2 billion tons to 6-7 billion tons of CO₂ in 2030.

In mapping out sustainable practices that India must adopt a "cradle to grave" analysis is required. And for this we need to have a total approach than a patch work point system or a grade based certification system. In order to have a comprehensive plan for sustainable construction, every structure may be thought about based on the following parameters:

Planning, design and specifications based on performance and service life

- Construction Practices
- Material Conservation and Selection
- Demolition and recycling
- Energy Conservation

I. Planning, Design and specifications

Structures in India are designed well however so far in most specifications, there is no reference to any service life or calculations thereof. To this effect, deeper study of various service life prediction models and calculations are essential. Specifications must to be performance based as opposed to their present form of being prescription based.

II. Construction Practices

It is acknowledged that wastage in the construction industry is as high as 30%. That means at the current valuation, we are talking about the wastage to the tune of Rs.1200 billion or \$27 billion in India. This is in itself a large, yet relatively simple and straight forward challenge to tackle.

These wastages are activities that absorb resources, man hours and materials but create no

value. Most developed countries have different forums / institutes / researchers / academic institutions for seeking solutions to mitigate these wastages and lean construction practices that emerged have yielded encouraging. Lean construction is a "way to design production systems to minimize waste of materials, time and efforts in order to generate the maximum possible value". While some novel initiatives are being taken in some parts of India to adopt leaner construction practices, India does not have a fully focused lean construction forum. Creation of an industry consortium or lean construction forum may be a good beginning.

III. Material Conservation and Selection

Concrete is the largest synthesized material which has a per capita consumption of 1.5 tons per annum in India. Presence of concrete is all pervading simply because it has the capacity to utilize locally available ingredients, develop adequate engineering properties for a variety of applications, easily adapt to any shape and size and has comparatively low initial and maintenance costs. While concrete not be as big of an energy consumer as structural steel, aluminum and glass; concrete and particularly cement still remains a major energy 'sink' due to its sheer volume of production and also environmentally unsustainable due to large quantities of CO₂ evolution associated with its manufacture. Raw materials for cement manufacture include non renewable natural resources like lime stone, aggregates, manufactured sands (fine aggregates), and so on. Hence the Indian concrete Industry needs to take a fresh look at these challenges. Some of the problems faced by Indian concrete industry towards achieving sustainability in concrete utilization are as follows:

A. Increase the use of fly ash and other cement substitutes – Studies indicate that by 2020 the economically feasible stocks of prospectable lime stone are going to be scarce. India has a reasonable availability of by-products like fly ash and GGBFS, and while this helps to an extent to lengthen the period of smooth supply of lime stone. India produces approximately 130 million tons of fly ash out of which only 35-40% is utilized. In another ten years, this production is going to double to more than 250 million tons.

B. Use of manufactured sand - Aggregate scarcity is the biggest concern today in India. On environmental grounds, there have been strict dredging restrictions from various local authorities pertaining to taking out sea sand as well as river sand. This position is more prevalent in the states of central and southern part of India. In northern India, especially in the Indo-Gangetic plains, good quality sand (FA) is available in plenty. However, due to the alluvial terrain of this region coarse aggregates are not easily available. This challenge manifests on the opposite form in central & southern India where availability of good quality fine aggregate is a constraint.

Hence the answer is to use manufactured sand which is artificially produced from rock, using a vertical shaft Impactor (VSI). VSI based manufactured sand is made by subjecting rock to operations like impact and cleavage attrition and typically results in consistently good quality products having uniform gradation and shape. This sand contains less organic and inorganic impurities too along with lesser chlorides and sulfates. As a result of lower levels of silt, clay and crusher fines there is a reduction in water demand thus improving strength and durability of the concrete. This also will reduce cement contents. As a result of less cement, fines and water in the concrete, shrinkage cracking can be reduced to enhance durability and thus sustainability. Additionally, there is substantial environmental benefit, in that the natural terrains of river basins are not disturbed too.

However, in India as of today, there are totally convenient misconceptions about manufactured sand. Manufactured sand is mistakenly equated with crushed rock fines (CRF) which is a byproduct of rock crushing to obtain coarse aggregates. CRF is a byproduct of primary and secondary crushing involving use of jaw crushers or cone crushers. Many concrete producers knowingly and unknowingly use CRF in concrete and that includes major ready mixed concrete manufacturers as well. This is obviously done due to acute shortage of river sand and also to overcome the grading deficiencies in river sand. In the days of "use whatever you get" at many places in metropolitan cities, sand received from nearby rivers is very coarse in nature, with

fineness modulus exceeding 4. Such coarse sand is unable to produce a cohesive mix, unless it is supplemented with inert fines such as CRF. This in turn necessitates the use of excess water, creating invariably defective concrete endangering the structure's durability right at its birth. Thus India needs to switch over to using VSI manufactured sand as opposed to CRF, or we risk hampering the growth of the industry will due to under performance of the concrete thereby endangering the sustainability.

C. Use of lightweight aggregates - In India, natural lightweight aggregates are not available. The focus then moved to the use of synthetic light weight aggregate. Lightweight aggregates can be produced by sintering waste product like fly ash. There are several examples of the use of these aggregates in structural lightweight aggregate concrete, with compressive strengths ranging from 20-50 MPa (Clarke J B, Structural lightweight aggregate concrete, Chapman & Hall, 1993 U.K.) The use of sintered fly ash sounds to be a good possibility in India as fly ash is available here in abundance. Yet another reason to use lightweight aggregate is that almost 70 to 80% of India has become prone to earthquake and thus to reduce the self-weight of various structural elements of a building bridge or any other structure can be substantially reduced enhancing economy as well as safety.

D. Demolition and Recycling

In India, the use of recycled aggregates has not been adequately explored. Reportedly, the construction and demolition waste has substantially increased as new super structures are being built on land after tearing down the smaller structures that previously existed. It is estimated that the construction industry in India generates about 10-12 million tons of waste annually. Projections for building materials requirement of the housing sector indicate a shortage of aggregates of about 55,000 million cu. m. An additional 750 million cu.m. of aggregates would be required for achieving the targets of the road sector. Recycling of aggregate material from construction and demolition waste may reduce the demand-supply gap in both these sectors. There is also an increasing-acute shortage of dumping grounds and landfills particularly in metropolitan cities. SERC, Ghaziabad had taken up a pilot R&D project on

Recycling and Reuse of Demolition and Construction Wastes in Concrete for Low Rise and Low Cost Buildings in mid nineties with the aim of developing techniques/methodologies for use of recycled aggregate concrete in construction. The experimental investigations were carried out in Mat Science laboratory and Institutes around Delhi/GZB to evaluate the mechanical properties and durability parameters of recycled aggregate concrete made with recycled coarse aggregate collected from different sources. Also, the suitability in construction of buildings has been studied.

The properties of recycled aggregates have been established and demonstrated through several experimental and field projects successfully. It has been concluded that recycled aggregates can be readily used in construction of low rise buildings, concrete paving blocks & tiles, flooring, retaining walls, approach lanes, sewerage structures, sub base course of pavements, drainage layer in highways, dry lean concrete(DLC) etc.

E. Energy Conservation

Since sources of good quality, aggregates are fast depleting, the concrete industry in India needs to prepare itself to use locally available 'marginal' aggregates. The use of local materials helps reduce the carbon footprint associated with transport. Thus, from sustainability angle, the emphasis should be placed on using locally-available aggregates, even if there are small deficiencies in their quality. It has been amply demonstrated that desired properties of concrete can be obtained by intelligent blending of available aggregates with crushed sand, inert fillers, supplementary cementitious materials and chemical admixtures.

Another important issue is that river sand and other construction materials are usually transported by road. India has a well developed and efficient rail and water transport system that need to be leveraged by the construction industry. This is not only more sustainable option but also most cost effective.

Why now is the best time to enter India? Investment opportunities in India

Construction development in residential, retail, commercial and hospitality sectors

- Technologies and solutions for smart sustainable cities and integrated townships.
- Technologies for the promotion of low cost and affordable housing.
- Green building solutions.
- Sustainable and environmentally friendly building materials.
- Training and skill development of construction sector workers.
- Smart cities, Urban water supply, urban sewerage and sewage treatment.
- FDI Policies 100% FDI through the automatic route is permitted in townships, housing, built-up infrastructure, and construction-development projects (including, but not restricted to housing, commercial premises, hotels, resorts, hospitals, educational institutions, recreational facilities, city and regional level infrastructure).
- The major conditions under which foreign investment can be made in this sector are: A minimum capitalization of USD 10 Million is envisaged for wholly-owned subsidiaries and USD.
- 5 Million for joint ventures with Indian partners. The funds will have to be brought in within six months of date commencement of business of the company. 100% FDI is allowed under the automatic route for urban infrastructure areas like urban transport, water supply, sewerage and sewage treatment subject to relevant rules and regulations.
- FDI policy for Industrial Parks 100% FDI is allowed under the automatic route. 'Industrial Park' is a project in which quality infrastructure in the form of plots of developed land or built-up space or a combination with common facilities is developed and made available to all the allottee units for the purposes of industrial activity. FDI in industrial parks is not subject to the conditionalities applicable for construction development projects etc., provided the industrial parks meet with the under-mentioned conditions

Top Reasons to Invest in India

1. **Size of India** India's GDP is currently US\$1.3 trillion, making it the 8th largest economy in the world. However, in PPP terms, which recognizes India's low cost base, the GDP notionally rises to three times this amount (US\$3.8 trillion) which places it on a similar size to Japan and, by 2013, it will become the third largest economy in the world (after the USA and China) in PPP terms. However, despite representing 7.5% of Global GDP (on a PPP basis) in 2010, India attracts less than 0.5% of investment inflows. An anomaly which is unlikely to continue for much longer!
2. **Economic growth** India's economy is currently growing by 8.75% per annum (in 2010) and this GDP growth rate is expected to increase to 9% - 10% per annum for each of the next 10 years. India's GDP will grow five times in the next 20 years, and GDP per capita will almost quadruple.
3. **Diversity:** The Indian economy offers investors exposure to a wide range of opportunities from consumer goods and pharmaceuticals to infrastructure, energy and agriculture. With its strong services sector (comprising 50% of India's economy), particularly in knowledge-based services (IT, software and business services) India has proved that industrialization and the export of commodities and resources is not the only path to rapid economic development.
4. **Demographics:** India is one of the youngest countries in the world, with an average age of 25 and likely to get younger. India's working-age population will increase by 240 million over the next 20 years. With a population of 1.2 billion, a strong work ethic, high levels of education, democracy, English language skills and an entrepreneurial culture, India is poised to dominate the global economy in the next 20 years.

5. High Savings: With a savings rate of 37% of GDP, India's domestic savings fuels most of its investment requirements, and only 20% of India's total public debt is sourced from foreign borrowing. With significant investment to be made in upgrading India's poor infrastructure in the next 10 years (estimated to be US\$1.7 trillion) India's Government is taking various steps to further encourage private and foreign investments.
6. Domestic economy: India's domestic consumption, generally led by the private sector, has played a significant role in India's growth and is expected to remain firm as more people enter the workforce and the emerging middle classes. India's wealthiest consumers (those earning US\$1m or more in PPP terms) will increase by 40 million in the next 10 years! Every sector within India's consumer market is booming, making India far less vulnerable to external shocks and pressures than other emerging markets.
7. A robust financial sector: India has a robust, diversified and well regulated financial system which has allowed it to weather the global financial crisis without any major difficulties and present an image of quality, resilience and transparency. India's banking sector is strong, with top quality balance sheets, high levels of competition (there are around 80 banks in India) and strong corporate governance.
8. Quality of Investment Markets: The Bombay Stock Exchange is the second oldest in the world (165 years) and offers investors a low cost, highly efficient, modern and well governed environment in which to prosper from India's extraordinary economic growth. The Indian stock market has generated investment returns of over 15% per annum for the last 10 years and experts expect this rate to increase in the next decade. More significantly perhaps, Indian investors have doubled.

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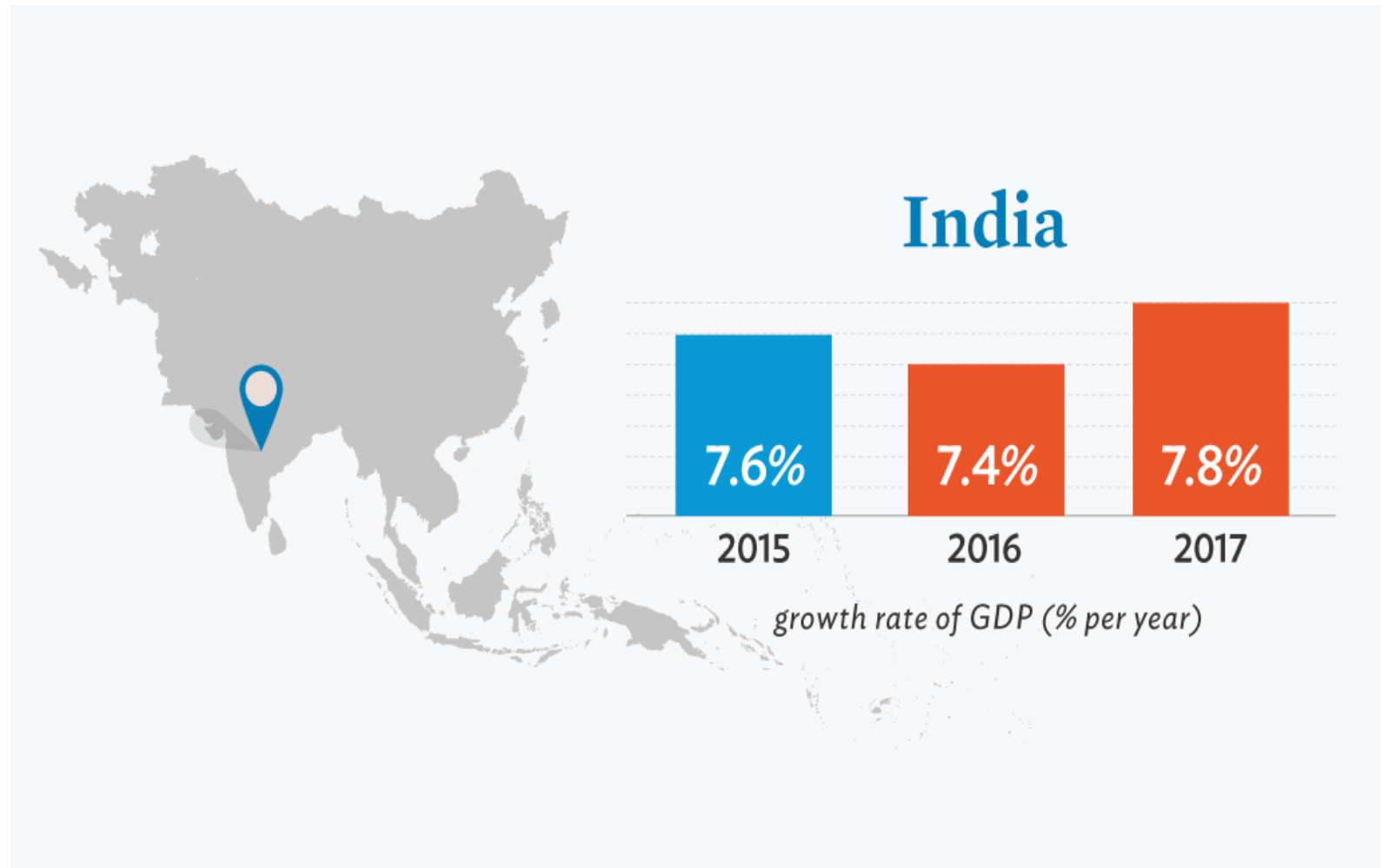
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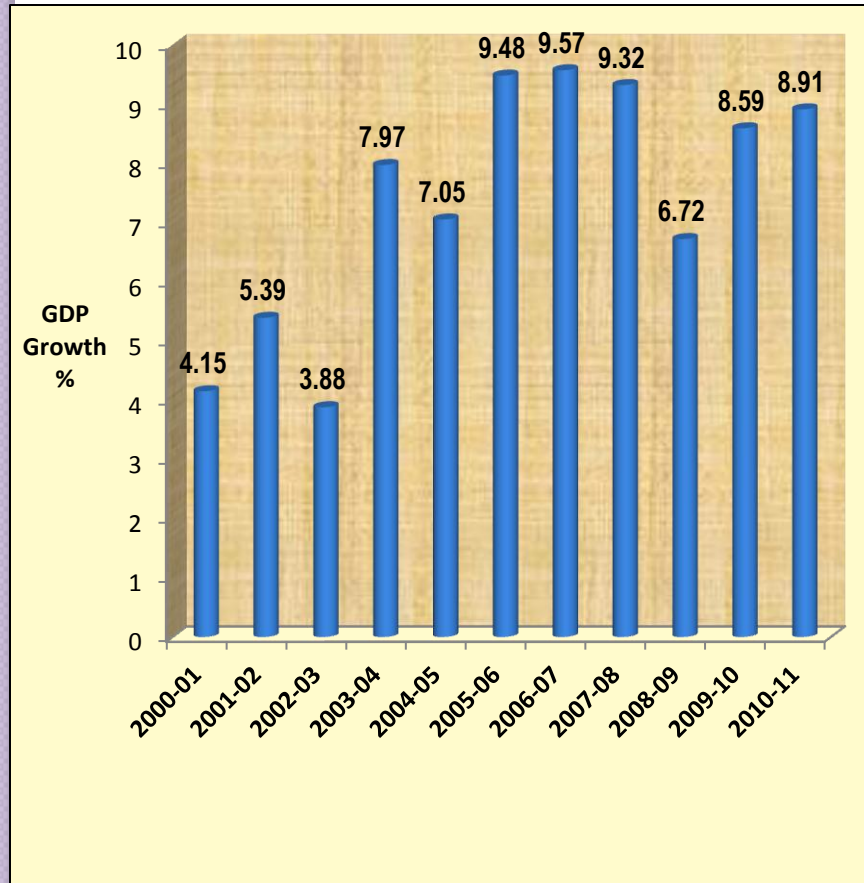


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Growth rate GDP

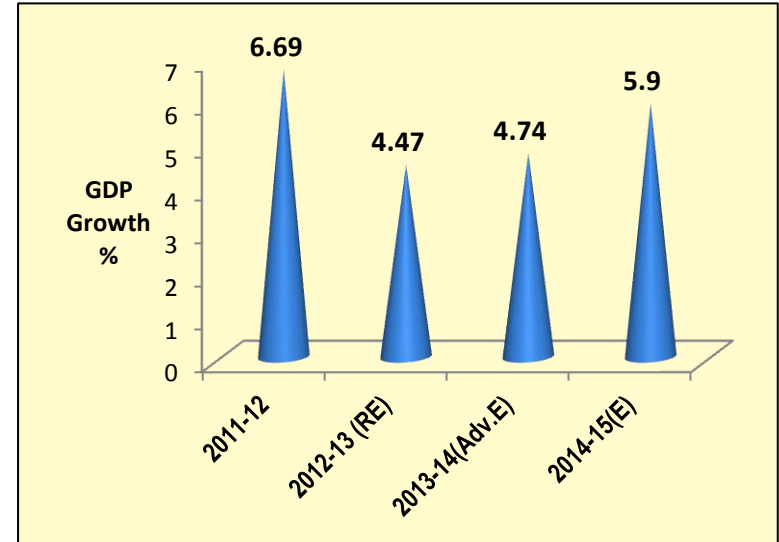


India's Growth (con'd)

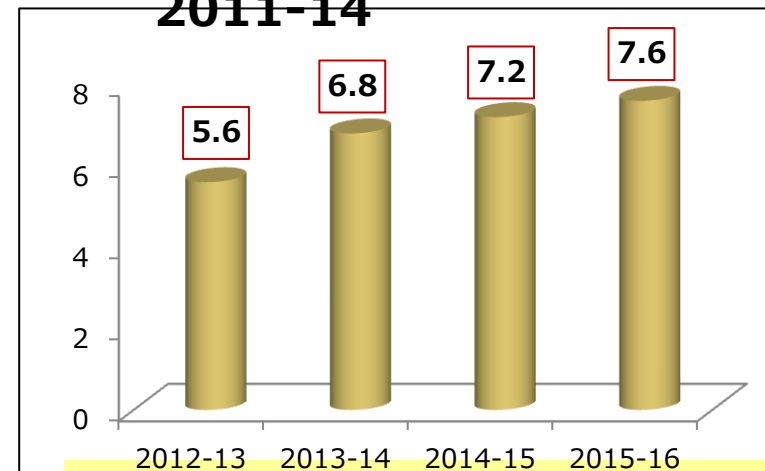


Real GDP Growth (Factor Cost)

Source: Ministry of Statistics and Program Implementation



Economic Slow Down 2011-14



Revised GDP: 2012-16

India's Growth (con'd)



Recent Positive Turn

- Inflation slows down
- Reduction in oil prices
- Fiscal deficit under control
- Stable government at national level
- Business sentiments vastly improved

Projected Growth Rates: India, China and World

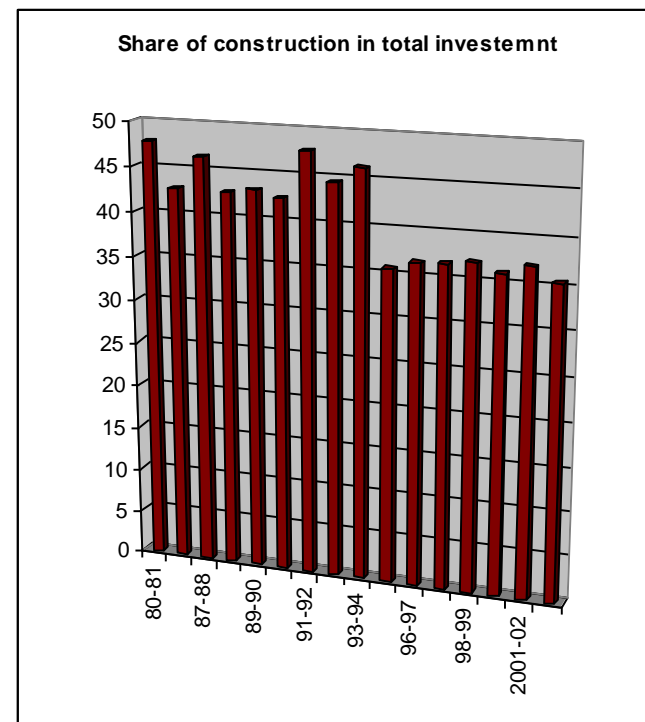
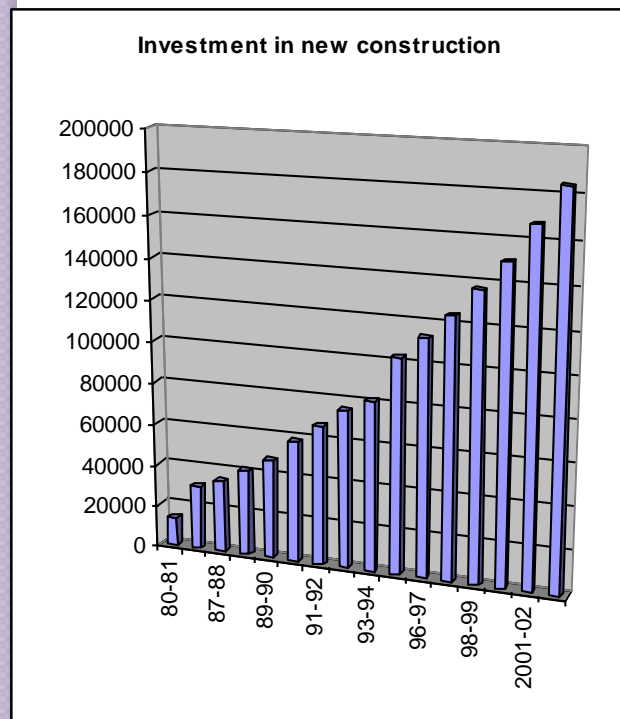
Year	2012	2013	2014 (E)	2015 (F)	2015(F)	2017(F)
India	4.7	5	5.6	6.4	7	7
China	7.7	7.7	7.4	7.1	7	6.9
World	2.4	2.5	2.6	3	3.3	3.2

Source : Global Economic Prospects, World Bank Report 2015

Indian Construction Industry



- **Construction – Second largest activity after agriculture**
- **Employs 35 million people**
- **Indian Construction industry valued at US\$ 126 million – Ranked 3rd largest in the world**

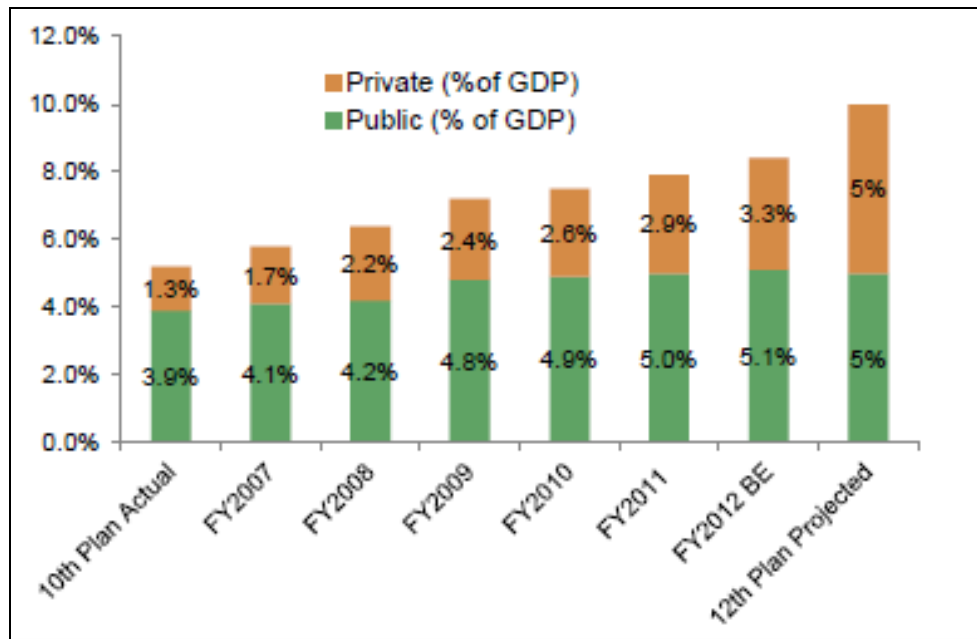


Source: NICMAR



Indian Construction Industry (con'd)

- 50% of demand for construction comes from Infrastructure
- US \$ 1,000 Billion investments planned for infrastructure during 2012-17
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100% increase in infrastructure investment over 11th Plan expenditure!



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- SBM aims at elimination of open defecation, eradication of manual scavenging, scientific Municipal Solid Waste Management, to effect behavioural change regarding healthy sanitation practices, generate awareness about sanitation and its linkage with public health, capacity augmentation for ULBs to create an enabling environment for private sector participation in Capex (capital expenditure) and Opex (operation and maintenance). The mission outlay is INR 62,009 crores. It covers all 4041 statutory towns.



Heritage City Development and Augmentation Yojana (HRIDAY):

- HRIDAY aims to preserve and revitalise the soul of an Indian heritage and reflect its unique character by encouraging aesthetically appealing, accessible, informative and secured environment and to undertaking strategic and planned development of heritage cities aimed at the overall improvement in quality of life with special focus on sanitation, security, tourism, heritage revitalisation and livelihoods retaining the city's cultural. It is a central sector scheme with 100% funding coming from Central Government. Initial Phase of the HRIDAY Scheme was launched in January, 2015 for a period of 27 months in twelve identified cities viz. 1) Ajmer 2) Amritsar 3) Amaravati 4) Badami 5) Dwarka 6) Gaya 7) Kanchipuram 8) Mathura 9) Puri 10) Varanasi 11) Velankanni 12) Warangal for development of the towns under the scheme with a total outlay of Rs. 500 crores.



The 12th five years plan projects an investment of 10% of the national GDP into infrastructure which equates to a staggering \$1 trillion or equivalently Rs.45 trillion.

INVESTMENT BOOST IN INFRASTRUCTURE THROUGH HIGHER PUBLIC FUNDING POSITIVE

Budgetary allocation: Total allocation for infrastructure has been increased by 1.5 times to INR 2.8 trillion (roads, railways and urban infrastructure the biggest beneficiaries).

Roads: Investments for development of national highways proposed to be hiked by 178% year-to year to INR 85,607 crore. A major portion of this increase will be funded by INR 4 per litre increase in road cess on petrol and diesel.



Railways: Total outlay raised by 52%, in the railway budget 2015-16, there have been many announcements of PPP projects in areas of coastal connectivity, gauge conversion, dedicated freight corridors (DFCs) and the Mumbai suburban rail. Funding availability: An INR 200 billion National investment and Infrastructure Fund to be set up for infrastructure finance companies to raise debt. The budget also provides for issuance of tax free bonds for roads, railways and irrigation projects, and aims to rationalize the tax regime for infrastructure investment trusts.

Other measures: The government's intent to table a Public Contracts (Settlement of Disputes) bill will help speedy redressal of disputes in large public projects and create a conducive environment for PPP projects. At a time when private sector interest in infrastructure development is low, the increase in budgetary support holds the potential to kick-start capital investments in the economy. Moreover, the significant increase in public funding for the roads sector has the potential to boost execution of national highway projects by about 5,800 km annually and create a robust construction opportunity for road engineering procurement & construction (EPC) companies. The Union Budget 2015 has proposed that the National Investment and Infrastructure Fund will create additional funding resources for private developers, over and above the rise proposed in public funding. Moreover, rationalisation of tax regime for Infrastructure Investment Trusts may help free up private capital currently locked in completed projects



Reasons to invest: An investment of USD 1,000 Billion has been projected for the infrastructure sector until 2017, 40% of which is to be funded by the private sector. 40% of infrastructure investment will be funneled into construction activity and 20% set to modernize the construction industry. The Indian government has undertaken a number of measures to ease access to funding for the sector. Construction activities contribute more than 10% of India's GDP. The construction industry in India has seen sustained demand from the industrial and real estate sector. An estimated USD 650 Billion will be required for urban infrastructure over the next 20 years. Housing for seniors has seen increased interest levels from corporates, the hospitality and healthcare industries over the last few years.

Drivers for Sustainability

GHG emissions, climate change and sustainability are at stake. It is estimated that GHG emissions would increase from 2 billion tons to 6-7 billion tons of CO₂ in 2030.

In mapping out sustainable practices that India must adopt a "cradle to grave" analysis is required. And for this we need to have a total approach than a patch work point system or a grade based certification system. In order to have a comprehensive plan for sustainable construction, every structure may be thought about based on the following parameters:



Planning, design and specifications based on performance and service life
Construction Practices
Material Conservation and Selection
Demolition and recycling
Energy Conservation

I. Planning, Design and specifications

Structures in India are designed well however so far in most specifications, there is no reference to any service life or calculations thereof. To this effect, deeper study of various service life prediction models and calculations are essential. Specifications must to be performance based as opposed to their present form of being prescription based.

II. Construction Practices

It is acknowledged that wastage in the construction industry is as high as 30%. That means at the current valuation, we are talking about the wastage to the tune of Rs.1200 billion or \$27 billion in India. This is in itself a large, yet relatively simple and straight forward challenge to tackle.



These wastages are activities that absorb resources, man hours and materials but create no value. Most developed countries have different forums / researchers / academic institutions for seeking solutions to mitigate these wastes. Lean construction practices that emerged have yielded encouraging results. Lean construction is a "way to design production systems to minimize waste of materials, time and efforts in order to generate the maximum possible value". While some novel initiatives are being taken in some parts of India to adopt leaner construction practices, India does not have a fully focused lean construction forum. Creation of an industry consortium or lean construction forum may be a good beginning.

III. Material Conservation and Selection

Concrete is the largest synthesized material which has a per capita consumption of 1.5 tons per annum in India. Presence of concrete is all pervading simply because it has the capacity to utilize locally available ingredients, develop adequate engineering properties for a variety of applications, easily adapt to any shape and size and has comparatively low initial and maintenance costs. While concrete not be as big of an energy consumer as structural steel, aluminum and glass; concrete and particularly cement still remains a major energy 'sink' due to its sheer volume of production and also environmentally unsustainable due to large quantities of CO₂ evolution associated with its manufacture. Raw materials for cement manufacture include non renewable natural resources like lime stone, aggregates, manufactured sands (fine aggregates), and so on. Hence the Indian concrete Industry needs to take a fresh look at these challenges.



Some of the problems faced by Indian concrete industry towards sustainability in concrete utilization are as follows:

A. Increase the use of fly ash and other cement substitutes – Studies indicate that by 2020 the economically feasible stocks of prospectable lime stone are going to be scarce. India has a reasonable availability of by-products like fly ash and GGBFS, and while this helps to an extent to lengthen the period of smooth supply of lime stone. India produces approximately 130 million tons of fly ash out of which only 35-40% is utilized. In another ten years, this production is going to double to more than 250 million tons.

B. Use of manufactured sand - Aggregate scarcity is the biggest concern today in India. On environmental grounds, there have been strict dredging restrictions from various local authorities pertaining to taking out sea sand as well as river sand. This position is more prevalent in the states of central and southern part of India. In northern India, especially in the Indo-Gangetic plains, good quality sand (FA) is available in plenty. However, due to the alluvial terrain of this region coarse aggregates are not easily available. This challenge manifests on the opposite form in central & southern India where availability of good quality fine aggregate is a constraint.



Hence the answer is to use manufactured sand which is artificially produced from rock, using a vertical shaft Impactor (VSI). VSI based manufactured sand is made by subjecting rock to operations like impact and cleavage attrition and typically results in consistently good quality products having uniform gradation and shape. This sand contains less organic and inorganic impurities too along with lesser chlorides and sulfates. As a result of lower levels of silt, clay and crusher fines there is a reduction in water demand thus improving strength and durability of the concrete. This also will reduce cement contents. As a result of less cement, fines and water in the concrete, shrinkage cracking can be reduced to enhance durability and thus sustainability. Additionally, there is substantial environmental benefit, in that the natural terrains of river basins are not disturbed too.

However, in India as of today, there are totally convenient misconceptions about manufactured sand. Manufactured sand is mistakenly equated with crushed rock fines (CRF) which is a byproduct of rock crushing to obtain coarse aggregates. CRF is a byproduct of primary and secondary crushing involving use of jaw crushers or cone crushers.



Many concrete producers knowingly and unknowingly use CRF in concrete and that includes major ready mixed concrete manufacturers as well. This is obviously done due to acute shortage of river sand and also to overcome the grading deficiencies in river sand. In the days of "use whatever you get" at many places in metropolitan cities, sand received from nearby rivers is very coarse in nature, with fineness modulus exceeding 4. Such coarse sand is unable to produce a cohesive mix, unless it is supplemented with inert fines such as CRF. This in turn necessitates the use of excess water, creating invariably defective concrete endangering the structure's durability right at its birth. Thus India needs to switch over to using VSI manufactured sand as opposed to CRF, or we risk hampering the growth of the industry will due to under performance of the concrete thereby endangering the sustainability.

C. Use of lightweight aggregates - In India, natural lightweight aggregates are not available. The focus then moved to the use of synthetic light weight aggregate. Lightweight aggregates can be produced by sintering waste product like fly ash. There are several examples of the use of these aggregates in structural lightweight aggregate concrete, with compressive strengths ranging from 20-50 MPa (Clarke J B, Structural lightweight aggregate concrete, Chapman & Hall, 1993 U.K.) The use of sintered fly ash sounds to be a good possibility in India as fly ash is available here in abundance. Yet another reason to use lightweight aggregate is that almost 70 to 80% of India has become prone to earthquake and thus to reduce the self-weight of various structural elements of a building bridge or any other structure can be substantially reduced enhancing economy as well as safety.

D. Demolition and Recycling

In India, the use of recycled aggregates has not been adequately explored. Reportedly, the construction and demolition waste has substantially increased as new super structures are being built on land after tearing down the smaller structures that previously existed. It is estimated that the construction industry in India generates about 10-12 million tons of waste annually. Projections for building materials requirement of the housing sector indicate a shortage of aggregates of about 55,000 million cu. m. An additional 750 million cu.m. of aggregates would be required for achieving the targets of the road sector.

Recycling of aggregate material from construction and demolition waste may reduce the demand-supply gap in both these sectors. There is also an increasing-acute shortage of dumping grounds and landfills particularly in metropolitan cities. SERC, Ghaziabad had taken up a pilot R&D project on Recycling and Reuse of Demolition and Construction Wastes in Concrete for Low Rise and Low Cost Buildings in mid nineties with the aim of developing techniques/methodologies for use of recycled aggregate concrete in construction. The experimental investigations were carried out in Mat Science laboratory and Institutes around Delhi/GZB to evaluate the mechanical properties and durability parameters of recycled aggregate concrete made with recycled coarse aggregate collected from different sources. Also, the suitability in construction of buildings has been studied.

The properties of recycled aggregates have been established and demonstrated through several experimental and field projects successfully. It has been concluded that recycled aggregates can be readily used in construction of low rise buildings, concrete paving blocks & tiles, flooring, retaining walls, approach lanes, sewerage structures, sub base course of pavements, drainage layer in highways, dry lean concrete(DLC) etc.



E. Energy Conservation

Since sources of good quality, aggregates are fast depleting, the concrete industry in India needs to prepare itself to use locally available 'marginal' aggregates. The use of local materials helps reduce the carbon footprint associated with transport. Thus, from sustainability angle, the emphasis should be placed on using locally-available aggregates, even if there are small deficiencies in their quality. It has been amply demonstrated that desired properties of concrete can be obtained by intelligent blending of available aggregates with crushed sand, inert fillers, supplementary cementitious materials and chemical admixtures.

Another important issue is that river sand and other construction materials are usually transported by road. India has a well developed and efficient rail and water transport system that need to be leveraged by the construction industry. This is not only more sustainable option but also most cost effective.



Why now is the best time to enter India? Investment opportunities in India

Construction development in residential, retail, commercial and hospitality sectors

Technologies and solutions for smart sustainable cities and integrated townships.

Technologies for the promotion of low cost and affordable housing.
Green building solutions.

Sustainable and environmentally friendly building materials.

Training and skill development of construction sector workers.

Smart cities, Urban water supply, urban sewerage and sewage treatment.

FDI Policies 100% FDI through the automatic route is permitted in townships, housing, built-up infrastructure, and construction-development projects (including, but not restricted to housing, commercial premises, hotels, resorts, hospitals, educational institutions, recreational facilities, city and regional level infrastructure).



The major conditions under which foreign investment can be made in this sector are: A minimum capitalization of USD 10 Million is envisaged for wholly-owned subsidiaries and USD.

5 Million for joint ventures with Indian partners. The funds will have to be brought in within six months of date commencement of business of the company. 100% FDI is allowed under the automatic route for urban infrastructure areas like urban transport, water supply, sewerage and sewage treatment subject to relevant rules and regulations.

FDI policy for Industrial Parks 100% FDI is allowed under the automatic route. 'Industrial Park' is a project in which quality infrastructure in the form of plots of developed land or built-up space or a combination with common facilities is developed and made available to all the allottee units for the purposes of industrial activity. FDI in industrial parks is not subject to the conditionalities applicable for construction development projects etc., provided the industrial parks meet with the under-mentioned conditions



Top Reasons to Invest in India

Size of India India's GDP is currently US\$1.3 trillion, making it the 8th largest economy in the world. However, in PPP terms, which recognizes India's low cost base, the GDP notionally rises to three times this amount (US\$3.8 trillion) which places it on a similar size to Japan and, by 2013, it will become the third largest economy in the world (after the USA and China) in PPP terms. However, despite representing 7.5% of Global GDP (on a PPP basis) in 2010, India attracts less than 0.5% of investment inflows. An anomaly which is unlikely to continue for much longer!

Economic growth India's economy is currently growing by 8.75% per annum (in 2010) and this GDP growth rate is expected to increase to 9% - 10% per annum for each of the next 10 years. India's GDP will grow five times in the next 20 years, and GDP per capita will almost quadruple.



Diversity: The Indian economy offers investors exposure to a wide range of opportunities from consumer goods and pharmaceuticals to infrastructure, energy and agriculture. With its strong services sector (comprising 50% of India's economy), particularly in knowledge-based services (IT, software and business services) India has proved that industrialization and the export of commodities and resources is not the only path to rapid economic development.

Demographics: India is one of the youngest countries in the world, with an average age of 25 and likely to get younger. India's working-age population will increase by 240 million over the next 20 years. With a population of 1.2 billion, a strong work ethic, high levels of education, democracy, English language skills and an entrepreneurial culture, India is poised to dominate the global economy in the next 20 years.



High Savings: With a savings rate of 37% of GDP, India's domestic savings fuels most of its investment requirements, and only 20% of India's total public debt is sourced from foreign borrowing. With significant investment to be made in upgrading India's poor infrastructure in the next 10 years (estimated to be US\$1.7 trillion) India's Government is taking various steps to further encourage private and foreign investments.

Domestic economy: India's domestic consumption, generally led by the private sector, has played a significant role in India's growth and is expected to remain firm as more people enter the workforce and the emerging middle classes. India's wealthiest consumers (those earning US\$1m or more in PPP terms) will increase by 40 million in the next 10 years! Every sector within India's consumer market is booming, making India far less vulnerable to external shocks and pressures than other emerging markets.



A robust financial sector: India has a robust, diversified and well regulated financial system which has allowed it to weather the global financial crisis without any major difficulties and present an image of quality, resilience and transparency. India's banking sector is strong, with top quality balance sheets, high levels of competition (there are around 80 banks in India) and strong corporate governance.

Quality of Investment Markets: The Bombay Stock Exchange is the second oldest in the world (165 years) and offers investors a low cost, highly efficient, modern and well governed environment in which to prosper from India's extraordinary economic growth. The Indian stock market has generated investment returns of over 15% per annum for the last 10 years and experts expect this rate to increase in the next decade. More significantly perhaps, Indian investors have doubled.

Amaravati, the dream capital of Andhra Pradesh



➤ An area covering 30 villages between Vijayawada and Guntur, some 35 km away from Amaravati town. For, this is the only place where the Krishna flows north instead of east or south.

The Andhra Pradesh government, through the AP Capital Region Development Authority, got some 30,000 acres of land .

The seed capital development area will cover 16.7 sq km and comprise the AP Legislative Assembly, Legislative Council, High Court, Secretariat, Raj Bhavan, quarters for the ministers and officials, and the township for government officials.

Expected to be completed by 2018-19, the Seed Capital Area (SCA) will be home to about 3 lakh residents.

The business hub is expected to generate about 7 lakh jobs in various sectors, including government. There will be a thriving, state of the art, Central Business District (CBD) for business and living



The master plan envisages nodes and corridors for a transit-oriented development approach.

- So, there will be an integrated network of 12km of Metro railways,
- 15km of Bus Rapid Transit systems,
- 7km of downtown roads,
- 26km of arterial and sub-arterial roads
- 53km of collector roads.

The city has been split into the CBD, residential townships, institutions, parks and gardens, water bodies, recreational spaces, waterfront etc. The city will be planned on sustainable development principles, with extensive, open green spaces, to add value to the urban ecosystem.

A regional expressway and an outer regional expressway will connect various towns to the core capital region. A dedicated freight corridor will connect with highways leading to New Delhi via Hyderabad. National Waterway 4 proposed to be developed on Wazirabad-Vijayawada-Vodarevu Port and Wazirabad-Vijayawada-Rajahmundry-Kakinada routes connecting other places via rivulets and canals. An airport planned at Mangalagiri, and five corridors will have high-speed railways. The more-or-less smooth acquisition of 32,000 acres of land from farmers by the Mr N Chandrababu Naidu government to build Amaravati, the new capital of Andhra Pradesh

*Thank
you*



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activities, please visit www.cidc.in**