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Sustainable development A Rethinking of Construction Industry in India

B. M. Kataria[1], V. B. Pathak[2], Dr.J. A. Shah[3]

PG student, Dept. of Civil Engineering, S.N.P.I.T. & R.C.,Umrakh, India[1]

Assistant Professor, Dept. of Civil Engineering,S.N.P.I.T. & R.C.,Umrakh, India[2]

Professor, Dept. of Civil Engineering, S.N.P.I.T. & R.C.,Umrakh, India[3]

Abstract: This review brings together research on available alternatives and implementations required for Sustainable development. More than ever, Construction industry of India is concerned with improving the social, economic and environmental indicators of sustainability. We know that we are endangering the future of forth coming generations by leaving depleted resources or no resources. Hence, an active effort is extremely essential by construction industry of India along with participation of all the institutions, professional bodies, academicians, industry as well as government for sustainable development and hence leave resources for the future generation to satisfy their needs. This paper provides possible aspect where and how sustainability can be adopted and implemented and/or incorporated for sustainable development.

Keywords:Construction industry**,** Energy conservation, innovation, manufactured sand, material conservation, planning design and specification, sustainability, sustainable development

I. INTRODUCTION

India's construction sector is assessed at Rs.4000 billion or $100 billion. As a result of government spending, private investments as well as foreign direct investment, has made India number one of the top ten spending nations on construction in the world. We manufacture more than 250 million tons of cement and are second only to China. A recent report "Global Construction 2020", estimates that India will be the third largest global construction market after China and USA.

In order to improve the standard of living of population, one of the key hurdles that faces today's India is to overcome the challenge of infrastructure bottlenecks. Government of India is spending 9% of the GDP to infrastructure projects. The National Planning commission has estimated an allocation of $515 billion which is equivalent to Rs.30 trillion to infrastructure sectors over the next five years. This includes construction of Roads, Highways, Airports, Bridges, Ports, Railways as well as water supply and sanitation amongst few others.

The 13th five years plan projects an investment of 10% of the national GDP into infrastructure which equates to a staggering $1 trillion or equivalently Rs.60 trillion.

II. WHAT IS SUSTAINABLE DEVELOPMENT?

"Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

According to Global Reporting Initiative guidelines, sustainability performance measurement is based on:

- **a.** Economic factors, or "an organization's impacts on the economic circumstances of its stakeholders and on economic systems at the local, national and global levels."
- **b.** Social factors, or "an organization's impacts on social systems within which it operate - including impacts on stakeholders at the local, national and global levels."
- **c.** Environmental factors, or "an organization's impacts on living and non-living natural systems, including ecosystems, land, air and water."

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III. WHY SUSTAINABILITY IS REQUIRED IN CONSTRUCTION INDUSTRY?

While India is preparing to achieve these growth plans with enthusiasm, it is essential that the country should analyse and take into account the price that the future populations of the world and India will have to pay in return if this growth takes place without adequate thought to sustainability. Should we consume all our energy, materials, and water resources without considering for the needs of our children and grandchildren? The future of the world and our nation is at stake due to Obvious GHG emissions, climate change and sustainability. It is estimated that GHG emissions would increase from 2 billion tons to 6-7 billion tons of CO_2 in 2030.

Some of us may question why India must slow down its pace of development and pay for the sins of already developed and industrialized Western nations. Clearly, the OECD or the industrialized countries must take the lead in mitigating climate change, reducing greenhouse gas emissions, but also large developing countries such as India and China will also have to start to reduce their emissions over the next 20 to 30 years if we truly want to give our children a chance at a future. Developing countries with large emissions should have some responsibility, although differentiated and different from the industrialized world. While sustainable practices and products are perceived as counter Productive with the growth of GDP. Growth that is not sustainable is not true growth.

IV. HOW CAN WE INCORPORATE SUSTAINABILITY IN CONSTRUCTION INDUSTRY OF INDIA?

In considering sustainable practices that construction industry of India must adopt, an analysis is required for each stage of construction. And for this we need to have a grade based certification system or a comprehensive plan for sustainable construction of every structure in country. This can be done by considering sustainability at aspects as:

A) Planning, design and specifications
B) Current Practices in Construction Industry
C) Material Conservation and Selection
D) Use of Construction Demolition and recycled Material
E) Energy Conservation
F) Innovation
G) People

A. Planning, Design and specifications

At planning stage considerations should be given to minimize the use of energy in operational stage by effective utilization of nature.

In India, Structures are designed well but there is no reference to any service life in most specification. To effect sustainable development, deeper study of various service life prediction models and calculations are essential. To ensure better service life, Specifications must be performance based and not in their present form of being prescription based.

Also, Specifications should keep in view to use eco-friendly and sustainable materials and methods for sustainable development.

B. Current Practices in construction industry

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 30 % more money and resources to be used in construction industry in India. This is relatively simple but a large and straight forward challenge that required attention and must be tackled for sustainable and economic growth of Country.

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 to develop lean construction practices that can help to solve this problem. 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.

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C. Material Conservation and Selection

Concrete is the largest synthesized material which has a per capita consumption of 1.5 tons per annum in India. Concrete is widely used 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.

Though concrete is not a big energy consumer as structural steel, aluminium and glass; concrete and particularly cement still remains a major energy 'sink' due to its large volume of production and also environmentally unsustainable due to large quantities of CO_2 emission associated with its manufacture. Raw materials for concrete include non-renewable natural resources like lime stone aggregates, River sand and aggregate etc.

The sustainable development options in this concept are:

1. **Increase the use of fly ash and other cement substitutes** – Studies indicate that by 2020 the economically feasible stocks of lime stone are going to be scarce. India has a reasonable availability of by-products like fly ash which faces environmental problem for it's disposal. Fly ash can helps to an extent to lengthen the period of smooth supply of cement and hence lime stone if utilized in concrete. 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 or more than 250 million tons. If we can find a way to utilize considerable amount of fly ash in concrete and construction industry, it will lead to sustainable and economic growth.

   Also cement substitutes such as Metakaolin, Hypo-sludge, GGBFS, Rice husk ash, Bagasse ash etc. shall be given consideration for sustainable development.
2. **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, 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 sulphates. 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.Foundry sand from industry can also provide an option for river sand in construction industry for sustainability.
3. **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 using waste product like fly ash and use of this fly ash based synthetic aggregates 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. Use of Construction demolition and Recycled aggregates

In India, the use of recycled aggregates has not been adequately explored. At present, 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.

Recycling of aggregate material from construction and demolition waste may reduce the demand of aggregates and also provide economical solution for small structures. There is also an increasing-acute shortage of dumping grounds and landfills particularly in metropolitan cities.

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.

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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.

F. Innovation

Innovation is the successful exploitation of new ideas to obtain competitive advantage. It is integral to developing new products for the market and new processes and ways of working. Greater sustainability should be at the heart of policy and of standards and procurement to provide the signals to which the industry can respond in an innovative and flexible manner.

The innovations in construction industry shall focus on sustainability as:

a. To reduce consumption of resources
b. To provide better ways of practices
c. To provide better product
d. To apply resource management in construction project

G. People

For sustainable development, people working in construction industry must be aware of importance of their work and for this they shall be equipped with necessary skills required. It is a basic need of industry in India as most labours in our country are not skilled and hence it's the major obstacle which needs to be tackle for sustainable development. Also, the safety is major issue in industry which requires attention.

This can be achieved by:

a. Development and promotion of skilled labours by providing initiatives.
b. Organising workshops and trainings for people of construction industry at each level.
c. Providing fully trained, qualified and competent workforce on all projects.
d. Reduce rate of accidents by implementing safety rules and training to work safe.
e. Developing awareness in various stake holders of construction industry about use of various waste which has potential of implementation for sustainability

V. CONCLUSION

1. India is a rapidly growing economy and hence the pressure on the use of natural resources is very heavy. There is an awakening about the words durability and then sustainability. Though the durability is understood to a point the real meaning and importance of sustainability is not fully comprehended by engineering fraternity as well as planners. Some scattered efforts are carried out in the form of academic experimentation; however, these efforts are in extreme primitive conditions.
2. We are endangering the future of forth coming generations by leaving depleted resources or no resources.
3. An active effort is extremely essential by construction industry of India along with participation of all the institutions, professional bodies, academicians, industry as well as government for sustainable development and hence leave resources for the future generation to satisfy their needs.
4. Authorities should provide incentives, motivations and regulation for construction industry to adopt Sustainable development.

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BIOGRAPHY

Bhavesh M. Katarriawas born in 1982 in Navsari, Valsad District of Gujarat. He received his Bachelor of Engineering degree in Civil Engineering from SardarVallabhbhai National Institute of Technology, Surat in 2004. He is pursuing his Master Degree in Construction Management from S.N.P.I.T. & R.C College, Umrakh; Gujarat Technological University.

Vyom B. Pathak was born in 1983 in Bardoli, Surat District of Gujarat. He received his Bachelor of Engineering degree in Civil Engineering from the Birla VishvakarmaMahavidyalaya, Sardar Patel University in 2005. He received his Master Degree in Structural Engineering from Sardar Patel University in 2007. He is Pursuing PhD. from SardarVallabhbhai National Institute of Technology, Surat. He is currently associated with Vidyabharti Trust as a head of Civil Material Testing and Consultancy Cell. He is Currently Working as an Assistant professor in S.N.P.I.T. & R.C. College, Umrakh in Civil Engineering Department. He has published Various National and International Papers in various Journals. He is also practicing as a consulting Structural Engineer in Bardoli since last 6 Years.

Dr. Jayesh A. Shah was born in 1971 in Anand District of Gujarat.Herecievedhis Bachelorof Engineering degree inCivil Engineering from the BirlaVishvakarmaMahavidyalaya, SardarPatel University in 1992. He received his Master Degree in 1999 from SVNIT, Surat. He received his PHD in 2012. At present he is working as a Principal in S.N.P.I.T. & R.C. College, Umrakh. He has published Various National and International Papers in various Journals.