

MINISTRY OF SCIENCE AND TECHNOLOGY MINISTRY OF EARTH SCIENCES MINISTRY OF HEALTH & FAMILY WELFARE GOVERNMENT OF INDIA



CSIR - NISTADS











"आत्मनिर्भर भारत और वैश्विक कल्याण के लिए विज्ञान"



Science for Self-Reliant India and Global Welfare



22nd- 25th December, 2020



विषय : पर्यावास (शहरी एवं ग्रामीण) Theme: Habitat (Urban & Rural)

> Proceedings and Recommendations



सीएसआईआर- केंद्रीय भवन अनुसंधान संस्थान, रुड़की, भारत CSIR- Central Building Research Institute, Roorkee, India





India International Science Festival -2020

Proceedings and Recommendations of HABITAT (URBAN & RURAL)

(22nd-25thDecember, 2020)

Editor

Dr. Ashok Kumar Principal Coordinator, Habitat (Urban & Rural), Chief Scientist & Head, Architecture & Planning and Mentor, Building Energy Efficiency, CSIR-CBRI, Roorkee

Disclaimer:

The thoughts, ideas and answers to the questions in different sessions given by the Panellists, Experts and Invited Speakers are based on their expertise, experience and knowledge-base.

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290



सबका साथ, सबका विकास, सबका विश्वास Sabka Saath, Sabka Vikas, Sabka Vishwas

य अन्संघान





डॉ हर्ष वर्धन Dr Harsh Vardhan

स्वास्थ्य एवं परिवार कल्याण, विज्ञान और प्रौद्योगिकी व पृथ्वी विज्ञान मंत्री, भारत सरकार Union Minister for Health & Family Welfare, Science & Technology and Earth Sciences Government of India

India has been the land of great Rishis and Munis who have fathomed deep scientific concepts in their spiritual pursuit to attain moksha. This scientific temper is evident in our ancient texts such as Vedas and Upanishads. Various ancient schools of science, medicine and mathematics are part of our rich heritage. Existence of premier international institutions such as Nalanda, Taxila and Vikramshila are symbolic of the pride we took in teaching the world about our ideas of Sciences. Many great scientific discoveries / advancements and technological achievements in the field of Mathematics, Astronomy, Architecture, Chemistry, Metallurgy and Medicine & Surgery have showcased excellence of our civilisation in Science & Technology to the world. Recently, in the COVID-19 pandemic, India has once again established itself as a pioneer in tackling the situation as well as in all fronts of scientific development, from testing kits to vaccine research.

India International Science Festival (IISF) is a celebration of Science and Technology by engaging with public from different cross-sections of our society and showcasing how Science, Technology, Engineering and Mathematics (STEM) are providing us with the solutions to improve our lives. It also educates our present generation as to how, over the centuries, India has been an inspiration for different countries in bringing new thoughts, ideas and novel innovations. IISF, launched in 2015, has, over the years, created a unique platform for inspiring curiosity and making learning more rewarding.

It is heartening to know that the 6th India International Science Festival (IISF) is being organized by Ministry of Science & Technology, Ministry of Earth Sciences and Ministry of Health & Family Welfare in association with Vijnana Bharati (VIBHA) during 22-25 December 2020 at New Delhi in virtual mode. I am sure that with use of digital platform, IISF will be able to bring together science loving people from the remotest

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-2-

corners of the country in a single click, thereby helping in fulfilling the objective of organising IISF.

I am happy to note that the number of events of IISF 2020 have increased from 28 to 41 covering many more important facets of Science, Technology and Innovation (STI) in tackling newer challenges that the world is grappling with today. The events are thoughtfully designed to ensure that not only are the STI advancements brought at the forefront but also to link them to History, Philosophy, Arts and Education. I hope that even the pre-existing events will grow richer in content and the new events will make the festival more holistic.

The proposed theme for IISF 2020: "Science for Self-Reliant India and Global Welfare" is very relevant in the present context when nation is looking towards Science & Technology for accelerating growth and for spearheading the vision of our Hon'ble Prime Minister of India Shri Narendra Modi ji of an "Atmanirbhar Bharat" playing "a bigger and more important role in the global economy".

I wish IISF 2020 a mega success in achieving its objectives and look forward to huge participation from all sections of the society.

(Dr. Harsh Vardhan)

Sido



डॉ. शोखर चिं. मांडे एपयतर. एफत्एससी. एफ्युनएएससी सचिव वैज्ञानिक और औद्योगिक अनुसंधान विभाग तथा महानिदेशक

Dr. Shekhar C. Mande FNA. FASe, FNASe Secretary Department of Scientific & Industrial Research and Director General



भारत सरकार विज्ञान और प्रौद्योगिकी मंत्रालय वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद वैज्ञानिक और औद्योगिक अनुसंधान विभाग

Government of India Ministry of Science and Technology Council of Scientific & Industrial Research Department of Scientific & Industrial Research



Message

It gives me immense pleasure to announce that the 6th India International Science Festival (IISF) 2020 is being jointly organized by Ministry of Science & Technology, Ministry of Earth Sciences and Ministry of Health & Family welfare in association with Vijnana Bharati (VIBHA) during 22-25 December 2020 at New Delhi in virtual mode. This year the Council of Scientific & Industrial Research (CSIR) is the coordinating organization for the festival.

The India International Science Festival (IISF) is a much-awaited annual event for students and science loving citizens from all spheres of life who look forward to gain new knowledge in the form of scientific developments and also creates opportunities for scientists, innovators and young researchers to interact, share their ideas and collaborate. It celebrates Science & Technology by showcasing how Science, Technology and Innovation had been instrumental in improving the quality of our lives which had from time to time directly or indirectly led to the progress of the nation.

This year, inspite of the pandemic situation of COVID-19, the IISF-2020 is being organized on a virtual platform which signifies the indomitable spirit of nurturing and celebrating scientific temperament amongst all stakeholders of Science, Technology and Innovation. I hope that the festival will ignite creativity in minds and instill the spirit of pursuing science for societal developments. The theme for this year IISF-2020 "Science for Self-Reliant India and Global Welfare" is expected to intensely deliberate on the role of Science, Technology and Innovation to build an Atmanirbhar Bharat and at the same time provide solutions to global problems.

I extend a very warm welcome to all the delegates from India and abroad to IISF-2020, which is being organized on a virtual platform for the first time.

[Shekhar C. Mande]

New Delhi November 5, 2020

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डॉ. एन. गोपालकृष्णन _{निदेशक}

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CSIR-Central Building Research Institute (A Constituent Establishment of CSIR) ROORKEE - 247 667 (INDIA)



Message

It is a matter of great pleasure that Habitat (Urban & Rural) Event of the India International Science Festival (IISF) 2020 is being organized by CSIR- CBRI, Roorkee during Dec. 22-25, 2020. As safe, secure, affordable, green and energy efficient habitat is vital for the prolific development of India, there are several challenges, which concerns the sustainability of both habitats and its habitants. The global pandemics like COVID-19 have highlighted the importance of innovative scientific approaches to be followed by planners, architects, building designers, and other stakeholders.

I am sure the deliberations of the Keynote Speakers, Panelists, Experts and Distinguished Invited Speakers, will be fruitful in identifying appropriate and innovative solutions to the ongoing problems and challenges. I am confident that the Conclusions of the Event will help in evolving an appropriate framework to understand the current as well as future trends, and the recommendations will act as a Roadmap for future research in the area of Habitat (Urban & Rural) for CSIR-CBRI.

I extend my heartiest greetings to the Principal Coordinator and the Coordinators. My best compliments to the Organizers of the Event.

I convey my sincere thanks to all the Dignitaries, Panelists, Experts and Invited Speakers, for their active participation. My best wishes to all the participants.

I wish the Event a grand success.

(Dr. N.Gopalakrishnan)

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PREFACE

From time immemorial, the habitats have been serving a much more important role in the lives of human beings; not just fulfilling the basic necessity of providing shelter but also physical and social infrastructure consisting of buildings, roads, water supply, and waste disposal systems, electricity etc. As safe, secure and affordable habitat for all is vital for the prolific progress and development of India; the habitats of today face a lot of challenges on multiple fronts, the most important of which concerns the sustainability of those habitats as well as its inhabitants. The emerging issues like climate change or the global pandemics like COVID-19, and other severe environmental problems like air & water pollution, water & energy shortage, traffic congestion, and sanitation due to increased urbanization; highlight the need to find effective and efficient solutions. The newly designed habitats are struggling with various issues arising from poorly conceived habitat design, based on Western concepts, while ignoring the environment, site conditions and ethos of Indian habitat design.

Therefore, the Habitat (Urban & Rural) Event of the IISF 2020, is being organized by CSIR- CBRI during Dec. 22-25, 2020. The main aim of the Event is to organize interactive programs including webinars, panel discussions, etc. and involve students through competitions, and general public to discuss and deliberate upon the challenges and issues faced, and develop a roadmap for sustainable habitats of the future. Therefore, there are forty-eight Panellists, Experts, Invited Speakers, along with Chief Guests and Guest of Honors in different sessions.

Scientific Discussion-I	:	Sustainable Urban Habitat of the Future' and Citizen Centric Governance.	
Scientific Discussion - II	:	'Cillage' - City Villages for a new Paradigm in Habitat.	
Scientific Discussion -III	:	Sustainable Urban Habitat - Present & Future.	
Plenary Session I	:	'Cillage' - City Villages for a new Paradigm in Habitat	
Plenary Session – II	:	Sustainable Urban Habitat - Present & Future	
Webinar – I	:	Sustainable Rural Habitat - Present & Future	
Webinar – II : Sustainability and Peri - Urban Development – Present & Future			
Panel Discussions – I	:	Sustainability and Urban Development - The Indian Context	
Panel Discussions – II	:	Sustainability and Rural Development- The Indian Context	

Interactive Meets and Students Competitions

I am grateful to Dr. Shekhar C.Mande, Secretary, DSIR & DG, CSIR, Dr. N.Gopalakrishnan, Director, CSIR-CBRI, and Dr. Ranjana Aggarwal, Chief Coordinator, IISF-2020, Director, CSIR-NISTADS, for their guidance, support and encouragement. I am gratified to all the Coordinators, and my colleagues at CSIR-CBRI for their help. I express my deepest appreciation and gratitude to the Organizing Team Members, especially Dr. Kishor S Kulkarni, Ms. Garima Bhanot, Ms. Simran Taneja, Mr. Nishant Raj Kapoor, Mr. Vivek Agarwal, Ms. Kritika Bisht, Mr. Ashish Pippal, Ms. Chetna, Tech Recording Host, and others for their support and help, without which it would not have been possible to arrange such an event virtually. I am thankful to all the dignitaries, panellists, experts, invited speakers for their overwhelming response and active participation.

I am grateful to God for his blessings and keeping us all safe during COVID times.

(Dr. Ashok Kumar)

Place: Roorkee

ABOUT IISF

Vision

Promotion of 'Atma Nirbhar Bharat' and Global Welfare through Science, Technology & Innovation.

Mission

India International Science Festival of 2020 – IISF 2020 – brings in an opportunity to demonstrate the strength and potential of Indian S&T not only to the people of India but to the entire international community as well. During these turbulent times, despite encountering various international challenges, especially because of the aggressive attitude of neighbours in the region, we have courageously displayed our indomitable resolve to protect our national interests. This reminds us of the technocentric exercise carried out by Dr. APJ Abdul Kalam in coming up with a 'Technology Vision 2020' to achieve the status of a developed nation. In this visionary document he expressed and emphasized the need to achieve self-reliance in strategic sectors in the context of national security. There is a greater need to build indigenous S&T capability to protect the sovereignty of the country.

A unified and generous worldview, based on the philosophy of 'Vasudhaiva Kutumbakam', exhorts us to utilize Indian S&T advancements for both – 'Atmanirbhar Bharat' and 'Global welfare'. It is time to make the world see the role of Indian Scientists in addressing global challenges. "Science for Self-Reliant India and Global Welfare" has therefore been chosen as the focal theme of the Sixth India International Science Festival (IISF) to be held during 22-25 December 2020. The Sixth IISF will be unusual in the sense that in keeping with the demands of the times it will be organized in a virtual environment. The unique platform of the India International Science Festival was created by the Ministry of Science & Technology, the Ministry of Earth Sciences and the Ministry of Health and Family Welfare in association with Vijnana Bharati (VIBHA). India International Science Festival is a unique combination of seminars, workshops, exhibitions, lectures, panel discussions and debates with interactive forms of engagement including hands-on demonstrations, film and magic shows, interactive dialogues with experts, and science-related theatre, music and poetry.

The science festivals provide a vibrant environment for students and citizens from all walks of life to witness science in action and are designed to instil creativity, critical thinking, problem-solving ability, and teamwork among the country's youth to take the country forward. This year, the India International Science Festival began on 22nd December 2020, the birthday of Srinivas Ramanujan, and culminates on 25th December 2020, the birthday of former Prime Minister of India Shri Atal Bihari Vajpayee. Ramanujan was a world-renowned Indian mathematician and an inspiring figure among the pantheon of Indian scientists. Shri Atal Bihari Vajpayee was a much-loved political figure who added to the inspiring slogan of 'Jai Jawan, Jai Kisan, 'Jai Vigyan'–reflecting his deep commitment to the belief that S&T would always be at the core of the nation's progress.



An equation means nothing to me unless it expresses a thought of God. Stilvas Ramanjan 1887-1920



Unless India stands up to the world, no one will respect us. In this world, fear has no place. Only strength respects strength. or ARV Addu (statum 1991-2015



Arise, awake and do not stop until the goal is reached. Swami Vivekanand 1853-1902



Jai Jawan Jai Kisan Jai Vigyan Atal Bhari Vajpayee 1924-2018

ABOUT CBRI

Vision

To be a world class research and knowledge centre of national importance for providing innovative solutions to all aspects of building science and technology.



Mission

Devotion to research, development, and innovation (RD&I) in solving national challenges of planning, design, materials, capacity building and construction including disaster mitigation in buildings to achieve safety, sustainability, resilience, smartness, comfort, functional efficiency, speed, productivity in construction, environment preservation, energy efficiency and economy.



CONTENTS

			Page no
1.	Intro	duction	1
2.	Objec	tives	1
3.	Conc	ept	1
4.	Salie	nt Features	1
-	4.1	Scientific Discussion I: Sustainable Urban Habitat of the Future' and Citizen Centric Governance	1
		4.1.1 Program Schedule	1
		4.1.2 Dignitaries and Experts for the Session	2
		4.1.3 Questions of the Scientific Discussion –I to the Experts	3
		4.1.4 Discussions and Recommendations	4
		4.1.5 Photos of the Session	5
	4.2	Scientific Discussion – II: 'Cillage' - City Villages for a new	6
		Paradigm in Habitat	
		4.2.1 Program Schedule	6
		4.2.2 Dignitaries and Experts for the Session	6
		4.2.3 Questions of the Scientific Discussion –II to the Experts4.2.4 Discussions and Recommendations	7
		4.2.5 Photos of the Session	7 8
	4.3	Webinar – I Sub- Theme I: Sustainable Rural Habitat - Present & Future	8
		4.3.1 Program Schedule	9
		4.3.2 Dignitaries and Experts for the Session	9
		4.3.3 Discussions and Recommendations	10
		4.3.4 Photos of the Session	12
	4.4	Plenary Session – II: Sustainable Urban Habitat - Present &	12
		Future	
		4.4.1 Program Schedule	12
		4.4.2 Experts for the Plenary and Scientific Discussion – III	12
		4.4.3 Questions of the Scientific Discussion – III to the Experts	13
		4.4.4 Discussions and Recommendations	14
		4.4.5 Photos of the Session	16
	4.5	Webinar – II: Peri - Urban Development and Sustainable Urban Habitat	16
		4.5.1 Program Schedule	16
		4.5.2 Dignitaries and Experts for the Session	17
		4.5.3 Discussions and Recommendations	17
		4.5.4 Photos of the Session	18
	4.6	Plenary Session – III: Ancient Knowledge Systems and India's Urban Haritage	18
		Urban Heritage 4.6.1 Program Schedule	18
			10

Page no.

	4.6.2	Dignitaries and Experts for the Session	19
	4.6.3	Discussions and Recommendations	19
	4.6.4	Photos of the Session	20
	4.7 Panel	Discussions – I: Sustainability and Urban Development -	20
	The I	ndian Context	
	4.7.1	Program Schedule	20
	4.7.2	Dignitaries and Experts for the Session	20
	4.7.3	Questions of the Panel Discussions – I to the Panellists	21
	4.7.4	Discussions and Recommendations	22
	4.7.5	Photos of the Session	25
	4.8 Panel	Discussions – II: Sustainability and Rural Development -	25
	The Iı	ndian Context	
	4.8.1	Program Schedule	25
	4.8.2	Dignitaries and Experts for the session	25
	4.8.3	Questions of the Panel Discussions – II to the Panellists	26
	4.8.4	Discussions and Recommendations	27
5.	Major Reco	mmendations and Key Takeaways	27
6.	Coordinator	rs and Other Organizing Team Members	28

1. Introduction

From time immemorial, the habitats have been serving a much more important role in the lives of human beings; not just fulfilling the basic necessity of providing shelter but also physical and social infrastructure consisting of buildings, roads, water supply, and waste disposal systems, electricity etc. Habitats have significantly contributed to the rise of civilizations with flourishing commerce and culture; and have also been a reason for their decline if their importance has been ignored. Habitat, particularly urban habitat, is the epicentre of global economic growth. The planning and design of human habitat, both urban and rural, should not only point towards at a meta-level of cities and rural clusters, but also at smaller levels like neighbourhood and community level respectively.

As safe, secure and affordable habitat for all is vital for the prolific progress and development of India; the habitats of today face a lot of challenges on multiple fronts, the most important of which concerns the sustainability of those habitats as well as its inhabitants. The emerging issues related to the climate change or the global pandemics like COVID-19, and other severe environmental problems like air & water pollution, water & energy shortage, heavy traffic, and sanitation due to increased urbanization, which affect all kinds of habitats and societies; thus, there is a need to address these contemporary challenges for finding effective and efficient solutions to the issues which plague the habitats of today. Since the intensity or severity of these challenges and issues are only going to increase due to an upsurge of rural people migrating to urban areas for their livelihoods, better education and urban amenities / facilities; this will add an enormous pressure on the resources and on the urban systems, in a country like India in the upcoming decades. The newly designed habitats are struggling with various issues arising from poorly conceived habitat design, based on Western concepts, while ignoring the environment, site conditions and ethos of Indian habitat design.

2. Objectives

The main aim of the program is to organize interactive events including webinars, panel discussions, digital exhibitions, and involve students through competitions, and general public to discuss and deliberate upon the challenges and issues faced by both the urban as well as rural habitats and develop a roadmap for sustainable habitats of the future. The major objectives are:

- To introspect and revisit the ancient knowledge systems in town planning
- To study the principles of Peri Urban Development and Sustainable Habitats
- To study current science and technology on sustainable habitat planning & design, and develop a future strategy for both urban and rural habitats

3. Concept

The India International Science festival is organised with a view to engage not only different domain experts to brainstorm through webinars and panel discussions on the challenges and issues faced by both the urban as well as rural habitats and develop a roadmap for sustainable housing and habitat for the future, but also students from various backgrounds to get united under one umbrella i.e. science and get exposed to the various domains.

4. Salient Features

4.1 Scientific Discussion I: Sustainable Urban Habitat of the Future' and Citizen Centric Governance

Modern development and unregulated urbanisation have yielded the living environment to the highly polluted, with the air, water and soil becoming sources of ill health, chronic to the highly polluted, chronic distress and climate change. Social life has also declined and become increasingly fragmented, with heavy urban congestion further exasperating outdoor open spaces and socialization. Rural-urban migration has also increased, with rural youth aspiring for modern 'convenient' life in the city, and disillusionment to rural life. Development doesn't always refer to be oblivion of the past and embrace the glittering present, but to harness the past in sustaining built environment in the present and the future. Sustainable habitat is

the single most influencing factor which outlines a society's aspiration for living a sustainable life. This session talks about the various possibilities and opportunities in regard to the sustainable Habitat of the Future and its Citizen Centric Governance. The first session on Dec 22, 2020 started with the Inauguration of the Habitat event.

4.1.1	Programme Schedule:
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Time	Program Schedule Details: Inaugural
1030-1300 hrs.	• Welcome and Introduction about the Programme by Dr.
	Ashok Kumar, Principal Coordinator- Habitat.
	Address by Dr. N. Gopalakrishnan, Director, CSIR-CBRI,
	Roorkee.
	• Address by the Guest of Honour, Dr. M. Rajeevan, (Secretary,
	Ministry of Earth Sciences, Govt. of India).
	• Address by the Guest of Honour, Dr. P.S.N. Rao, Director, SPA,
	New Delhi.
	• Scientific Discussion - I: 'Sustainable Urban Habitat of the
	Future' and Citizen Centric Governance.
	• Experts: Dr. Satish Kumar (President & ED, AEEE), Dr. P.S.N.
	Rao, Dr. Manoranjan Parida (Dy. Director, IIT Roorkee), Dr.
	Vishal Garg (Professor, IIIT, Hyd.), Dr. N. Gopalakrishnan, Ar.
	Deependra Prasad (Practicing Architect).
	• Moderator: Dr. Ashok Kumar and Q/A.
	• Vote of Thanks by Shri Vivekananda Pai, Coordinator-Habitat.

4.1.2 Dignitaries and Experts for the Session



Dr. N. Gopalakrishnan Director CSIR-CBRI Roorkee



Dr. Satish Kumar President & ED AEEE New Delhi



Dr. M Rajeevan Secretary Ministry of Earth Sciences Govt of India, New Delhi



Dr. Manoranjan Parida Deputy Director IIT Roorkee



Dr. P.S.N. Rao Director SPA New Delhi



Dr. Vishal Garg Professor IIIT Hyderabad



Ar. Deependra Prasad Principal Architect DPAP New Delhi



Dr. Ashok Kumar, Chief Scientist and Head Ar & P, CSIR-CBRI Roorkee *(Moderator)*



Shri Vivekananda Pai Secretary Vijnana Bharati (Vote of Thanks)

4.1.3 Questions for the Scientific Discussion-I to the Experts

- Q1. There is low–rise high density and high –rise high density concept. How do you see these built-forms from the perspectives of COVID-19 like pandemics?
- Q.2. COVID-19 like pandemics have led to a new concept of working from home. And looking the current scenario, people are finding difficulty to adjust this type of scenario. Do you think the requirements in future designs, where space for office in the houses may dominate & the approach towards design of public & private spaces will be adapted in due course of time? What are your viewpoints on these?
- Q.3. The SDGs focus on Cooling as developmental needs. How in EWS & LIG category the same can be achieved? What are you suggesting to address the cooling needs? In Urban scenario how can the cooling interventions be tied to low energy consumption and low carbon emissions?
- Q.4 India is one of the first countries in the world to develop a comprehensive Cooling Action Plan (ICAP), which has a long-term vision to address the cooling requirements across sectors and lists out actions which can help reduce the cooling demand in residential and commercial buildings, cold-chain, refrigeration, transport and industries. If we want to make a building to address the ICAP needs, what are the major interventions we would do to deliver that? How can we drastically reduce Urban Heat Island (UHI) resulting from HVAC usage, the heat rejection from the inside of buildings to the outside environment?
- Q.5. The proposed Net Zero Carbon Buildings Commitment (Paris Agreement) challenges organisations, cities, states and regions to reach net zero carbon in operation by 2030, and to advocate for all buildings to be net zero carbon in operation by 2050. What interventions / strategies are required in India to develop globally ambitious yet locally relevant, flexible and universally viable solutions for buildings in cities, states or regional boundaries?
- Q.6. Do you think climate change is such a major issue especially in urban content that Govt. should mandatorily introduce quantifiable factors for all buildings, which addresses the ICAP, Climate change, GWP and ODP etc. issues outside Green Buildings? Is there a need to address ICAP as a precursor to Green Building Certifications and rewrite the actual building energy codes? What new interventions can be made to make a drastic change to Global Warming Potential (GWP) and Ozone Depletion Potential (ODP) and therefore, climate change?
- Q.7. There are Naturally Ventilated buildings, AC buildings or mixed mode buildings or cooling without AC etc. in urban areas. What are your recommendations on these typologies from the perspectives of COVID-19 like pandemics?
- Q.8 There are different Codes, Standards, Norms and Regulations in the country like: ECBC, and many certification systems and nomenclature like GRIHA, LEED-IGBC, ICAP, NBC, SP41, URDPFI guidelines, etc. Why all are not mandatorily 100% quantifiable? What are your views on these to make them easily acceptable / adoptable by the society? Why we need to certify buildings according to a particular nomenclature, if there is no quantification? Or is the quantification missing or can we quantify say energy savings by adopting different strategies? How can we compare

performance-based systems vis-à-vis efficiency?

- Q.9. There is misconception in the minds of building professionals about different Codes like ECBC etc. being prepared & implemented based on Western concepts, which may or may not be relevant to the country like India. What is the science behind these? Why professionals are not coming forward to adopt these? What are your view points on this? And can you throw some light, how these can be made more effective and made mandatory, if these can lead to quantified benefits in terms of energy consumption reduction.
- Q.10. The Govt. of India has set a target of 20 million affordable houses by 2020. On one hand we are dependent on the traditional method of constructions (Red bricks & RCC roofs) due to highest acceptability rate amongst society because of the customer satisfaction in the past. On the contrary, there are attempts to promote alternative technologies to take care the speed & quality to meet stipulated targets. How do you see their functional performance and acceptability by EWS & LIG? Do you think 50% government constructions should be made of such alternatives to build a confidence amongst masses?
- Q.12. The Govt. of India has set a target of developing smart cities. On one hand, there are no scientific guidelines or codes on these yet, although attempts are still going on to develop user friendly guidelines. On the other side, it is important that the attempts made by Govt. of India in advocating the concepts are being adopted by many states, where several developmental activities have happened and ICT is playing a major role in such developments. How do you relate these to Citizen Centric Governance? What are your views on these?
- Q.13. All the major Cities of India are expanding due to large scale urbanization taking place and putting enormous pressure on urban infrastructure like transport, sanitation, etc. Cities have started developing Metro as one of the important means of transport. However, due to COVID 19 like scenario, the public transports are not considered safe. What are your view points on these? Can you suggest some alternative means of transport or development strategy?
- Q 14. India is divided into five climatic zones and the climate conditions have changed during the past two decades and these have impacted the comfort inside the buildings on one hand and energy consumption on the other? There has been a felt need to come out with new climate classification. CBRI has carried out extensive research on this to develop new climatic classification. ISHRAE also has done some work on this. Can you throw some light on this?
- Q15. The Atma Nirbhar Bharat talks of focus on housing and development of Tier 2 and Tier 3 cities. How do you think this will curb urban mobility towards mega cities?
- Q.16. There are several building technology options / solutions available for different class of people. However, their implementation by trained manpower is not happening due to lack of skilled manpower. What are your suggestions on these to build more capacities / skill sets for EWS & LIG habitats? Can standardized basket of solutions, help the beneficiary or else what are your suggestions on these?
- Q17. Looking into the current & future challenges, what are your recommendations & / suggestions on the future Research on Building Science & Technology

4.1.4 Discussions and Recommendations

Dr. Ashok Kumar, the Principal Coordinator of the Event, gave a brief Introduction about the Programme. He appreciated the joint efforts made by all the Coordinators and the Organizing Team in making this event a grand success. He also highlighted the overwhelming response received from about 48 eminent Panellists, Experts & Speakers etc., majority of whom are Who's – Who in their respective domains.

Dr. Gopalakrishnan, Director CSIR-CBRI gave his welcome address. He said 'I am delighted to see a galaxy of experts being invited and all have agreed to participate in the deliberations'. Dr. Gopal, talked on the role of CSIR-CBRI in the areas of Building Science & Technology in solving the problems of housing habitat in the Country. He showed his gratitude for being part of this Festival and called this as the

Page | 4

'Celebration about the Victory of Vigyan over Ignorance and Irrationalism'. He further discussed about the importance of habitat in the context of the Indian cities.

Dr. P.S.N Rao, Director, SPA, the Guest of Honour, was very happy to be part of the Festival with the galaxy of eminent Panellists attending the Event. He started his lecture by defining 'Habitat' as a place, where a living being lives including the whole ecosystem. He further mentioned about the Habitat - I Conference, which was held in 1970s in Canada, where people across the world participated. As a result of this conference, a UN Human Settlement Programme was formulated in order to discuss and resolve problems regarding the emerging issues of Habitat Planning and Design. Followed by this, he discussed about the Habitat-II conference, which was held after 20 years. The outcome of this conference included two major goals i.e. sustainable human development and adequate shelter for all. Lastly, he concluded with the Habitat III conference, which was held in 2016; as Habitat is an important part of the city and a major focus on sustainability, culture and ultural diversity is to be given.

Dr. M. Rajeevan, Secretary, Ministry of Earth Science, Govt. of India gave his address by thanking the fraternity for making him a part of this event. He coined with the following major objectives of this theme: (i) to introspect the knowledge and ground planning; (ii) to study the principles of urban development and sustainable habitat; (iii) to study the current science and technology on sustainable habitat planning; and (iv) to develop a future strategy for both urban and rural habitats. He stressed on urban habitat, where he mentioned that by 2050 the population will be doubled, which will further increase challenges on housing, infrastructure, services, health, safety, natural resources etc. Hence, it is the need of the hour to come up with solutions concerning sustainability, inclusive growth, social and cultural development and environmental protection.

Ar. Deependra Prasad, practicing architect while answering the questions gave the following remarks: (i) High-rise could be a problem as compared to low-rise, considering the conditions in the pandemic. (ii) Low- rise is the one, which is closer to the ground, mutually shaded and the greener areas could be used easily. (iii) Also the dependence on the artificial cooling, heating and lighting would be less in the case of low-rise buildings.

Dr. Satish Kumar, President and ED, AEEE, while discussing about the ICAP plan expressed that it looks in the different segments of the common space cooling, mobile air conditioning etc. and hence, the interventions in the policies & business should be made holistic in nature. He also expressed that coordination between central and state govt. should make some progress, where planning and execution be made easily possible. *He thanked Dr. Ashok for inviting and raising very important questions to all the Panellists*.

4.1.5 Photos of the Session



Dr. Ashok welcoming Guest of Honour Dr. P.S.N. Rao, Chairman SPA, New Delhi and all the other dignitaries during Inaugural Function on 22nd Dec. 2020



Dr. M. Rajeevan, Secretary, Ministry of Earth Sciences, Govt. of India, Guest of Honour delivering his Speech during the Inaugural Function on 22nd Dec. 2020

5 | Page

4.2 Scientific Discussion – II: 'Cillage' - City Villages for a new Paradigm in Habitat

The major discussions revolved around how to achieve sustainability in rural habitat? How & why the ancient knowledge systems and culture should be used in the present-day context. Why sustainable materials and technologies should also be included in the component of the future rural housing development? Looking into the significant contribution made already in the area of rural housing & sanitations, the Institutions like *CSIR-CBRI* must take lead in evolving strategies and roadmap for developing rural areas keeping sustainability as the major focus.

4.2.1 Programme Schedule

Time	Program Schedule Details: Plenary Session and Scientific Discussions
0930-1030 hrs.	Plenary Session I: 'Cillage' - City Villages for a new Paradigm in Habitat
	Welcome by Shri Vivekananda Pai, Coordinator- Habitat.
	• Inaugural Address by the Chief Guest, Dr. Anil Kakodkar, Chairman, Solar
	Energy Research Advisory Council, JNNSM & Member, Board of Trustees, Council on
	Energy, Environment and Water
	• Address by the Guest of Honour, Prof. Mahesh Tandon, Managing Director,
	Tandon Consultants Pvt. Ltd., New Delhi.
	• Scientific Discussion – II: 'Cillage' - City Villages for a new Paradigm in
	Habitat.
	• Experts: Dr. N. Gopalakrishnan, Dr. Ashok Kumar, Dr. Monto Mani.
	• Moderator: Dr. Amogh Gupta, Coordinator- Habitat and Q/A.

4.2.2 Dignitaries and Experts for the Session



Dr. Anil Kakodkar Chairman Solar Energy Research Advisory Council JNNSM & Member, Board of Trustees, Council on Energy, Environment & Water



Prof. Mahesh Tandon Managing Director Tandon Consultants Pvt. Ltd., New Delhi



Dr. Ashok Kumar Principal Coordinator, Habitat, Chief Scientist & Head, Architecture & Planning CSIR-CBRI, Roorkee



Dr. Monto Mani Professor Centre for Sustainable Technology IISc, Bangalore



Dr. Amogh K Gupta Chairman SPA New Delhi (Moderator)

Page 6

4.2.3 Questions for the Scientific Discussion – II to the Experts

- **Q.1.** Looking into the PURA, Rurban and Cillage Concepts, what is your opinion on Smart Villages? Could there be Model Smart Villages in every state of India? Will you throw some light on this? Can you cite example of any International Model Village?
- **Q.2.** There is a Technology Vision 2035, which covers several Prerogatives and Enabling Technologies. Can you throw some light on this? Is this TV relevant to urban areas & can similar Technology Vision be prepared for the development of Rural Areas?
- **Q.3.** City Villages have acted an important link between major cities / Towns for delivering basic facilities (Milk, Vegetables, Grains, etc.). What is your opinion on this? Could these City Villages be developed as Model Villages with all the Infrastructure Facilities? Can this lead to concept of reverse Migration from Cities to Urban Villages? Can you propose a new approach for the development of City Villages for New Paradigm in Habitat?
- **Q.4.** Being the Director of the Prestigious Building Research Institute, how the S&T and Innovation fruits can reach to rural masses, and could there be a different approach to 'Cillage' than discussed by Dr. Ashok & Dr. Monto Mani?
- **Q.5.** Looking into the Key Challenges before India, how innovative approaches to Sustainable Development, Inclusiveness and Environment can lead to the overall development of the Villages for a New Paradigm in Habitat 'Cillage' that leads to greater happiness all around us?

4.2.4 Discussions and Recommendations

Dr. Anil Kakodkar, Chief Guest of the Session, firstly expressed that it's a great pleasure for him to be invited for the Session on 'Cillage' as a part of habitat of IISF 2020, and expressed his gratitude to all the experts and other participants. He expressed that post Agrion and industrial era, we are currently in the knowledge era, which has the sense of livelihood and promotes decentralization and democratization. Knowledge era has a great opportunity to correct the disparity between the rural and urban by creating opportunities, leveraging the expertise and capability that get building in natural areas for general economic and other factors in rural areas. He expressed that the pandemic has taught a lot and quoted an example that a big MNC company named SOHO, shifted its Headquarters from Francisco to a small village in Tamil Nadu, meaning how work from village can actually work. He concluded by saying that whether the parallel cities, mirror cities or rural areas, all should be set up in such a way that they can practice agriculture, manufacturing and other services. Therefore, the design of habitats should be such that it bridges the gap between city and villages. Also, the main ingredient of the eco-system is the knowledge institutes, which are able to promote R&D and rejuvenate new technologies.

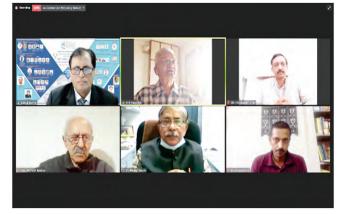
Dr. Mahesh Tandon, Guest of Honour of the Session, thanked Dr. Ashok & CSIR- CBRI for calling at such a platform, to be a part of this mega festival. He talked about the sustainability of the habitat, wherein he started listing the major issues that include shelter, urbanization, water, energy, global issues of CO₂ emissions, Covid-19, mobility & other natural hazards. With his thought provocative presentation, he asked the audience to come up with the innovative solutions in order to solve the above - mentioned issues in the event.

Dr. Ashok Kumar, gave a conceptual layout of developing 'Cillages', wherein he said that the Rurban Mission (GoI) must include Physical Connectivity (PC), Electronic Connectivity (EC) and Knowledge Connectivity (KC) in line with the PURA concept in achieving Economic Connectivity (E_{co} C), such that PC+EC+KC= E_{co} C. The 'Cillage' concept must be adopted as a Model of City Villages for a New Paradigm in Habitat, wherein through roads, villages connect to cities, different hierarchy of settlements, and time for travel could be between 10-30 minutes from Rural to Urban & Urban to Rural. This will certainly lead to minimizing the migration.

The education must be reoriented towards livelihood / entrepreneurship (KC + E_{co} C). The ITIs & Diploma

colleges must be strengthened for imparting training on all kinds of skill sets including agro-industries needed in the country for (KC + E_{co} C), particularly for creating livelihoods in rural areas. Research on traditional planning systems and craftsmanship should be further taken up to improvise on the traditional wisdom (KC). The 'Cillage' concept was further elaborated by Sh. Tulsi Tawari, CEO and said that India needs development of 5000 Cillages in the whole country. The Cillage must have low – rise (4 storeyed) high - density development. Therefore, the Institutions like CSIR-CBRI must extend the work done in this area to develop science – based solutions. Prof. Monto Mani suggested the following: Modern development and unregulated urbanization have yielded the living environment to be highly polluted, with the air, water and soil becoming sources of ill health, chronic distress and climate change. Social life has also declined and become increasingly fragmented, with heavy urban congestion further exasperating outdoor open spaces and socialization. Rural-urban migration has also increased, with rural youth aspiring for modern 'convenient' life in the city, and disillusionment to rural life. The COVID-19 pandemic has not only exposed our vulnerabilities but has also induced us to rethink on our fast-paced consumerist lifestyle, environmental vitality and wellness (physical and emotional/mental). The lockdown has challenged our need for travel (congestion), restrained our daily needs/purchases and reconfigured our concept of work/office and schooling. The challenges need to be addressed in view of sustainability in the built environment.

The 'Cillage' concept was further elaborated by Sh. Tulsi Tawari, CEO and said that India needs development of 5000 Cillages in the whole country. The Cillage must have low – rise (4 storeyed) high - density development. *Therefore, the Institutions like CSIR-CBRI must extend the work done in this area to develop science – based solutions.*



4.2.5 Photos of the Session

Dr. Anil Kakodkar, Chief Guest and Dr. Mahesh Tandon, Guest of Honour delivering their speech during Scientific Discussion on 23rd Dec. 2020



Dr. Ashok Kumar giving his Views as a Panellist during Scientific Discussion -II on 23rd Dec. 2020

4.3 Webinar – I Sub-Theme I: Sustainable Rural Habitat - Present & Future

The broad discussions revolved around innovative approaches to visualize habitat from the perspective of ancient knowledge systems in planning of spaces, and societal connect vis- á- vis cultural ethos across the country. Similarly, the significance of sustainable materials & technologies, and Future Roadmap on R&D for sustainable rural habitat have been discussed. Rural sustainability can be defined as a continuous search for development strategies (aimed at a general improvement in the human condition) to maintain and produce "healthy" rural communities in which economic, socio-cultural, political and environmental

Page 8

values are compatible and which respond to any imperatives in these dimensions, at least in the long run. It is thus fundamentally the same as "urban sustainability", the differences are only in type of environments present, population densities and activity bases yield differences in the way in which the issues are posed and solutions constructed.

4.3.1 Programme Schedule

Time	Program Schedule Details: Webinar and Interactive Meet
1035-1235 hrs.	Webinar – I
	Sub- Theme I: Sustainable Rural Habitat - Present & Future
	• Welcome by Dr. Ashok Kumar, Principal Coordinator- Habitat.
	• Keynote Address by Dr. P.K. Das, Member, National Task Force on Rural
	Housing and Habitat, Government of India, Ministry of Rural Development.
	Webinar Lectures by the Invited Speakers
	• Ar. Gita Balakrishnan, Ethos, NGO, Kolkata.
	• Dr. Monto Mani, Professor, Centre for Sustainable Tech., IISc, Bangalore.
	• Dr. Yogesh K. Garg, Professor & Head, Dept. of Architecture, MANIT, Bhopal.
	• Shri S.K. Negi, Chief Scientist & Head, DCE, CSIR-CBRI, Roorkee.
	• Dr. S.R. Karade, Sr. Principal Scientist & Head, ASCD, CSIR-CBRI, Roorkee.
	• Dr. Rajni Lakhani, Sr. Principal Scientist & Head, OBM, CSIR-CBRI, Roorkee.
1235-1300hrs.	Interactive Meet-I on 'Sustainable Rural Habitat of the Future'
	Moderator: Dr. Ashok Kumar, Principal Coordinator-Habitat.

4.3.2 Dignitaries and Experts for the Session



Dr. P.K. Das Member, National Task Force on Rural Housing and Habitat, Government of India, Ministry of **Rural Development**



Shri S.K. Negi Chief Scientist & Head DCE, CSIR-CBRI Roorkee



Ar. Gita Balakrishnan Founder Ethos, NGO Kolkata



Dr. S.R. Karade Sr. Principal Scientist & Head Sr. Principal Scientist & Head ASCD, CSIR-CBRI Roorkee



Dr. Yogesh K. Garg Professor Dept. of Architecture MANIT, Bhopal



Dr. Rajni Lakhani **OBM. CSIR-CBRI** Roorkee

4.3.3 Discussions and Recommendations

Dr. Ashok Kumar, after welcoming the dignitaries and invited speakers, informed the importance of sustainable rural habitats of the present as well as the future, and why sustainability is important for the rural habitats.

Dr. P.K. Das, showed his gratitude for inviting him to the Festival. He discussed about various aspects including rural housing (a case of Tripura) - people-centric-aspiration and cultural ethos based; sustainable habitat planning (Maharashtra); summary of leaning (towards sustainable rural housing and habitat planning). He further discussed about "architecture by the people" where every society has evolved its own architecture with a few simple context specific rules that shapes the building. And lastly he concluded that people's architecture forms the major portion of the built environment as well.

Dr. Monto Maini stressed on the following aspects:

- (I Affordable low-resource/carbon dwellings developing building functional performance codes for decentralized local (traditional) building materials and technologies. Revive ancient wisdom of deriving contentment with less.
- (ii) Climate change resilience studying various building typologies for their vulnerability (structural/durability, thermal and indoor air quality in response to climate change, and identification of appropriate interventions.
- (iii) Effective wellness efficiency-based pursuits are proving to be counterintuitive leading to increased net resource/energy consumption and waste generation, and increased ill health (eg. vision distress due to LED lighting). Effectiveness based approach focusing on reducing resource/energy footprint per capita and wellness is an emerging concept, thought its roots can be traced to traditional native wisdom.
- (iv) Safe integration of waste in the building environment with the emergence of unseen carcinogenic toxicity such as micro plastics, forever chemicals and endocrine disrupting chemicals (EDCs), there is not only a need to carefully manage waste, but also their safe integration/upcycling in the building environment. Integrating plastics into roads and buildings could increase carcinogenic EDC exposure, and needs careful study keeping in mind environmental breakdown and migration of toxins.

Dr. Yogesh K. Garg in his presentation titled as 'Revisiting Ancient Indian wisdom for sustainable rural habitat' highlighted about the following aspects:

- (i) Try to resolve rural problems with urban scenario in background.
- (ii) In ancient times, not only urban and rural habitats but also their housing was considered as a domain of *Sthapati* (The Architect) having a knowledge of planning and designing settlements ranging regional planning to city planning to village planning to building design and even interior having a complete picture to integrate all aspects of planning. With the era of specialization, all these aspects are considered as independent identities to an extent that even in planning urban and rural are also considered as independent identities. However, with their integration, Rurban, city village, Ruro urban started developing.

Although we consider them as a link between urban- rural and envisaged them as intermediate urban-rural areas having benefits of both urban infrastructure and rural setting. This hypothesis is derived while trying to solve the ill effects of urbanization in cities in terms of travel distance, environmental conditions, quality of life etc. This concept is hypothesized with somewhere in back of our mind considering the continuous expansion of urban areas due to rural migrations. As the rural migration will be a continuous process with rural areas converting to Peri-urban and then to urban. The same approach is evident form the process of our development plan preparation. Hence, this is the right time, when we must look the problem of rural areas in an innovating way and not through an eye of urban perception.

(iii) Understanding sustainability with rural perspective the especially rural settlement can only be sustainable if the development ensembles to the socio-cultural, demographic and occupational

pattern of the region. Therefore, in broader context, sustainability of rural areas cannot be equated with sustainability of urban areas and can only be defined with reference to its context. Theoretically, sustainability can be defined in three dimensions applicable to different contexts.

- Net produce should be sufficient to sustain the population of habitat with almost zero input and output.
- Habitat should be sufficiently rich to purchase everything from outside.
- Net produce should be more than sufficient to be delivered outside the habitat.

Ar. Gita Balakrishnan concluded the following in her talk entitled "The (Indi) genius of young minds reviving and sustaining sustainable rural living": Nelson Mandela once said that "The youth of today are the leaders of tomorrow". With the right resources and education, the youth can soar to new heights and take the entire world with them. Education today needs to reflect the changes happening in the world around and equip the youth with the tools they need to create a well-informed, smooth functioning, sensitive society. Architecture has an Atlas-like responsibility on its shoulders in this respect.

The sprawling cities and the fastgrowing rural areas have problems of varying scales and complexities. However, all these problems, whether it is housing, unplanned development, climate change or poverty, are not without solutions. The youth can offer different perspectives and outlooks that will lead us to more efficient solutions. The government can involve the participation of students through institutions in developing good proposals for such projects. Graduate education in architecture and design colleges do have provisions for learning through interaction with live case studies and field work. Rural cases and studying the conditions of existing sites are the standard approach for all studio-based programs in architecture and design throughout the country. However, these initiatives are limited to a short duration, and most often are hypothetical thought experiments, without any involvement or feedback from government bodies, or other stakeholders who may stand to gain from such initiatives.

Continued and frequent engagement with urban and rural issues can make the students aware of struggles in the real setting while urging them to test design solutions in an actual context. The curriculum and pedagogy can play a significant role in allowing for experimentation and practical learning equipping the youth to become successful professionals in their independent fields. The institutes can join hands with the state in order to create concepts for existing proposals catering to the prevailing needs. Involving students through participating in open design competitions in a live-site will change the perceptions of the youth and gently guide them into becoming sensitive citizens.

Ar. S.K. Negi, started his presentation "Sustainable Rural Habitat- Present and Future" with a quote by Mahatma Gandhi i.e. "Heart of India lies in villages" implying if the heart will be strong and healthy, then the whole body will be strong. He further discussed about the rural disparity, where the rural are contributing approximately 40% in the GDP. And quoted, a major problem, which is migration from rural to urban areas and also gave a speculation stating that by 2050 about 50% population will be living in the urban centres. Migration is caused by the reasons such as: lack of good education, employment, business, etc., and in order to solve these issues, he stressed on "sustainable and inclusive growth of rural India through a multi prolonged strategy for eradication of poverty by increasing livelihood opportunities, providing social safety and developing infrastructure for growth and improvement of quality of life in rural India".

Dr. S. R. Karade, gave a talk on 'Building Materials from Wastes- Path towards Sustainability.' He discussed that considering the major environmental issues as waste materials in the form of harmful solid, liquid and hazardous gaseous waste, global warming etc. He stressed on using all kinds of wastes to make useful building products. More research needs to be done in order to enhance the performance of the materials based on wastes and thus catering to sustainability.

Dr. Rajni Lakhani, presented on 'Sustainable Building Materials and Technologies from Waste'. She discussed about the major wastes including fly ash, slag, by-product gypsum, lime sludge, rice husk etc. and the various developed technologies such as "anti-corrosive coatings obtained by modifying epoxy resin with phenolic resin; EPS door shutters from EPS foam core, agro forestry wooden frame; polytiles and

polycem flooring tile; development of alternate building components from heavy metal sludge. Further, she discussed about the importance of using light weight concrete in improving the thermal and energy performance of buildings.

4.3.4 Photos of the Session



Ar. Gita Balakrishnan, delivering her lecture during the Webinar I along with all other Panellists



Dr. P.K.Das, Dr. Monto Mani, Dr. S.R.Karade, Dr. Rajni Lakhani delivering their lectures and Dr. Ashok Kumar, Moderating the Webinar Session I on 23rd Dec. 2020

4.4 Plenary Session – II: Sustainable Urban Habitat - Present & Future

"A City is its People" - economic opportunity, adequate affordable housing and access to infrastructure apart, there is an aspirational dimension, which is equally important. Housing remains at the top of the aspiration table and hence, should be an important consideration in planning residential developments and their options. City planning and Master Plans cannot only be confined to spatial dimension of land use, housing, infrastructure and transportation but also should address the social, cultural and emotional needs of its citizens.

11 0		
Time	Program Schedule Details: Plenary Session and Scientific Discussions	
1400-1500 hrs.	Plenary Session – II: Sustainable Urban Habitat - Present & Future	
	• Welcome and Introduction of the Plenary Session by Dr. Ashok Kumar, Principal Coordinator- Habitat.	
	• Welcome Address by Dr. Gopalakrishnan, Director, CSIR-CBRI.	
	• Address by the Guest of Honour, Shri V. Suresh, Chairman, IGBC.	
	• Scientific Discussion-III: 'Sustainable Urban Habitat - Present & Future'	
	• Experts: Shri V. Suresh, Ar. Chitra Jain (Practicing Architect), Dr. N.	
	Gopalakrishnan, Ar. Kuldeep Singh (MD, ARKA, IPMS, Hyd.).	
	Moderator: Dr. Ashok Kumar, Principal Coordinator- Habitat	

4.4.1 Programme Schedule

4.4.2 Dignitaries and Experts for the Session



Shri V. Suresh Chairman, IGBC Mumbai



Ar. Chitra S. Jain Practicing Architect New Delhi



Ar. Kuldeep Singh MD, ARKA IPMS, Hyderabad



Dr. Ashok Kumar Chief Scientist, CSIR-CBRI, Roorkee (Moderator)

4.4.3 Questions of the Scientific Discussion-III to the Experts

- **Q.1.** The sustainability of the Indian cities is hampered by several factors such as, inadequacy of land, inadequate water supply, mass transport and housing, poverty and environment degeneration. Similarly, preparing India's cities for a rapid growth scenario will require a paradigm shift in planning for urban habitat and infrastructure etc. What are your view points on this? Could you suggest a Vision and a Roadmap for the Sustainable Habitats of the Future?
- **Q.2.** Urban habitat is the epicenter of global economic growth and subsequent energy requirements. With increased economic and industrial activity, average global CO₂ emissions is growing at 1.3% per year. What is your view-point on organization of urban human habitat, that should imply planning & design at a meta-level of cities and adjoining neighborhoods and communities? And how sustainability can improve the current environmental position, as well as socio-economic stability and / or prosperity of urbanites?
- **Q.3.** Global urbanization is both a social and environmental issues, and the challenge of raising global living standards while reducing carbon emissions is a worldwide problem. Thinking of cities as habitat for human's means offering different choices in our day-to-day lives; greener ways of living and much more.

Do you agree that life in the future will be more difficult, looking into the Pandemics like COVID? How the habitats of the future should be planned and / or designed?

- **Q.4.** Sustainable habitat is one of the most influencing factor which outlines a society's aspiration for living a sustainable life. What are your views on future habitats to be sustainable and inclusive? Can you recommend a new Approach / Strategy to visualize habitat not only from the perspective of space, but also to its deep ecological and emotional values attached with spaces outlining society's aspiration for living a sustainable life?
- **Q.5.** Govt. of India, Ministry of Urban Development, has a National Mission on Sustainable Habitat, which emphasis on Addressing Climate Change: Mitigation and Adaptation, which is component of the National Action Plan for Climate Change. What is your assessment on this? What could be the prerogatives that are essential for improving the quality of life?
- **Q.6.** Looking into the current challenges & issues, what is the way-forward for Sustainable Habitat of the future for India? What research initiatives and policy needs to emphasize on application of research on the "ground-level"? Could you highlight some research priority areas under Housing, Resiliency & Energy & Environment etc. that need to be emphasized on priority? What will the future of sustainable cities look like?
- **Q.7.** The cities of 2030, 2050 and 2100 will be very different from today, transformed in their demographic composition, in their implementation of technology and in their wider ecological contexts, and meeting the changing needs of the future will require new ways of thinking and working. Do you think, the sustainable future will be resilience to guard against future risk; and smart cities deploy the best technology for the job and how? What approach would you recommend to tackling the current and expected future problems, to realize a sustainable urban future in India, Asia and the Pacific and how this may help adapt to the demands of tomorrow?
- **Q.8.** Looking into the futuristic challenges, would you recommend eco-cities / towns as an alternative approach? Is there an inter-relationship between biodiversity and the resilience of the ecological system? Could you share your thoughts on this?
- **Q.9.** The climate is changing and is impacting our habitats / cities. Are our cities, towns, buildings ready & are our master plans ready to address such changes? How the urban resilience or city respond to

shocks and stresses, and could you suggest resilience strategies and climate action plans?

- **Q.10.** In light of the uncertain environmental, social and economic future, the Indian cities' infrastructure development is not being monitored regularly after implementation that eventually fails when it reaches its stipulated time. Do master planning standards need to be revisited / reviewed?
- **Q.11.** Sustainability and saving renewable resources should be cultivated by every individual at the grass root level. Would you recommend bottom -up development or top down development approach? What is your insight on this, and what are your viewpoints for the policy makers on this?
- **Q.12.** Looking into the current pace of development, where billions of square meters of space is yet to be built by 2047, and construction wastes are big issue in metro cities. What are your plans to develop alternative materials like recycled aggregates, m-sand, low-carbon cement, materials from industrial wastes etc.? What more should be done on circular economy and improve resource efficiency in the building / habitat sector?

4.4.4 Discussions and Recommendations

Sh. V. Suresh, in his address, talked about the current challenges of urban habitats and gave some recommendations for the future habitats main streaming sustainability as a part of every development. He informed that NBC 2016 has already included a chapter on Sustainability and all stakeholders must follow NBC.

Ar. Chitra S. Jain expressed that do we have a choice of not moving towards greater sustainability and inclusivity in our cities and towns? It is now imperative that Habitats of the future need to build in sustainability and inclusivity into all its aspects and dimensions. With increasing urbanization and around 60 to 65 percent population of most cities in the lower income groups with a sizeable migrant population, our cities are struggling to be equitable.

- Inequities today exist in access to not only housing but also physical and social infrastructure, especially open spaces and community spaces. Our cities are unable to provide affordable housing at the pace required leading to growth of slums, squatter settlements and unauthorized colonies, with a low quality of life. Our cities do not adequately address the issues of marginal groups such as single working women, students, differently abled and transgender. Needs of home based informal workers also needs to be adequately addressed as do the needs of the Youth who study, work and live in the city.
- To reduce the gap between demand and supply of affordable housing options in our cities and towns, public housing supply needs to be supplemented with supply from private sector. For this to happen in a scale that is significant, our Master Plans need to build in incentive options like additional FAR and TDR without any ambiguity. Affordable rental housing is another important sector that warrants adequate detailing of scale, location and incentives to rope in private sector participation.
- The narrative of Sustainable cities needs to begin with sustainable neighbourhoods and buildings. Sustainable measures that need to and can easily be built into at city, neighbourhood, as well green field and brownfield project levels are:
- (i) Renewable energy generation, distribution and management (with most parts of India blessed with several months on sunlight, solar energy should be capitalised on);
- (ii) Management of solid waste leading to net zero waste cities and neighbourhoods is essential Indore has shown the way forward to make solid waste management sustainable and remunerative.
- (iii) Use of ICT to monitor and manage infrastructure, public transportation, mobility and governance must be enhanced;

- (iv) Citizen participation in planning, implementation and management is must.
- (v) Safe Housing- ensure housing developments are moved away from untenable areas like natural drains, rivers etc. In areas where it is not feasible, like coastal areas, plan for safe structures or shelters to house affected people during disasters.
- (vi) Flood control measures and systems- improving on existing natural drains or waterways while ensuring zero tolerance to encroachments on existing water bodies; Use of ICT for information gathering, sharing and managing actions.
- (vii) Reduce urban heating-identifying urban heat islands and mitigating the same through localised solutions including localised greening, improved planting and through suitable choice of paving.

Ar. Kuldeep Singh concluded with the following transformations:

- a) Urban mobility- with virtual reality technology- distance will be things of the past. Companies such as Microsoft, Google and Facebook are inventing Augmented Reality where any person can be virtually transported to any part of the world with the help of 5G/6G Internet. This will change the way people travel and do business. The cities of the future will be car free and human friendly. Fleet CAR Model, Individual Flying Drone/Cabs (Battery or solar powered) will mark the end of Ownership of cars, Less Car means lower carbon emission, lower parking requirement and cleaner environment.
- b) Future of Construction; with advent of robotics and 3D Printing building will be made faster and without much impact on natural resources, this will enable cities to be more eco friendly and sustainable. This will be in some urban development or new towns-planned & designed on the TEN principle of sustainability.
- c) Decentralization Mega metro cities of today will struggle to adapt/survive and will give way to Newer urban centres. Smaller clusters of urban centres will emerge with decentralized model of Administration for Housing, Water, Waste and STPs/WTPs.

Dr. Ashok Kumar, the Principal Coordinator and moderator of the session responding to some of the questions that remained unanswered, said that looking into the current challenges and issues, net-zero energy building, zero carbon building & communities are the future, and strategies as well as Codes are required to be developed. Similarly, codes on Smart cities are needed. He further said that looking into increasing pollution levels in the metro and mega cities, solutions are needed. He gave an example of electrical vehicles, use of public transport like Metro instead of personal cars, even-odd for cabs & cars, developing pollution abatement strategies and technologies, resilience against different kinds of disasters.

Looking into the cities of 2050, 2100, the sustainable future will have to guard against risk. Dr. Ashok stressed on reading of Technology Vision 2035 and Habitat Vision 2035 of TIFAC that must be read not only by every scientist and student but also by all the stakeholders involved in planning and development of cities, towns & habitats.

4.4.5 Photos of the Session



Shri V. Suresh, Chief Guest sharing his experiences of more than five decades during the session



Ar. Kuldeep Singh and Ar. Chitra Jain sharing their views in the Scientific Discussion -III

4.5 Webinar – II: Peri - Urban Development and Sustainable Urban Habitat

India is a vast country with immense diversity and one size fit all will not work. Urban development in India should be environmentally friendly; more market oriented and taking care of the poor and informal sector. It would be urban development with a human face. This will lead to sustainable and inclusive habitat development in the country. Sustainable Development Goals (SDGs) are universal goals accepted by the UN General Assembly to achieve by 2030. Most relevant SDG to urban planning is SDG 11: 'Make cities and human settlements inclusive, safe, resilient and sustainable.' To achieve this goal, there is a need for a paradigm shift in which the cities of today are planned and managed. Broad discussions revolved around innovative approaches to visualize peri - urban development and urban habitat from the perspective of ancient knowledge systems in planning, and roadmap on R&D for peri - urban development & sustainable urban habitat.

4.5.1 Program Schedule

Time	Program Schedule Details: Webinar & Interactive Meet	
1505 -1735hrs.	Webinar – II : Peri - Urban Development and Sustainable Urban Habitat	
	Webinar Lectures by the Invited Speakers	
	• Prof. Chetan Vaidya, Former Director, SPA, New Delhi.	
	• Sh. M. Devasahayam, IAS (Retd.), Nagercoil, Tamil Nadu.	
	• Prof. Manmohan Kapshe, Professor, MANIT, Bhopal.	
	Ar. Tanmay Tathagat, Practicing Architect, New Delhi.	
	• Mr. Tulsi Tawari, NGO, CEO & Chief Strategist, Mumbai.	
	• Prof. S.K. Singh, Sr. Principal Scientist & Head, PPCD, CSIR-CBRI, Roorkee.	
	• Dr. Asokan Pappu, Chief Scientist & Head, PBD, CSIR-AMPRI, Bhopal.	
1740 -1810hrs.	Interactive Meet-II on 'Sustainability and Peri - Urban Development – Present & Future'	
	Moderator: Shri Vivekananda Pai, Coordinator Habitat	

4.5.2 Dignitaries and Experts of the Session



Prof. Chetan Vaidya Former Director SPA New Delhi



Sh. M. Devasahayam IAS (Retd.) Tamil Nadu



Prof. Manmohan Kapshe Professor MANIT Bhopal



Ar. Tanmay Tathagat Managing Director EDS Pvt. Ltd. New Delhi



Mr. Tulsi Tawari CEO Mumbai



Prof. S.K. Singh Sr. Principal Scientist & Head, PPCD CSIR-CBRI, Roorkee



Dr. Asokan Pappu Chief Scientist & Head, PBD, CSIR-AMPRI, Bhopal

4.5.3 Discussions and Recommendations

Prof. Chetan Vaidya said that urban India is very large with immense diversity and one size fit all will not work. Urban development in India should be environmentally friendly, more market oriented, taking care of the poor and the informal sector. It would be urban development with a human face that will lead to sustainable and inclusive habitat development in the country. This mainly deals with four issues, namely, (a) urban planning; (b) integrating spatial and economic planning; (c) strengthening local governance; & (d) decentralised delivery of services.

Dr. Asokan Pappu presented several agro-industry based building products including the Parali waste that produces large quantities of pollution. He requested the architects to use bio-products and give feedback for further improvements. Strategies for Research – Academia – Industry interface to have more industry driven research/connect. This includes, CSIR-AMPRI Bhopal and working towards finding holistic solution for Parali burning and create employment, income and improve the livelihood of farmers and rural people in the state of Haryana and Punjab, where huge quantity of Parali has been burned which creates major smog and air pollution to the National Capital Delhi and NCR. Dr. Asokan suggested that the future R&D is needed to guide sustainable urban & rural habitats of the future.

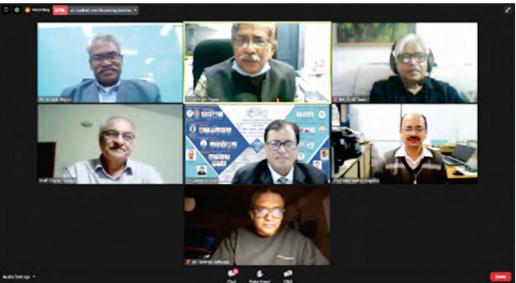
Mr. Tulsi Tawari discussed about the peri- urban development, 'Cillage - for a new Paradigm in Habitat' and further stressed on the following:

- (i) Adapt a model which is replicable across the whole nation that can meet all key requirements of sustainability. A model was proposed: a city of upto 10 kms, within 100/200 villages, called CILLAGE;
- (ii) Consider seven key-parameters as the basis to assess a Habitat model for sustainability: space/population density; time in control in day-to-day life; economics of survival; economics of prosperity; environment; knowledge-centre; emotional-coexistence/social-fabric;
- (iii) Policies to restructure overall economy, to move towards decentralized-economy;
- (iv) Ecosystems to empower multi-level first-generation entrepreneurs, to drive decentralized economy;



Mr. Tawari further highlighted on developing 5000 Cillages in the country to restrict rural urban migration.

4.5.4 Photos of the Session



Prof. Chetan Vaidya, Ar. Tanmay Tathagat, Mr. Tulsi Tawar, Prof. Manmohan Kapshe sharing their views during the session as Panellists and Dr. Amogh K Gupta being the Moderator

4.6 Plenary Session – III: Ancient Knowledge Systems and India's Urban Heritage

The broad discussions revolved on ancient knowledge systems & the works of Patrick Geddes, and their relevance in Town Planning' and examples of towns like Varanasi, Rakhi Gari etc. Ancient Indian system of planning and designing (Popularly known as Vastu-Shastra) is considered as non-scientific, primitive and ritualistic in present day modern context. Since independence there are improvements in physical, social and economic character of our urban and rural habitat, but as a matter-of-fact result are marginal. Even in the era of specialization, all these aspects are considered as independent identities to an extent that even in planning urban and rural are also considered as independent identities though in the recent years their integration restarted.

Time	Program Schedule Details: Plenary Session and Panel Discussions
0930-1100 hrs.	Plenary Session – III: Ancient Knowledge Systems and India's Urban
	Heritage
	Welcome and Introduction of the Plenary Session by Shri Vivekananda Pai.
	• Patrick Geddes Memorial Lecture by Shri Jayant Sahasrabudhe, National Organizing Secretary, Vijnana Bharati.
	Introduction of the Speakers by Sh. Manoj Kumar, Coordinator- Habitat
	• Dr. Rana P.B. Singh - Varanasi: Making of India's Heritage City
	• Dr. Vasant Shinde - Story of Rakhi Garhi
	• Dr. Rajiv Nigam – Application of Paleontology in Marine Archaeology: Examples of Indian Regions

4.6.1 Program Schedule

4.6.2 Dignitaries and Experts of the Session







Dr. Rana P.B. Singh Professor IIT, BHU Varanasi



Prof. Vasant Shinde Former Vice- Chancellor Deemed University, Pune Director General, National Maritime Heritage Complex, Gandhinagar



Dr. Rajiv Nigam Emeritus Scientist (Former Head, Marine Archaeology) NIO Goa

4.6.3 Discussions and Recommendations

Sh. Jayant Sahasrabudhe delivered first 'Sir Patrick Geddes' lecture. Sir Patrick Geddes played a very vital role in improving the conditions of India, as his designs considered local context and tradition alongside being aware of the development needs. He believed that Eastern philosophy is more readily conceived of "life as a whole" therefore "civic beauty in India has existed at all levels, from humble homes and simple shrines to palaces magnificent and temples sublime." Sh. Jayant Sahasrabudhe shared from Bombay Town Planning Act of 1915, that reveals his thinking:

- Preservation of human life and energy, rather than superficial beautification;
- Promoting trade and commerce;
- Preserving historic buildings and buildings of religious significance;
- Developing a city worthy of civic pride, not an imitation of European cities; and
- Promoting the happiness, health and comfort of all residents, rather than focusing on roads and parks available only for the rich.

He said that there are many examples in India that stand testimony to Geddes Planning principals.

Dr. Rana P.B. Singh, in his presentation titled as "Kasi-Varanasi, making of the heritage city of Bharat, discussed about the evolution of the Varanasi including the Kasi mandala which is a diagrammatic representation of Varanasi. It depicts a yogic body with its head at the southern boundary marked by the river Asi and the fesst at the northern boundary marked by the river Varana. He also talked about the solar shrines and corresponding alignments showing integration of time and space that together converges into the cosmic geometry of sacredspace. Lastly, he discussed about the various famous shrines in Kashi kshetra including Kardameshwar, Bhimachandi, Ramnagar, Kashi Vishwanatha, Kapiladhura etc.

Dr. Vasant Shinde's title of the lecture 'Story of Rakhigarhi', which is present in the Hissar district of Haryana as the biggest Harappan metropolis. His major research goals included: the total site area of the site transformation from culture to civilisation, who the Harappan civilisation people are and how do they look like. And also discussed the application of scientific methods for recording and analysis of data like GPR, DNA and forensic science, stable isotope etc.

Dr. Rajiv Nigam, talked about "the application of the Palaeontology in Marine Archaeology- examples of the Indian region". He discussed about the various applications of Foraminifera including pollution monitoring, marine archaeology, sea level changes, fisheries etc. And lastly discussed about the various evidences from Lothal and tried to understand if Lothal was a port town or not.

4.6.4 Photos of the Session



Shri Jayant Sahasrabudhe National Organizing Secretary, Vijnana Bharati delivering Sir Patrick Geddes Memorial Lecture during Plenary Session

4.7 Panel Discussions – I: Sustainability and Urban Development - The Indian Context

Sustainable urban development is the way forward for cities to mitigate climate change, thereby, integrating urban places to bring people, activities, buildings, and public spaces together, with easy walking and cycling connection between them and transit service to the rest of the city. It is imperative to promote inclusive development approach which is essential for long-termsustainability, equity, shared prosperity, and civil society in cities.

4.7.1 Program schedule	4.7.1	Program	schedule
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Time	Program Schedule Details: Plenary Session and Panel Discussions
1135-1240 hrs.	Panel Discussions – I: Sustainability and Urban Development -
	The Indian Context
	Welcome by Dr. Ashok Kumar
	Guest of Honour & Chairman: Dr. Anjan Ray (Director, CSIR - IIP,
	Dehradun)
	Panellists:
	• Prof. (Dr.) Rajan Rawal, Executive Director, CEPT, Ahmedabad.
	• Dr. S.K. Agarwal, Executive Director, BMTPC, New Delhi.
	• Sh. Arijit Ghosh, Managing Director, SAP Automation, New Delhi.
	• Dr. Alpa Sheth, Managing Director, VMS Consultants Pvt. Ltd., Mumbai.
	• Dr. Srinivasan Duraiswamy, Vice President, Reliance, Navi Mumbai.
	• Sh. Pramod Adlakha, Managing Director, Adlakha Associates Pvt. Ltd.,
	New Delhi
1245-1325 hrs.	Interactive Meet-IV on 'Sustainable Urban Habitat of the Future'
	Moderator: Dr. Yogesh K. Garg, Professor & Head, MANIT, Bhopal

4.7.2 Dignitaries Experts of the Session



Dr. Anjan Ray Director CSIR-IIP, Dehradun



Dr. Rajan Rawal ED, Centre for Advanced Research in Building Science & Energy, Ahmedabad



Dr. S.K. Aggarwal Executive Director BMPTC



Shri Arijit Ghosh Managing Director SAP Automation New Delhi



Dr. Alpa Sheth Managing Director VMS Consultants Pvt. Ltd. Mumbai



Dr. Srinivasan Duraiswamy Vice President Reliance Navi Mumbai



Sh. Pramod Adhlaka MD, Adlakha Associates Pvt. Ltd. New Delhi

4.7.3 Questions of the Panel Discussions-I to the Panellists

- **Q.1.** There is a massive increase in urban population in Indian cities and this is leading towards hike in ecological footprint as well. The Western / European countries are developing products with ecological footprint tags on different building materials / systems. However, in India, such efforts are scarce. What are your assessments / opinion on this? Should the Ecological Footprint and Life Cycle Energy Assessment be the important indicators for sustainable urban development?
- **Q.2.** Why the certification systems keep the plug loads out of the calculations or actual performance of buildings in grade systems rather than quantifiable measures? Should we measure their impacts on creating on the planet, and shouldn't these be the basis of building permit?
- **Q.3.** Govt. of India, BEE has proposed ECBC, and we have so many certification systems and nomenclature. Why all are not mandatorily 100% quantifiable? What is your assessment on this? Could ECBC be made more stringent with quantifiable benefits to help reduce energy consumption considering both passive and active design measures and building physics principles being pre-requisites? Why we need to certify buildings according to a particular nomenclature, if there is no quantification? How can we compare performance or efficiency?
- **Q.4.** The SDGs focus on cooling as developmental needs. In Urban scenario, how can the cooling interventions be tied to low energy consumption, and low carbon emissions? What do you think, are the key ways forward to cool buildings with new technologies without increasing energy usage and carbon emissions? How can we drastically reduce UHI resulting from HVAC usage, the heat rejection from inside of a building to the outside environment?
- **Q.5.** The climate change is going to impact our habitats. How are our buildings ready & are our codes ready? Are our measurement systems ready for assessing its impact on habitats?
- **Q.6.** If you were to make a building to address the ICAP needs what are the 3 major interventions, you would consider to deliver that?
- **Q.7.** There is a basket of alternate materials & technologies in the market developed by various Research Institutes of the country & being promoted by BMTPC. However, these have not been accepted by the society at large. Could you throw some light on this, as to how these can be made acceptable to society at large? Do you think, the indicators of sustainability can be integrated into urban habitat for regulatory development, to bring more focus on the quantifiable benefits of these alternative materials & technologies and their likely acceptance by the society at large?
- **Q.8.** There is a new norm / terminology on 'Performance Based Designs', be it structural or functional performance. But in India, it is still not being practiced. Could you throw light on this, as to why this still being not so popular/ why there are still no Performance-Based Design Codes in India? What is your opinion on this? Do you think, it is mandatory or not?
- Q.9. In India, there is poor post-occupancy maintenance and management of infrastructure after it has

21 | Page

been installed & is in operation? What is your opinion on this, and how can it be made a specialized field like outside countries? Do you think, Startups can be successful in these endeavors?

- **Q.10**. In India, the Research, Academia Industry interface is not practiced as done in Europe, although, it has been highlighted by NITI Ayog, DSIR and PSA etc. Why industries do not come forward (currently it is low), to have joint research programs so that the industry driven research can solve industry specific problems? Could you throw light on this, as to how Research Academia Industry interface can be enhanced?
- **Q.11.** Sound urban practices lead to long term sustainability. The National Commission on Urbanization (NCU) India recommended that Low-Rise High Density built- urban form for Indian cities. The Commission also felt that this typology is more economical than apartments because less space is required for public circulation and lifts, besides it also provides much better living conditions. On the other hand, high population density aggravates negative externalities like air pollution, noise and loss of green space, on the other it may reduce per capita domestic energy consumption, and also promote infrastructure efficiency and use of public transport. What is your opinion on this? Could low-rise high density or high-rise high density be the norm, and why?
- **Q.12.** The International Community's commitment is to build disaster resilient infrastructure. However, the stakeholders are not sensitive to the issue. What reforms we need to make so that the losses to life and property due to different disasters like earthquakes, floods, cyclones etc. can be minimized?
- **Q.13.** The Aatma Nirbhar Bharat speaks of becoming self reliant India, and it is important for development particularly in Tier 2 & 3 cities. Do you think, Startups can be successful in Aatma Nirbhar Bharat? What are the major challenges on this?

4.7.4 Discussions and Recommendations

Dr. Anjan Ray expressed his gratitude for being part of this event. He talked about "Urban habitats in India- community participation in sustainable practices. In his session he talked about various sustainable goals including no poverty, zero hunger, good health and well-being, quality of education, gender equality etc. He talked about the three E's i.e. Environment, Economy and Equity, which plays a very important role in the human well-being. Although he stressed more on the environmental aspect which includes pollution and resource conflict. He gave various examples which helps in reducing the carbon impact, this includes: using used cooking oil- a Dehradun case study, biodiesel concept everywhere, development of improved PNG burner, use of plastic waste, where a community oriented plastic waste collection model is being created which helps in segregation, collection, transportation and recycling. Not only this but it helps various communities and stakeholders to be engaged for behavioural change.

Dr. Rajan Rawal, while answering his question regarding life cycle assessment and ecological footprint, gave two main key recommendations. Firstly, there is a need to arrive at a common framework under which people need to conduct various researches and studies. And secondly, decides to how much disclosure of the data needs to be done which people require for their study. He also pointed out that most of the rating systems in India are intent based, rather they should be performance based. Thus, keeping this in mind, design and performance based rating systems should go hand in hand.

Dr. S.K Agarwal quoted that "we are trying to bring in a paradigm shift in the construction sector, by bringing new and innovative technological systems. A technology sub-mission as a part of PMAY is also being initiated. It is a mission with green technologies along with the collaboration of academia and research institutes, as these institutes play a very vital role in promoting these new technologies. In continuation with the performance based question, he expressed that total cost of ownership and various other factors are also evolved from the client side, which implies that slowly and gradually performance based design is also increasing in demand as the time is passing by.

Dr. Alpa Sheth, said that performance based designs run around a lot of aspects including the building itself. Also the two major aspects include: Tall buildings and Fire Safe buildings. Performance based designs somehow restrict the design of the building. Therefore, there is a need to increase the understanding as to how design of such buildings is accomplished. She further stressed upon giving more open spaces in the buildings which are very essential for physical and mental health of the well-being.

Dr. Srinivisan Duraiswamy talked about the two major aspects of Research - Academia – Industry (RCI) interface. First, there is a need for the fundamental understanding. Second, user inspired intervention is also important where there is quest for the fundamental knowledge and the user practice both. Hence, there should be a balance between both fundamental and user based practice. He thanked Dr. Ashok for RCI as one of the important parameters.

Sh. Pramod Adhlaka discussed about the various aspects including performance based system and prescriptive based system where he concluded that Performance based system is the one in which the performance of a building design has to meet Code-based-objectives using accepted means of verification, whereas in prescriptive based system; there is only a single set of solution to achieve the Code standard objectives. Also, a performance based regulatory system allows any solutions that meet the Codal mandatory objectives, through alternative materials & methods.

Performance Code will incentivize the use of innovative products and technologies. This would also put in large amount of responsibility on building owners and designers for the design and construction. Performance based design solutions utilize engineering standards, practices tools & methodologies. He further stressed on the followings:

- (i) Fire code specify travel distance, performance based code would leave it to the designers to achieve the subjective of safe evacuation.
- (ii) The Codes mention external walls 200/230mm, and in the performance oriented codes, lesser thickness can be adopted. However, thermal performance is important.
- (iii) Masonry Codes: The present Code specify permissible stresses of masonry with mortar. When thin joints, are used, hollow perforated blocks and when interlocking blocks are used, the permissible stresses are more objective in a performance based Code.
- (iv) NGT restriction: Regarding dust control NGT dictates that do this or don't do this. The performance based Code would leave the method of dust control to designers/contractors to evolve strategies for its use or control. Delhi Building Byelaws-2016 have taken a step in this direction when it leaves the methods of pollution control measures to designers to achieve the objectives.
- (v) If we bring "professionalism" through small time courses and training, it will give opportunity to young millions of students to become entrepreneurs. They will themselves create further job opportunities for skilled/trained workers. Those blue collar workers can use the skill development platforms promoted by the Govt. for self-skilling. Since we have never given the due status to a construction worker, skilling would bring in "pride" to their professional skill. Instead of mason, he can be given a status of "Building or Construction Technician", like in a manufacturing unit.
- (vi) Construction practices and construction systems cannot be compared with industry. "Capital Technologies" are meant for industrialists, for industrialised housing, which cannot serve the individual or small players.
- (vii) If we have to achieve Atam Nirbhar Bharat, we have to convert our "jugaad" industry to create a "Tech-cottage" industry in New Avtar that combines traditional materials and techniques with improvised new-techniques, known as IDDM (Indigenously Designed Developed and Manufactured), that not only has economic value but adds social values to it. Let under employed-unemployed Architects-Engineers become entrepreneurs. We can create "Learning factories" of

enterprise, which shall also become medium of interface with Academia and Research Institutions.

- (viii) We can also reinvent the Reverse Engineering, by importing technologies from developed countries, which were used by them decades ago (when the labour force was sufficiently available), and may be obsolete now in those countries due to labour shortage, that would fit into Indian culture and Indian conditions, even now and future and those technologies do not use Automation. It then becomes affordable for small players. Research Institutions like CSIR-CBRI and Academia can provide technical support to such small players.
- (ix) Multi-storeyed & Hi-tech Technologies cannot be evaded in Metro and Tier 1 cities, due to largescale migration, which increases the density and thereby the land cost too. However, in semi-urban and other urban areas, 80% of houses construction is low rise, which are self-constructed or by small players, particularly the low income category. Socially too, this class intend to remain closer to mother earth. Moreover, the maintenance cost is much lower. The affordability is another factor promoting low-rise-medium-density development.

Therefore, the solution lies in creating small nucleus cities around larger & metro cities, which are self-supported with infrastructure health, education, entertainment and self-oriented work opportunities. Connectivity to main city would complete the cycle. Dr. Ashok Kumar aslo stressed to create self-supporting settlements/ communities/neighbourhoods and towns.

Shri Arijit Ghosh concluded that it's the need of the hour for us to take several steps to take care of the global warming and the climate change.

- (i) Since Climate Change is 100% quantifiable, the interventions adding up to the same, viz. Green Buildings (ALL MANDATORILY) must be expressed and graded against performance.
- (ii) Performance must be GWP, ODP and % ZNEB quantifiable parameters only.
- (iii) Government should not allow extra FAR as the non-quantifiable green certified building may not prudently design to impact less GWP, ODP and % ZNEB.
- (iv) All Certification systems must be mandatorily number based and each segment must be quantified. The bench mark should be set up first and must not easy targets like current ECBC or similar certification process. The idea is to raise the bar to reach the climate goals, not make every building pass without doing anything (getting some points off-course) and getting the extra FAR allowance.
- (v) Certifications should be based on simple questions and quantifications:
 - How much energy does the building consume?
 - How much of it is recycled or used from infinite nature/renewable?
 - How much of clean air in the building? (In PPM)
 - Complete calculation of ODP and GWP & LCE or just making it simple CO_2 emission (kgs).

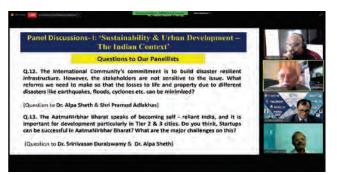
He further said that experts in India reason that, cost of compliance is too much. Hence, most parts can be left to prescription. In my opinion, either we comply now or you pay the "cost of peril".

Dr. Ashok Kumar further stressed on quantifying each strategy to achieve building energy efficiency and emphasized on the using building physics principles as a pre-requisite. Dr. Kumar gave an example of Experimental Test Beds created at CSIR-CBRI and measured the quantified savings to achieve 36 % energy efficiency by adopting different strategies.

4.7.5 Photos of the Session



Dr. Alpa Sheth, Dr. Srinivasan Duraiswamy, Sh. Arijit Ghosh, Er. Pramod Adhlakha sharing their views during Panel Discussion



Sh. Arijit Ghosh, Er. Pramod Adhlakha, Dr. Yogesh K. Garg sharing their viwes during Panel Discussion

4.8 Panel Discussions - II: Sustainability & Rural Development - The Indian Context

Sustainable rural development is vital to the economic, social and environmental viability of nation. The manifestation of poverty goes beyond the urban-rural divide, it has sub-regional and regional contexts. It is, therefore, critical and there is great value to be gained, by coordinating rural development initiatives that contribute to sustainable livelihoods through efforts at the global, regional, national and local levels, as appropriate.

4.8.1 Program Schedule

Time	Program Schedule Details: Panel Discussions
1415-1555 hrs.	Panel Discussions – II : Sustainability and Rural Development- The
	Indian Context
	Welcome by Dr. Ashok Kumar, Principal Coordinator- Habitat
	Guest of Honour & Chairman: Dr. Biswajit Banerjee (Joint Secretary,
	Ministry of Rural Development, Govt. of India)
	Panellists:
	• Ar. Rajiv Verma, Practicing Architect & Urban Designer.
	• Dr. N. Gopalakrishnan, Director, CSIR-CBRI, Roorkee.
	• Dr. Prabhjot Kaur, Director, PTU, Chandigarh.
	• Dr. V. Ramachandra, Vice President (Tech.), Ultratech Cements, Mumbai.
	• Ar. Gaurav Shorey, Founder Member and President- 5WARAJ.
	• Prof. (Dr.) C.S. Gokhale, Professor & Dean, NICMAR, Pune.
	 Prof. (Dr.) Minakshi Jain, Director, SPA, Vijayawada.
	• Ar. Anurag Bajpai, Co-founder & Director, Green Tree, New Delhi.
	• Q/A

4.8.2 Dignitaries and Experts for the Session



Dr. Biswajit Banerjee Joint Secretary Ministry of Rural Development Government of India



Ar. Rajive Verma Freelancer Actor & Architect



Dr. Prabhjot Kaur Professor and Director IKG Punjab Technical University, Punjab



Dr. V. Ramachandra Vice President (Technical) Ultra Tech Cements

25 | Page



Ar. Gaurav Shorey Practicing Architect and CO-founder SWARAJ New Delhi



Dr. C.S. Gokhale Professor & Dean National Institute of Construction Management and Research, Pune



Dr. Minakshi Jain Professor & Director SPA Vijayawada



Ar. Anurag Bajpai Building Energy Efficiency Expert & Cofounder of Green Tree Building Energy (P) Ltd., New Delhi

4.8.3 Questions of the Panel Discussions – II to the Panellists

- **Q.1.** The National Rurban Mission (NRuM) follows the vision of "Development of a cluster of villages that preserve and nurture the essence of rural community life with focus on equity and inclusiveness without compromising with the facilities perceived to be essentially urban in nature, thus creating a cluster of "Rurban Villages". Could there be Model Villages in every state of India? How it can be encouraged for local economic development, enhanced basic services, and well planned Rurban clusters? Do you think the earlier concepts like PURA could be linked to this to create Smart Villages in every district of the country to bridge the rural-urban divide?
- **Q.2.** Looking into the current pandemic COVID scenarios, what initiatives are required to create livelihood generation activities in rural areas? Which Enabling Technologies could be deployed immediately, stimulating local economic development with emphasis on reduction of poverty and unemployment in rural areas and attracting more investment in rural areas?
- **Q.3.** Villages have acted an important link between cities/towns for delivering basic facilities (Milk, Vegetables, Grains, etc.). Could these Villages be developed as Model Villages with all the Infrastructure Facilities and made self- sufficient? Would you recommend a new approach for the development of Villages for New Paradigm in Habitat?
- **Q.4.** Looking into the Key Challenges before India, how innovative approaches to Sustainable Development, Inclusiveness and Environment can lead to the overall development of the Villages for a New Paradigm in Habitat 'Rurban' that leads to greater happiness all around us?
- **Q.5.** The vernacular architecture has been adhering to the basic architectural principles, on the native knowledge of how buildings can be effectively designed and built taking advantage of local materials and resources. What traditional scientific principles can be used for our present day buildings/ contemporary architecture? Is there a need to introspect and revisit the ancient knowledge systems in planning of villages and why?
- **Q.6.** The International Community's commitment is to build disaster resilient buildings and safe, secure and affordable habitat for all is vital for the prolific development. How the sustainability of rural habitat and its habitants can be ensured to meet the challenges? What skill sets do we need to minimize the losses to life and property due to different disasters like earthquakes, floods, cyclones etc.?
- **Q.7.** The Govt. of India's Mission on Affordable Housing for all under PMAY-Gramin, aims at providing a pucca house, with basic amenities like kitchen, W.C. and bath. The major constraint is the cost of the houses. But hardly there are architects working in rural areas. How planning and selection of materials & technologies can lead to lowering the cost without compromising the quality? Do you think the model typology designs with a basket of choices of materials and technologies for different regions of the country for safety, and affordable habitat are required and how? Can approach to sustainability of rural houses be relooked?

4.8.4 Discussions and Recommendations

Strategies to deal with rural development should take into consideration the remoteness and potentials in rural areas and provide targeted differentiated approaches.

- Promoting poverty eradication in rural areas.
- Promoting pro-poor planning and budgeting at the national and local levels;
- Addressing basic needs and enhancing provision of and access to services as a precursor to improve livelihoods and as an enabling factor of people's engagement in productive activities.
- Providing social protection programs to benefit, inter alia, the vulnerable households, in particular the aged, persons with disabilities and unemployed many of whom are in rural areas.
- Ensuring universal access to food with a sustainable farming production.

5. Major Recommendations and Key Takeaways

The major discussions revolved around how to achieve sustainability in both urban and rural habitat and how ancient knowledge systems, culture should be used in the present-day context. Why sustainable materials and technologies should be the main component of the future development? The major recommendations are given below.

The Institutions like CSIR-CBRI must take lead in evolving strategies and roadmap for developing both urban & rural areas keeping sustainability as the major focus.

(A) Rural Development:

- The Rurban Mission (GoI) must focus on Physical Connectivity (PC), Electronic Connectivity (EC) and Knowledge Connectivity in line with the concept PURA in achieving Economic Connectivity (EC).
- The 'Cillage' concept must be adopted as a Model of City Villages for a New Paradigm in Habitat. This requires development of 5000 Cillages in the whole country that must connect different hierarchy of settlements with a road covering a distance of 10-30 minutes from Rural to Urban & Urban to Rural and to minimize the migration. The Cillage shall have low – rise (4 storeyed) high density development.



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Dr. N. Gopalakrishnan delivering the concluding remarks during Valedictory on 25th Dec., 2020 along with Prof. Sudhir Singh Bhadauria, Secretary General, Vijnana Bharati

Dr. Ashok Kumar concluding the Session by giving the key takeaways from the Habitat theme

27 | Page

- Therefore, the Institutions like CSIR-CBRImust extend the work done in this area to develop science based solutions.
- The education must be reoriented towards livelihood / entrepreneurship (KC & EC). The ITIs & Diploma colleges must be strengthened to impart training for all kinds of skill sets needed in the country (KC & EC). Research on traditional planning systems and craftsmanship should be further taken up to improvise on the traditional wisdom (KC). For the rural housing designs, community / beneficiary participation must be ensured to increase the adoptability of the designs by poor households.

(B) Urban Development:

- The Ratings like are not defining the quantifiable benefits.
- The metro cities demand high rise due to high land prices. However, the users' survey with 85%

respondents prefer the height not exceeding 100meters. Government must regulate on the land prices. Therefore, the maximum height of residential buildings must be less than 100M.

- New technologies must be evaluated from functional and / or sustainable performance in addition to structural performance for confidence building. The government buildings must be built using the alternative technologies as a showcase for assessing the overall performance and adoptability by larger society.
- An integrated approach for Transit Oriented Development (TOD) at a city level must be taken up for regularizing urban form, density, and energy use.
- Sustainability must be made mandatory part of every planning & development to meet the objectives of SDGs. Strategies for reducing cooling load at city level must be developed.
- Indoor and Outdoor thermal comfort & cooling loads along with development of envelope materials & technologies must be taken up for further research. Working Groups (WGs) consisting of subject area experts may be formed to further research on futuristic planning, design and development with specific timelines. There is a need to develop science based architectural design and building science solutions for the urban development problems looking into the expectations and the future requirements vis-à-vis challenges. More Research is needed on standardization, planning, alternative materials, and technologies.
- Frequent Industry meets must be organized with different stakeholders like Architects & Civil Engineers to impart knowledge on new research outcomes, new materials and technologies for marketability and to increase the capacity building.
- The Institutions like CSIR-CBRI must take a lead in developing science-based strategies supported by experimental test needs for quantitative validations of energy and water saving.
- Develop science based codes and policies supported by experimental test-beds for quantitative validation of energy and water savings. The new Codes for Net Zero Energy Buildings, Zero Carbon Buildings as well as the Performance based Codes must be developed.

6. Coordinators & Other Organizing Team Members

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