Department of Civil Engineering
Jamia Millia Islamia

(A Central University by an Act ofparliament)

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Taameer تعمیر

جامعہ کا ترانہ

دیار شوق میرا دیار شوق میرا
شہر آرزو میرا شہر آرزو میرا

ہوئے تھے آکے یہیں خیمہ زن وہ دیوانے — اٹھے تھے سن کے جو آواز رہبران وطن
یہیں سے شوق کی بے ربطیوں کو ربط ملا — اسی نے ہوش کو بخشا جنوں کا پیراہن
یہیں سے لالۂ صحرا کو یہ سراغ ملا — کہ دل کے داغ کو کس طرح رکھتے ہیں روشن

دیار شوق میرا، شہر آرزو میرا

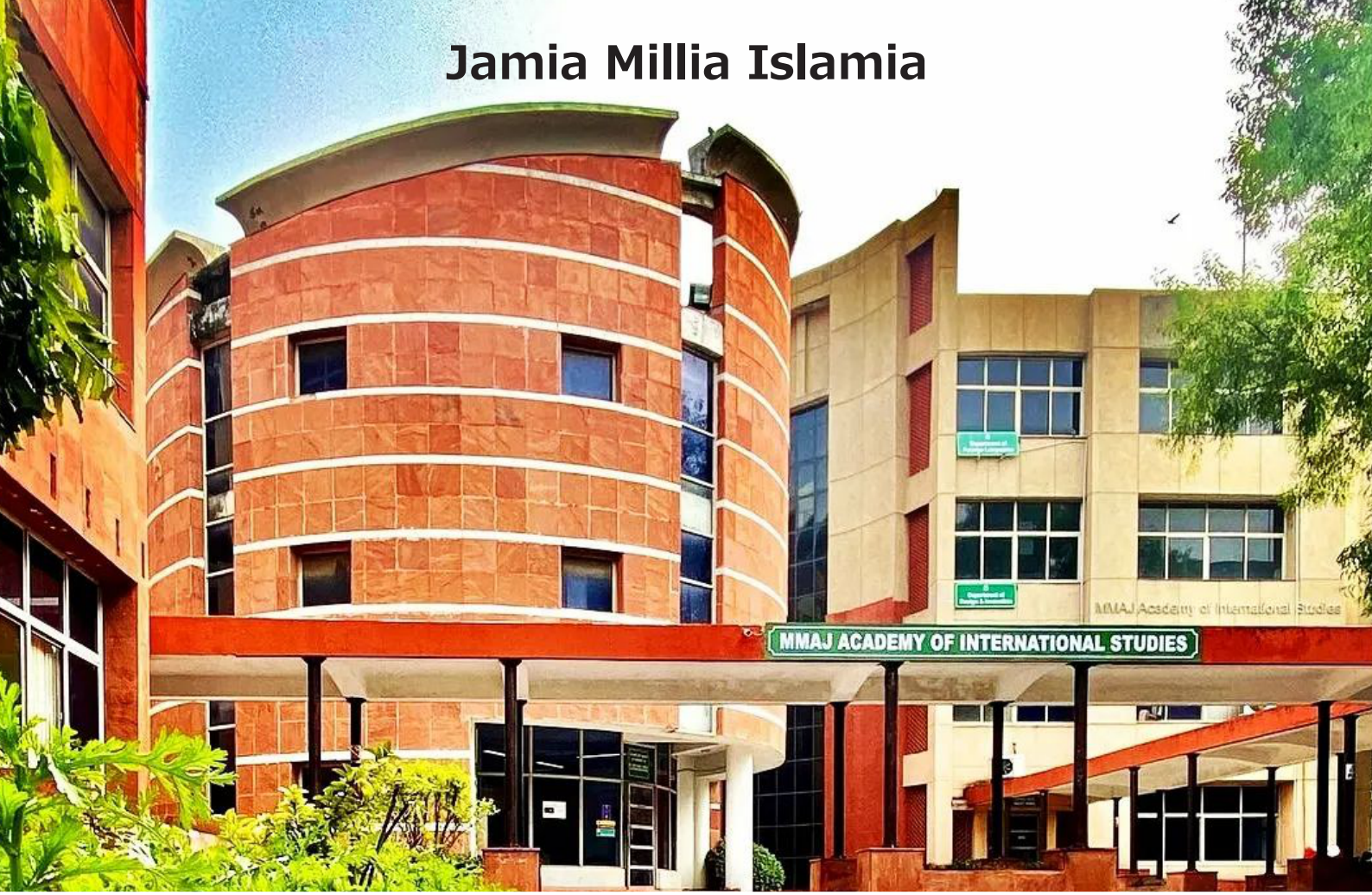
یہ اہل شوق کی بستی یہ سرپھروں کا دیار — یہاں کی صبح نرالی، یہاں کی شام نئی
یہاں کی رسم و رہ مے کشی جدا سب سے — یہاں کے جام نئے، طرح رقص جام نئی
یہاں پہ تشنہ لبی مے کشی کا حاصل ہے — یہ بزم دل ہے یہاں کی صلائے عام نئی

دیار شوق میرا، شہر آرزو میرا

یہاں پہ شمع ہدایت ہے صرف اپنا ضمیر — یہاں پہ قبلہ ایماں کعبہ دل ہے
سفر ہے دین یہاں، کفر ہے قیام یہاں — یہاں پہ راہ روی خود حصول منزل ہے
شناوری کا تقاضہ ہے نو بہ نو طوفاں — کنار موج میں آسودگی ساحل ہے

دیار شوق میرا، شہر آرزو میرا

Jamia Millia Islamia



Jamia was established in 1920 by a group of nationalist Muslim intelligentsia at Aligarh, Uttar Pradesh during the khilafat and Non-Cooperation Movement in response to Gandhiji's cell to boycott governmentsupported educational institutions. Among those who enthusiastically responded to this call were Shaikhul Hind Maulana Mahmud Hasan, Maulana Mohammed Ali Jauhar, Hakin Ajmal Khan, Dr. Mukhtar Ahmad Ansari, Abdul Majeed Khwaja and Dr. Zakir Husain and others. In 1925, its campus shifted from Aligarh to Delhi and the foundation stone of the present campus was laid on 1st March 1930. Since then, it has been continuously growing, always refurbishing its methods and branching out from time to time to meet new needs. True to the ideals of its founders, it has, over the years, tried to enhance the physical and mental development of its students, and has become known as a premier educational institution of the country. Recognizing its contributions in the field of teaching, research and extension work Jamia Millia Islamia was declared a Deemed University under Section 2 of University Grants Commission (UGC) Act in 1962. Jamia was declared a Central University, as per Jamia Millia Islamia Act 1988, which was passed by the Parliament on 26th December 1988.

Jamia Millia Islamia is an ensemble of a multi layered educational system which covers all aspects of schooling, undergraduate and postgraduate education and research. The University recognizes that teaching and research are complementary activities that can advance its long-term interests. It has Natural Sciences, Social Sciences, Engineering & Technology, Education, Humanities & Languages, Architecture & Ekistics, Fine Arts, Law and Dentistry Faculties. It also has the well-known Centre namely the AJK Mass Communication Research Centre besides several other research Centers that have given an edge to Jamia in terms of critical research and programmes that can offer opportunities to its students and teachers to expand the horizons. Jamia Millia Islamia conducts Undergraduate, Postgraduate, M. Phil. and Ph.D. as well as Diploma and Certificate courses. Jamia Millia Islamia has been declared a "Minority Institution" by National Commission for Minority Educational Institutions on February 22, 2011 under Article 30 (1) of the Constitution of India read with Section 2 (G) of the National Commission for Minorites Institutions Act.

जामिया मिल्लिया इस्लामिया
(केन्द्रीय विश्वविद्यालय)
मौलाना मोहम्मद अली जौहर मार्ग, नई दिल्ली-११००२५

JAMIA MILLIA ISLAMIA
(Central University)
Maulana Mohammad Ali Jauhar Marg, New Delhi-110025
(ACCREDITED "A" GRADE BY NAAC)

جامعہ ملیہ اسلامیہ
(مرکزی یونیورسٹی)
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प्रोफेसर नजमा अख़्तर
कुलपति

Professor Najma Akhtar
Vice Chancellor

پروفیسر نجمہ اختر
شیخ الجامعہ

Vice Chancellor's Message

It gives me immense pleasure to present, TA'MEER, a magazine brought out by Department of Civil Engineering, Jamia Millia Islamia. It opens a window of opportunity for the students to express their creativity, perceptions, innovations and scholarly appreciation of innovative activities and works, enumerating the impressive strides made by Department of Civil Engineering. It aspires to showcase the latest growth, development and innovations, engaging the students pursuing their curriculum, researches and investigations, reflecting the ethos and aspirations of Department of Civil Engineering, its students and faculty members.

With its spectacular performance in NIRF Rankings, Jamia Millia Islamia figures among top six Universities of India. It has been providing accessible and affordable quality education since its inception. Committed to delivering the best experiential education and keeping abreast of changing trends and paradigm shift in pedagogy, technology and innovation, it fosters creativity, inspires critical thinking and pursuit of excellence.

I congratulate the Head, Department of Civil Engineering, the Editor, editorial team, students and faculty members on bringing out such a wonderful issue of TA'MEER.

Wishing a resounding success!

Najma Akhtar

(Prof Najma Akhtar)

JAMIA MILLIA ISLAMIA जामिया मिल्लिया इस्लामिया
(A Central University Accreditted Grade 'A++ by NAAC))

Faculty of Engineering and Technology

Maulana Mohammad Ali Jauhar Marg, New Delhi-110025
Phone No.: 26985831 Extn.: 2201, 2202, 2203 & 2204
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Prof. Mini Shaji Thomas
Dean

Message from the Dean

I Congratulate the Department of Civil Engineering for bringing out another edition of the magazine. This magazine serves not only as a platform to showcase the academic and extracurricular accomplishments but also as a reflection of the collective spirit, dedication, and passion that define our community.

I appreciate the efforts of the faculty members who have continued to set high standards with their outstanding work, while our students have shown exceptional creativity and resilience in their endeavours, whether in the classroom, laboratory, or on the stage of competitions.

I encourage everyone to continue embracing a culture of curiosity, inclusivity, and excellence. Let us remain committed to learning, growing, and contributing to the world in meaningful ways. Together, we can make a difference, and together, we will achieve greatness.

I extend my appreciation to the editorial team for their hard work and dedication in bringing this publication to life.

With best wishes,

Prof. Mini S. Thomas
Dean

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Message from the Head

Transformation and developments in technology is posing new challenges for the civil engineers in the twenty first century. “Tameer” is a platform dedicated to highlight the new developments and modernization in the field of civil engineering. Each issue is a testament to the hard work, technical expertise, and problem-solving spirit that defines our department.

Our collective knowledge is one of our greatest assets, and this magazine serves as a vital tool for fostering collaboration, sparking new ideas, and keeping us at the forefront of industry trends. As we continue to face new challenges in our field, I encourage you to explore the articles, engage with the research, and share your feedback.

Let’s continue to innovate, inspire, and drive progress in civil engineering together. Thank you to everyone who contributed to this issue.

Best regards,

Farhan Ahmad Kidwai
Head, Department of Civil Engineering

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Message from Editor

I take this opportunity to congratulate the students of civil engineering department for bringing out this magazine and contributing the technical articles with great enthusiasm. The area of civil engineering deals with several aspects of human civilization and its development. The "TAMEER", a civil engineering magazine harness the creative energy of academic community and distils the essence of their inspired imagination in the most brilliant way possible. Hence it gives me immense pleasure to bring out "TAMEER" 2023 a civil engineering magazine. A special thanks to honorable vice chancellor and Jamia administration for their encouragement and support. Also, I would like to thank all my research scholars and my colleagues.

Best regards,

Prof. Nazrul Islam
Editor

About Civil Engineering Department

Department of Civil Engineering the Department of Civil Engineering (DCE) offers two undergraduate courses in Civil Engineering and Master's program with specializations in Environmental Engineering and Earthquake Engineering. More than 80 Ph. D. scholars including foreign students from different countries are currently working in the Department on emerging research areas. DCE also renders technical advice to various Government and Private Sector companies on consultancy basis. DCE has many collaboration programs with foreign universities including University of Applied Sciences, Erfurt, Germany; Wessex Institute, UK; University of Waterloo, Canada; Asian Institute of Technology, Bangkok. DCE regularly organizes international and national conferences, seminars and workshops on current themes. This international conference is a sequel to the earlier conferences held on the themes of sustainability and development and is an endeavor of the DCE to focus on the emerging areas of smart city development.

Today, Jamia Millia Islamia is "A" grade Central University accredited by NAAC. Jamia Millia Islamia Continues to cater to the interests of students from all communities, but also aims to meet the particular needs of the disadvantaged sections of the Muslim society. True to the legacy of its founders, it continues to support measures for affirmative action and foster the goals of building a secular and modern system of integrated education.

WASTE-TO-ENERGY TECHNOLOGIES TURNING TRASH INTO TREASURE

HYFA HANIEF
B. Tech (Civil) 8th Sem

SANIA SHAKIL
B. Tech (Civil) 8th Sem

Significant environmental problems are caused by the rising waste generation, which have an adverse effect on ecosystems, human health and natural resources. The following are some of the major environmental problems brought on by the increased trash generation.

- **Landfill pollution:** Methane, a potent greenhouse gas responsible for climate change is produced as waste builds up in landfills.
- **Air Pollution:** Without effective pollution controls, open burning or incineration releases dangerous pollutants and particulate matter into the air, which can worsen air quality problems and cause respiratory ailments.
- **Water Contamination:** Hazardous compounds may seep into water bodies or may reach the water table in the form of leachate as a result of improper waste disposal. 4. Climate Change: Methane, a strong greenhouse gas that contributes to climate change, is created when organic waste decomposes in landfills.
- **Degradation of Soil:** Contaminated soil that cannot be used for agriculture might result from improper waste disposal and landfilling, which has an impact on food production.

Solid Waste Recycling Plant Supplier in Gujarat– Pinakin (https://images.app.goo.gl/Pz4hugqMqMk5J9996)

Adopting sustainable waste management strategies, such as recycling and waste-to-energy conversion, is crucial to addressing these environmental problems. Garbage to energy technologies, or Waste to Energy (WtE), are cutting-edge and environmentally friendly approaches that transform different types of garbage into useful energy sources.

Composting is a process by which the biodegradable waste can be decomposed in the form of humus like substance or black soil. Further non-biodegradable and biodegradable waste can be used to produce energy by using new technologies Waste to Energy (WtE) processes use a variety of techniques, including anaerobic digestion, gasification, and incineration. By carefully burning waste, incineration creates heat that can be utilized to heat homes or create energy. Syngas, which can be used to create power or biofuels, is created during the gasification process by converting organic waste into high temperatures and little available oxygen.

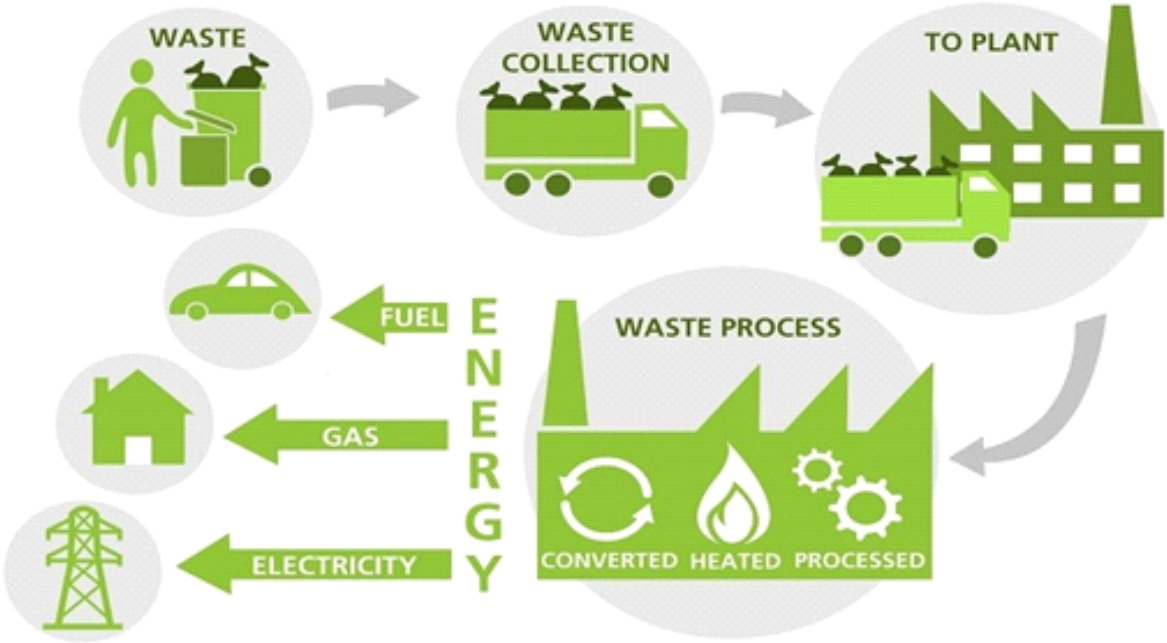
Diverse technologies and methods are used to extract energy from diverse types of waste during the waste to energy conversion process:

- **Collection and Sorting:** The collection and sorting of waste is the first phase. MSW is typically collected from residences and commercial establishments. Paper, plastic, and other recyclable items are separated for recycling.
- Burning or incineration Incineration is one of the most popular waste-to-energy processes. Non-recyclable garbage is burned in controlled combustion chambers at high temperatures during this process. Burning fuel produces heat that is used to create steam, which powers a turbine attached to a generator to provide electricity.
- **Gasification:** Another waste-to-energy technique, gasification entails transforming organic waste (such as food scraps and agricultural residues) into a mixture of gases that includes hydrogen, carbon monoxide, and other gases. It can also be used to create biofuels like synthetic natural gas (SNG) or bio-oil.
- **Anaerobic Digestion:** Anaerobic digestion is a method for processing organic waste, including food scraps and sewage sludge. In the absence of oxygen, this biological process decomposes the waste, creating biogas (methane and carbon dioxide) as a byproduct.
- **Pyrolysis:** Pyrolysis is a thermal decomposition method that, in the absence of oxygen, transforms organic waste into biochar, bio-oil, and syngas. Syngas and bio-oil can be used to produce electricity, and biochar can be used to amend soil to improve soil fertility and carbon sequestration.
- **Mechanical Biological Treatment (MBT):** MBT combines biological and mechanical sorting. In this method, recyclable components are recovered from waste by sorting, and the leftover organic waste is biologically processed to create compost and energy-producing methane.

Using waste to energy technologies has a number of advantages, including

- It lessens the quantity of waste that is dumped in landfills, when open land is already scarce in the urban areas reducing environmental pollution and possible health risks.
- It offers a dependable and sustainable energy source, assisting in energy mix diversification and lowering reliance on fossil fuels.

- Waste to Energy (WtE) technologies reduce greenhouse gas emissions by capturing the powerful greenhouse gas methane produced by the decomposition of garbage.



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Waste-to-energy (WtE) technology has shown to be quite beneficial in a number of ways for both the present and the future generations. It is beneficial for the current generation in terms of producing sustainable energy, managing waste better, protecting the environment, preserving land, promoting the circular economy, reducing climate change, and ensuring energy security. While WtE technology is set to become even more significant for future generations as the globe looks for sustainable solutions to waste management problems and energy demands. In the years to come, improvements in Waste to Energy (WtE) processes, such as increased productivity, less emissions, and better waste sorting technologies, will increase the value of these facilities.

However, there are several challenges that we are currently facing to convert waste into energy. Some of the challenges are listed below:

- Severe lack of infrastructure in the collection and transportation of the solid waste.
- Lack of properly planned landfill and dumping sites
- Lack of optimum routing for transportation of solid waste
- Inefficiencies in proper segregation and door: to: door collection (DTDC) of garbage.
- Lack of adequate community participation and awareness.
- The existing number of bins and containers is extremely low as compared to the required bins and containers.
- Complete dependence on the government for funds.

2

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AUTOCLAVED AERATED CONCRETE BLOCK(AAC)

"BEAT THE HEAT WITH THERMALLY INSULATED AAC BLOCKS"

Introduction

Bricks are the world's oldest building material and an important material in construction. Traditional clay bricks are made from clay and fired at high temperatures, consuming a lot of energy and leaving a huge carbon footprint. These are made from the top fertile layer of the soil, resulting in soil sterility and erosion. Nearly 15% of overall air pollution is caused by brick kilns, which has become a serious environmental problem.

Kilning of ordinary bricks promotes global warming and climate change and has produced a slew of environmental and health issues on a worldwide scale. Various Greenhouse gases are emitted during the kilning process such as Carbon dioxide, Carbon monoxide(CO), Methane, Nitrous Oxide, and total suspended particulates (TSP) which lead to **Global Warming**.

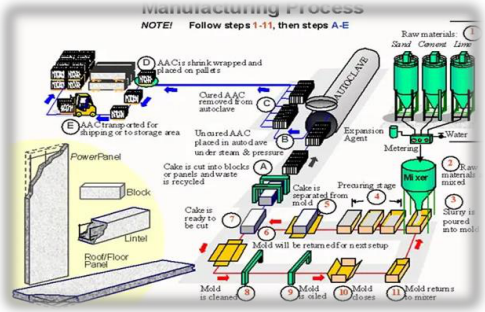
There is a necessity to replace this material, and AAC has emerged as the best clay brick substitute.AAC will have a lower environmental effect and will help to prevent global warming. AAC is a green construction material that resembles a foam block in composition. AAC blocks are an environmentally beneficial, green, and long-lasting construction material made from fly ash, a waste product from power plants. The trash generated by AAC blocks may be recycled.

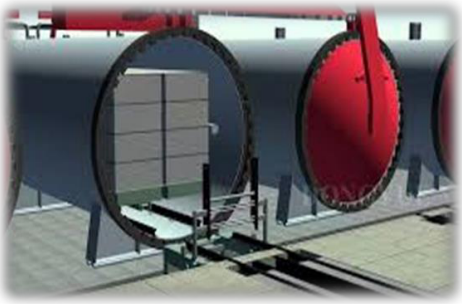
This article presents a comparison between clay bricks with Autoclaved Aerated Concrete blocks in terms of environmental effect, cost, physical and mechanical qualities such as water absorption, compressive strength, dry density, and weight.

Environmental Impact

Autoclaving recycling process which decreases CO2, emissions. The cost of transportation is dramatically reduced by using AAC blocks. It is much lighter than regular bricks, making it easier and less expensive to transport. The use of AAC blocks considerably decreases a building's total dead weight, enabling the construction of higher structures. Because it is so light, it helps to minimize the bulk of construction. AAC blocks' structure provides optimum thermal insulation for walls and building interiors, reducing heat loss in buildings. The substance has microscopic air pockets, and hydrogen is used to foam the concrete, providing it with exceptional heat insulation properties that allow for mild

winter temperatures and cool summer ones. As a result, it can help you save up to 25% on your air conditioning expenditures. AAC blocks are lightweight material, which makes them a better material for usage in strong seismic areas because they decrease the mass of the structure.





Ingredient properties of AAC Block

Normally, AAC blocks contain the following ingredients –

1. Fly-ash – 59%
2. Cement (usually OPC grade 53) -33%
3. Lime – 8%
4. Aluminium powder – 0.07%
5. Water

Properties of AAC block

- **Cost effective:** Using concrete blocks in construction significantly reduces cost in various ways. Each block can save approximately 25% more than using bricks.
- **Made from waste:** They do not harm or deplete nature for being made they are made from fly ash, which is nothing but a residue of thermal power plants.
- The **thermal conductivity** of AAC blocks varies between 0.21 to 0.42 W/mK. Hence, more thermal-resistant blocks are obtained.
- AAC blocks are made from inorganic and insect-resistant materials that prevent termite attacks.

- **Strength:** Concrete blocks have enough resistance for earthquakes which are happening quite frequently these days.
- The presence of air voids in AAC blocks and its lightweight structure provides good sound reduction compared to red bricks.
- AAC blocks achieve speedy construction due to their bigger size, low weight, and fewer joints.

SPECIFICATIONS	AAC BLOCKS	RED BRICK
1. Size (inches)	• 24 x 9 x 8 • 24 x 8 x 8 some other size are also available.	9 x 4 x3
2. Fire Resistance	More	Less
3. Thermal conductivity(k)	0.15 – 0.17	0.8
4. Weight	Lightweight	Heavyweight
5. Wastage	Less waste (less than 5%)	More waste (average 10 to 12%)
6. Carpet area	More	Relatively less
7. Speed for construction	Speedy construction	Relatively low
8. Carbon emission	Less	More
9. Compressive strength in N/mm^2	2.5 to 3.5	3 to 4.5

The calculation shows that **42 AAC blocks** are needed for 1 cubic meter, with each block costing 90 rupees. This totals to **3780 rupees**. On the other hand, for the same volume, **500 red bricks** are required, priced at 5 rupees each, resulting in a total cost **of 2500 rupees**. This demonstrates that though AAC blocks have a higher initial cost, their overall expense is lower compared to red bricks.

In terms of construction specifics, while 10 to 12 mm mortar is necessary for red bricks, only a 3 mm thickness is needed for AAC blocks, leading to cost savings. The lightweight nature of AAC blocks also reduces labor expenses. Furthermore, the fixed size of AAC blocks minimizes waste, unlike red bricks. Additionally, AAC blocks facilitate easier installation of electrical and sanitary fittings.

AAC (Autoclaved Aerated Concrete) blocks indeed have several advantages, but like any material, they also come with certain disadvantages. Some of the demerits or drawbacks of AAC blocks include:

- Not Suitable for Small Projects: AAC blocks are more commonly used in larger construction projects due to economies of scale. For smaller projects, the initial costs of setting up the required machinery for AAC block production might outweigh the benefits.
- Limited Load-Bearing Capacity: While AAC blocks do have some load-bearing capacity, they are more commonly used in non-load-bearing or framed structures. This limitation restricts their use in certain types of construction where load-bearing capabilities are essential.
- Sill Band Requirement: AAC blocks can be porous, which means they may absorb water. To prevent water absorption and improve structural stability, a sill band (a horizontal beam) is often required at regular intervals (around every 900 to 1000 mm) in construction.

- Water Retention: The porosity of AAC blocks can lead to water retention within their pores. This can potentially lead to moisture-related issues if not properly managed. When applying finishes to the walls, using materials that allow the wall to "breathe" and prevent trapped moisture is important.
- Plastering Challenges: Plastering AAC block walls can be challenging due to the porous nature of the blocks. Proper bonding between the plaster and the AAC surface might require

"In conclusion, AAC blocks stand as a compelling and efficient construction material, offering a harmonious blend of cost-effectiveness, environmental sustainability, and ease of installation. As the construction industry continues to evolve, AAC blocks emerge as a promising solution that not only addresses traditional challenges but also paves the way for a more resilient and innovative future in building construction."

Thrive Technical Quiz-2023

Thrive Technical Fest-2023

3
SHREEJA KACKER
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Modular Construction: Unlocking Technical Marvels across Diverse Typologies and Standardized Modules

Modular construction, also known as prefabricated construction or off-site construction, is a construction method in which a building or structure is constructed off-site in sections or modules, often in a factory or controlled environment. These modules are then transported to the construction site and assembled into the final structure. This approach differs from traditional construction, where most of the building is constructed on-site, piece by piece.

Key characteristics of modular construction include:

1. **Factory-Based Production:** Modules are manufactured in a controlled factory environment, which allows for greater precision, quality control, and efficiency in the construction process.
2. **Standardization:** Modules are typically designed to standard sizes and specifications, allowing for interchangeability and ease of assembly.
3. **Transportation:** Finished modules are transported to the construction site using trucks or other transportation methods. This can reduce the need for on-site material storage and transportation.
4. **Assembly:** On-site, the modules are lifted into place and connected to form the final structure. This assembly process is typically faster than traditional construction methods.
5. **Reduced Site Disruption:** Modular construction can minimize disruption to the surrounding area because much of the construction work is done off-site. This is particularly advantageous in densely populated or sensitive environments.
6. **Quality Control:** The controlled factory environment allows for rigorous quality control processes, resulting in consistent and high-quality construction.

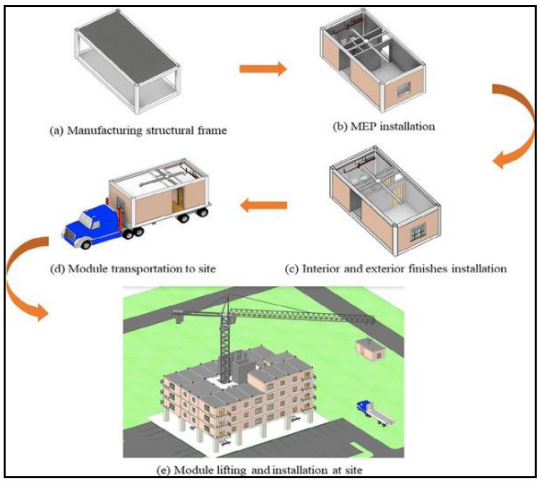

Figure 1: Steps of Modular Construction
(source: Steel concrete composite systems for modular construction of high-rise buildings by Y.S. Chua)

Typologies of Modular Construction: Molding Urban Landscapes with Technical Expertise

1. **Volumetric Modules:** Whole units, equipped with walls, floors, ceilings, and even intricate architectural details, are fabricated off-site in controlled conditions [4]. These volumetric wonders are then efficiently transported to the construction site and assembled, akin to a well-orchestrated symphony of engineering precision.

2. **Panelized Modules:** This approach dissects a structure into panels, where each panel is meticulously produced off-site [5]. On-site, these panels interlock to form a cohesive whole. Think of it as constructing a complex puzzle where every piece fits seamlessly, driven by technical exactitude.

3. **Hybrid Construction:** Balancing customization and modular efficiency, hybrid construction blends on-site craftsmanship with the precision of modular components [6]. This methodology offers architects a canvas to express creativity while enjoying the logistical advantages that modular construction provides.

Standardized Modules: The Metric of Technical Excellence

A hallmark of modular construction lies in standardized module sizes. These dimensions form the foundation for seamless assembly, transportation, and integration [2]. Common dimensions include:

1. **Width:** Typically ranging from 8 to 16 feet for panels, and 8 to 14 feet for volumetric modules.
2. **Height:** Modules are generally designed with standard ceiling heights, often in the range of 8 to 10 feet.
3. **Length:** Volumetric modules can extend up to 60 feet, allowing for substantial spatial configurations.

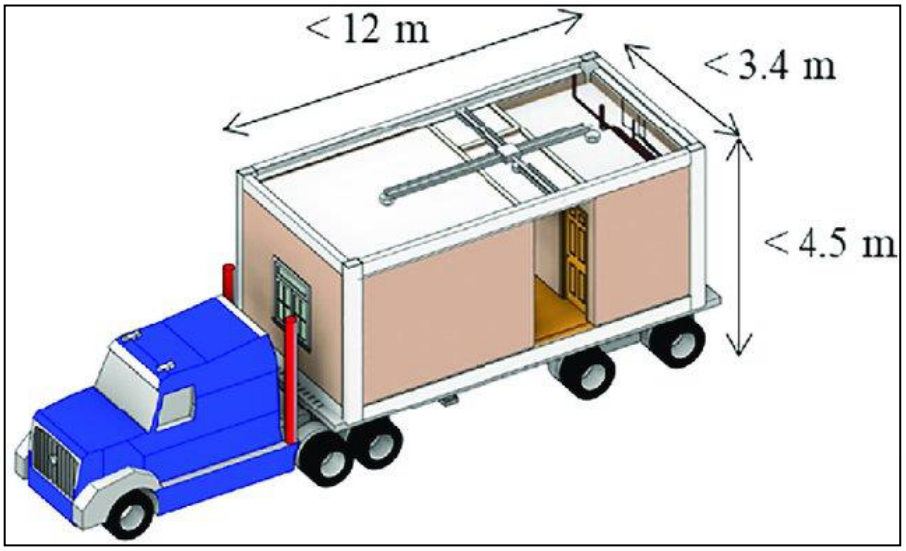

Figure 2: Size of a standard module
(source: Steel concrete composite systems for modular construction of high-rise buildings by Y.S. Chua)

The Technical Advantages: Where Precision Meets Progress

1. **Strategic Resource Management:** Controlled factory settings minimize material wastage and optimize resource allocation [1].
2. **Logistical Dexterity:** Standardized module dimensions enable efficient transportation, leading to streamlined logistics and cost savings [2].
3. **Quality Assurance:** In a controlled environment, modules are assembled with precision, reducing errors and ensuring uniform quality [1].
4. **Time Efficacy:** By embracing concurrent off-site fabrication and on-site assembly, modular projects are completed up to 50% faster [3].
5. **Sustainability in Construction:** Reduced waste, energy-efficient designs, and efficient resource use contribute to environmentally conscious urban development [7].

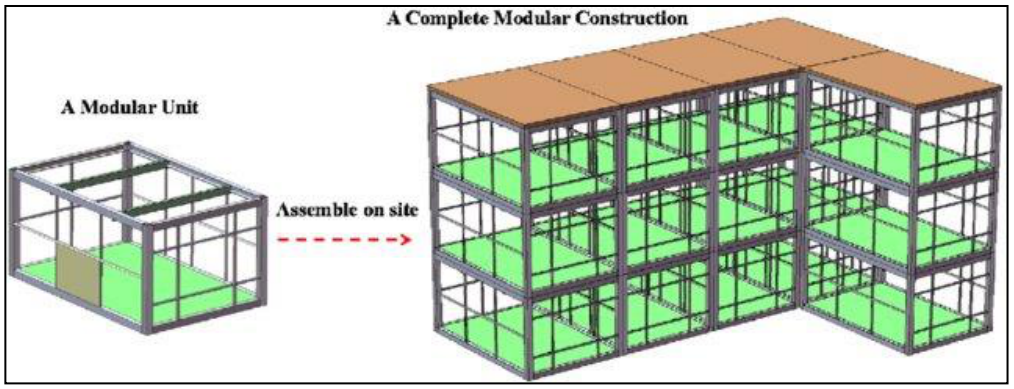

Figure 3: Complete Modular Construction

(source: Analytical and numerical studies on steel columns with novel connections in modular construction by Deng et. al.)

Bridging Innovation with Technical Craftsmanship

Modular construction's technical symphony resonates with strategic ingenuity, streamlining construction processes while prioritizing quality and sustainability. Modular construction is a testament to the harmonious collaboration between technology and human expertise, ensuring that our urban landscapes are crafted with precision, efficiency, and innovation.

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4

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ROAD INFRASTRUCTURE: A WAY TO PROSPERITY

THE ROAD TO SUCCESS COMES THROUGH HARDWORK, DETERMINATIONS AND SACRIFICES

It was the year 1927 when the foundation of Indian Road Congress was laid down by the British Indian rule. slowly but steadily with the collective efforts of government along with private players independent India has traveled from the muddy and gravely roads to the magnificent signature bridge (of wazirabad) and giant expressway (like recently inaugurated Purvanchal and Yamuna expressway) and much more.

Though the network in India has increased from 3.99 lakh kilometers in 1951 to more than 6 million kilometers at present. In modern society road infrastructure has become an indispensable part of daily life. Individual road users along with logistic firms and public transport agencies expect reliable and safest road infra for transporting goods and people from one location to other. Road agencies need to properly plan, build, and maintain along with operation to create high value for commuters. Recent development includes the performance measures to evaluate the efficiency and effectiveness of the service and to make the structures disaster resilient as also pushed by the government in its Coalition for Disaster resilient Infrastructure (CDRI) initiative.

SIGNATURE BRIDGE: AN ICON

Bridges play a key role in infrastructure development and can become an important landmark for a city or a region at the same time. One such bridge is the "Signature Bridge" in Wazirabad, Delhi (fig 1.1) , which is a new landmark while helping to channel traffic flows. India's first signature bridge being constructed across the Yamuna River at Wazirabad, promises to be a great attraction of New Delhi. An ambitious project of the Delhi Tourism & Transport Development Corporation.

The area around the bridge will later be developed based on the concept of the architect Ratan J. Batliboi into a park and the Yamuna River will be widened to lake-like dimensions. Therefore, the client had asked for a rather long span but light-weight bridge and a design which could become one of the area's attractions.

This bridge is an unsymmetric cable-stayed bridge with a main span of 251 meters and total length of 675 meters, the bridge's composite deck carries 8 lanes (4 in each direction). It is about 35m wide and is supported by lateral cables spaced at 13.5 meters intervals. The height of the steel tower is approximately 150 meters.

The pylon consists of several legs made of steel boxes fusing into one upper pylon zone in which the cables connecting the main span as well as the backstays are supported and connected. As this is the first of its kind but as the need of roads for logistics as well as aesthetic purpose is increasing day by day more of these structure which will be designated as the signature of a city come into existence.

EXPRESSWAYS: PATHWAYS TO FUTURE

The superhighways free of steep grades, sharp curves, frequent and arbitrary entry/exit points with Magnificent span and width represents the expressway on which a spectacular speed can be achieved. They have lots of advantages like high speed, greater safety, comfort and convenience for drivers and passengers. Along with benefits expressways also brought some pains due to high speeds and foggy roads in winter especially so many commuters lost their lives.

Among the so many examples of expressways and super highways. The Yamuna expressway and recently inaugurated Purvanchal expressway needs special mention.

A 6 lane and 165.5 km long access controlled highway connecting pari chowk in Greater Noida with kuberbur in Agra built by Utter Pradesh government in 2012 is known as Yamuna expressway. It was the one of its kind at that time and reduced the travel time between the heritage city of Agra and capital city New Delhi to 3 hrs. Now the significance of Yamuna expressway will be enhanced with the construction of Jewar International Airport, the world's fourth largest airport. It will surve the crores of people in cities including Delhi, Noida, Ghaziabad, Aligarh, Agra and Faridabad.

Next in line is The Purvanchal Expressway which traverse the 340.8 km long distance with its 6 wide lanes. It covers the development hungry area of purvanchal by connecting the Gosainganj in Lucknow with Haydariya village in Ghazipur district. This expressway also has some spectacular features like inbuilt air strip which can be used in case of emergencies and on demand. During inauguration the Prime Minister of India landed at airstrip in a *C-130 Hercules* plane. There are 18 flyovers, seven railways over bridges, seven long bridges, 104 minor bridges, 13 interchanges and 271 underpasses on the highway.

These are few in numerous examples in which the beauty of architecture and skills of engineering can be clearly observed.

NEED OF THE HOUR

As the main purpose of constructing big highways is to decongest the older routes and make the commutation faster and economical. But in terms of Logistics Performance India stands at 44th rank in the World Banks Logistics Performance Index. As far as the regional disparity is concern the Gujarat retains a top slot on logistics performance index. However, the states like north eastern and eastern states are not performing well.

To make use of existing infrastructure and building new one, active push from the sides of different governments and other stakeholders is required. By keeping in mind the socio-economic differences of the regions. Spending on Research and Developments must needs to be enhanced. Multimodal projects will play a special role in linking the best of different modes of transportation.

The global spectacular projects should be keenly observed so that we can train our engineers to execute world's best infra projects. Public Private Partnership should be given push so that financial crunch can be addressed by keeping in mind the exploitative side of privatisation and finally the collective efforts of governments, engineering communities, MNCs and other big players should be ensured so that India can traverse the way to prosperity.

5
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Structural Health Monitoring: Enhancing Infrastructure Resilience Through Advanced Monitoring Techniques

Introduction

Structural Health Monitoring (SHM) is a field of engineering that focuses on continuously monitoring the health and condition of structures, such as bridges, buildings, aircraft, pipelines, and other critical infrastructure. The primary objective of SHM is to assess the structural integrity, identify potential damage or degradation, and detect any signs of deterioration or failure in real-time or periodically over the structure's lifetime.

SHM utilizes various sensors, data acquisition systems, and advanced analysis techniques to monitor and analyze the structural response to external forces, environmental conditions, and other factors that may impact the structure's performance. The data collected from the monitoring system allows engineers to make informed decisions regarding maintenance, repairs, and safety measures.

SHM has become increasingly important as it provides a proactive approach to managing infrastructure assets and mitigating potential risks associated with aging and deterioration.

Benefits for Structural Health Monitoring (SHM)

1. **Enhanced Safety Assurance:**
   - SHM plays a crucial role in ensuring the safety of people and assets by continuously monitoring the health of structures in real-time.
   - It detects potential defects or damages early on, enabling timely intervention and preventing catastrophic failures that may lead to loss of life and property.
2. **Early Detection of Structural Issues**:
   - SHM provides continuous and detailed data on the structural behaviour, which allows for the early identification of any anomalies or signs of degradation.
   - Early detection allows engineers to address potential problems before they escalate, avoiding costly repairs and unplanned disruptions
3. **Reduced Inspection Costs:**
   - SHM reduces the need for frequent manual inspections, saving time and reducing operational costs.
   - By focusing on areas that requires maintenance efforts become more efficient and cost-effective

4. **Enhanced Structural Design and Validation:**
   - SHM data can be used to validate and refine structural designs, ensuring they meet safety and performance requirements.
   - The feedback obtained from SHM helps improve future designs and fosters innovation in the engineering field.
5. **Mitigation of Risks and Liability:**
   - SHM aids in mitigating risks associated with aging infrastructure, reducing liability for owners and operators.
   - Proactively addressing structural issues minimizes the potential for accidents, litigation, and reputational damage.

Applications

SHM is a process of implementing damage detection strategy for civil engineering or any other infrastructure. It has a wide range of application in assessing the structural health of critical infrastructures (Bridges, buildings, dams, railways, highways, airports etc)

1. **Energy infrastructure:** Evaluating the performance of power plants and wind turbines to prevent failures and optimize output.
2. **Oil and gas industry:** Detecting defects and stress in pipelines and offshore platforms to prevent accidents and leaks.
3. **Environmental monitoring:** Responding to natural disasters like earthquakes and floods by assessing structural impact.
4. **Research and development:** Useful in Testing novel materials and designs to understand structural behaviour and enhance engineering theories.

Methodology

SHM involves a systematic approach for identifying and monitoring cracks within structures. Steps including Sensor Selection, Sensor Placement, Data Acquisition Setup, Analyze sensor data to identify unique signatures associated with crack propagation, such as changes in strain, vibration patterns, or acoustic emissions. Develop algorithms capable of detecting patterns consistent with crack formation and growth. This can involve statistical methods or machine learning techniques.

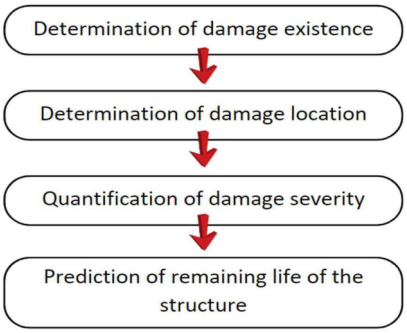

Fig.1 Steps of Structural Health Monitoring

- Create a user-friendly interface to visualize real-time and historical sensor data. This aids in monitoring cracks and assessing their severity.
- Validate the crack detection algorithms through controlled experiments or comparisons with known crack locations. Calibrate sensors to ensure accurate measurements.
- Install the crack detection system in real-world structures prone to cracking. Monitor the structures over time to capture crack initiation, propagation, and behavior.
- Data Interpretation: Analyze collected data to determine crack characteristics, such as location, length, and growth rate.
- Comparison with Conventional Methods: Compare the effectiveness of the SHM crack detection system with traditional visual inspections or manual methods.
- Quantitative Assessment: Evaluate the system's performance in terms of accuracy, false positives, false negatives, and response time.
- Discussion and Insights: Discuss the benefits and limitations of the SHM crack detection methodology, highlighting its potential to enhance safety and maintenance practices.

This methodology ensures a systematic and data-driven approach to detect cracks in structures using SHM techniques. The key lies in sensor selection, accurate data acquisition, advanced algorithms, and effective visualization to provide reliable insights into crack presence and behavior.

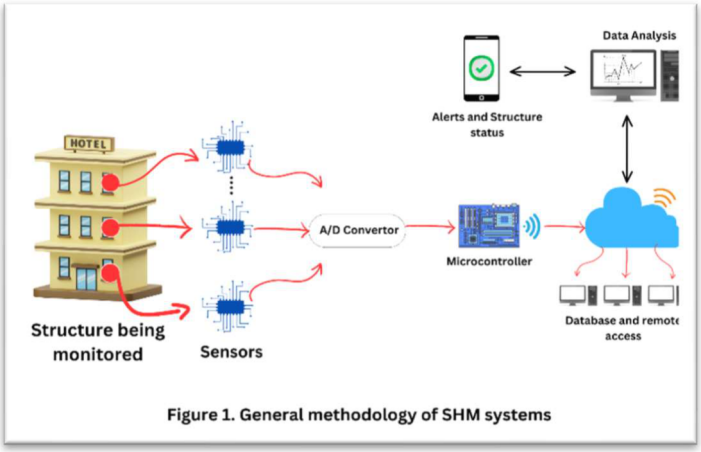

Figure 1. General methodology of SHM systems

Conclusion

Structural Health Monitoring is transforming the way we approach infrastructure maintenance and safety. By harnessing the power of sensors, data analysis, and real-time insights, SHM enhances resilience, minimizes risks, and promotes sustainable development. As technology continues to evolve, the potential for SHM to revolutionize the world of structural engineering grows, ensuring that our built environment remains safe and resilient for generations to come.

The field of SHM is rapidly evolving, driven by advancements in sensor technology, data analytics, and the Internet of Things (IoT). However, challenges such as sensor reliability, data management, and the integration of SHM into existing structures remain. The future promises innovations like self-powered sensors, AI-driven anomaly detection, and enhanced communication protocols to address these challenges.

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Annual Sports Meet, ASCE, 2023

ASCE Activities 2023

6

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Efficient, Economical, and Eco-friendly Green Concrete Approach for a Better Sustainable Environmental System

INTRODUCTION

The rapid growth of the world population has led to a significant increase in the demand for new structures and infrastructure. This surge in construction activity is placing strain on natural resources and exacerbating environmental depletion. As more buildings, roads, and other infrastructure projects are constructed to accommodate growing populations, the extraction of raw materials such as timber, minerals, and aggregates intensifies, leading to deforestation, habitat loss, and ecosystem degradation. Additionally, the construction industry is a major contributor to carbon emissions, both directly through burning fossil fuels for machinery and transportation and indirectly through the production of construction materials like cement, which releases large amounts of carbon dioxide during manufacturing. The depletion of natural resources and the emission of greenhouse gases contribute to climate change, exacerbating environmental challenges such as global warming, extreme weather events, and sea level Rise.Traditional concrete, while widely used, poses challenges due to its high carbon footprint, resource consumption, and lack of recyclability.In light of these challenges, researchers and engineers have been exploring innovative approaches to tackle waste management ,carbon emissions and resource depletion in the construction sector. There is a growing need for sustainable construction practices that minimize the environmental impact of construction activities while meeting the demands of urbanization and population growth including the adoption of the use of waste materials in concrete production does offer a multitude of advantages across environmental, economic, and technical fronts. Numerous research studies have concentrated on the utilization of waste materials in concrete production.The integration of waste materials into concrete production offers dual benefits. First ly, It addresses waste accumulation, averting landfill overflow and curbing environmental pollution.Secondly, I targets cement production emissions by utilizing waste as partial cement replacement, effectively lowering the CO2 footprint and primary resource conservation.This study explores various waste materials, including industrial byproducts, agricultural residues, and recycled materials, as potential substitutes for conventional raw materials in concrete mixes.

CONVENTIONAL CONCRETE

Conventional concrete is a simple combination of cement, fine aggregate, and coarse aggregate, and some additives to enhance properties like plasticizers, etc.

ENVIRONMENTAL IMPACT OF TRADITIONAL CONCRETE

a. Carbon Emissions
b. Resource Depletion
c. Pollution

GREEN CONCRETE

Green Concrete is a new-fangled outlook in the construction era. Green concrete is the idea of using waste in place of cement or aggregates to cut CO2 emissions to a certain level. Green concrete follows the principle of reducing, reusing, and recycling techniques. Green concrete addresses several environmental issues associated with conventional concrete production, such as high carbon dioxide emissions, resource depletion, and waste generation. Here are some common waste materials that can be utilized in green concrete production and their Applications:

FLY ASH

Fly ash is a fine powder residue obtained from the combustion of pulverized coal in thermal power plants. It is rich in silica, alumina, and other pozzolanic compounds as shown in Figure 1. In concrete production, fly ash can be used as a partial replacement for cement. Its pozzolanic properties improve the workability, durability, and long-term strength of concrete while reducing heat generation during hydration. Additionally, incorporating fly ash reduces the environmental impact of coal combustion by diverting waste from landfills and lowering the carbon footprint of concrete production.

Figure 1 : Fly ash powder

BOTTOM ASH

Bottom ash, another byproduct of coal combustion, is coarser than fly ash and is often used as a partial replacement for fine aggregates in concrete as shown in Figure 2. In addition, bottom ash is not as commonly used in concrete production as fly ash, bottom ash can be processed and utilized as a partial replacement for fine aggregates or as a supplementary cementitious material. Its chemical composition and physical properties vary depending on the coal source and combustion process. By incorporating bottom ash in concrete, the construction industry can reduce reliance on natural resources and promote the sustainable management of coal combustion byproducts. It contributes to the density and strength of concrete mixes while reducing the need for natural resources.

Figure 2 : Bottom ash powder

EGGSHELL POWDER

Eggshell powder is a biogenic waste material that is generated from egg processing industries, as shown in Figure 3.

Figure 3 : Eggshell powder

It is rich in calcium carbonate and other minerals. While not a traditional waste material in concrete production, eggshell powder has gained attention as a potential supplementary cementitious material or mineral admixture. Research suggests that finely ground eggshell powder can enhance the compressive strength, durability, and sulfate resistance of concrete when used as a partial replacement for cement or as a filler material. Utilizing eggshell powder in concrete offers an eco-friendly solution for repurposing agricultural waste and reducing the environmental impact of eggshell disposal.

RICE HUSK ASH

Rice husk ash (RHA) obtained from burning rice husks, is rich in silica and possesses pozzolanic properties as shown in Figure 4. It can be used as a partial replacement for cement in concrete mixes, typically ranging from 10% to 20% by weight of cementitious materials. RHA enhances concrete strength, durability, and resistance to chemical attack.

Figure 4 : Rice husk ash

BAGASSE ASH

Bagasse ash, a byproduct of sugarcane processing, is another valuable material for concrete production. It contains silica and can be used as a partial replacement for cement or as a supplementary cementitious material. The dosage of bagasse ash in concrete mixes varies based on its quality and desired concrete properties.

Figure 5 : Bagasse ash

Moreover, rice husk ash (RHA) and bagasse ash are agricultural waste materials obtained from rice milling and sugarcane processing, respectively. Both materials are rich in silica and possess pozzolanic properties. In concrete production, RHA and bagasse ash can be used as partial replacements for cement or as supplementary cementitious materials. They improve the workability, strength, and durability of concrete while reducing the environmental footprint of agricultural waste disposal. Incorporating RHA and bagasse ash in concrete promotes resource efficiency, sustainable agriculture practices, and circular economy principles.

CONCLUSIONS

Utilizing the above waste materials in concrete production offers a sustainable approach to addressing environmental challenges, conserving resources, improving performance, and reducing costs in the construction industry. By embracing innovation and collaboration across the value chain, stakeholders can advance the adoption of sustainable concrete practices and contribute to a more resilient and environmentally responsible built environment.

Visit of german delegation to the department (September 2023)

Delegates of German university meeting with Civil Engineering JMI professors

Technical presentation of German Delegates at CED, JMI

Interaction of German and JMI Students

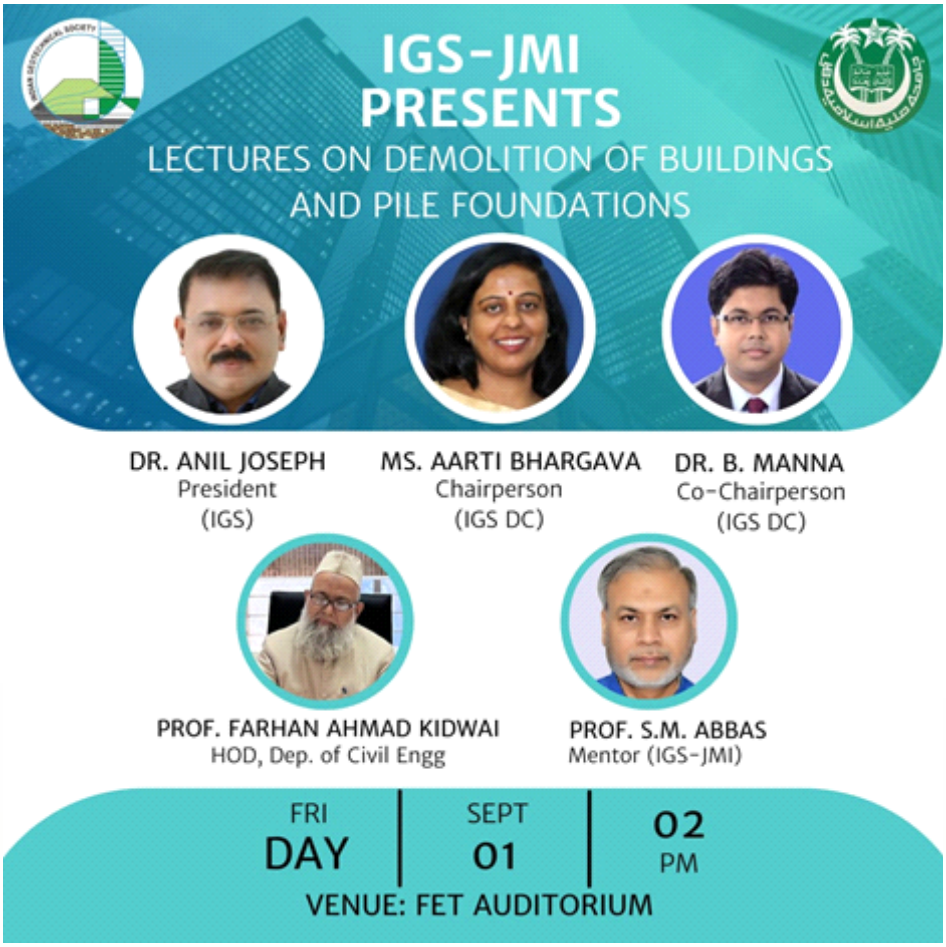
Vigilance Awareness week 2023

Basket Ball Tournament Organised by ASCE

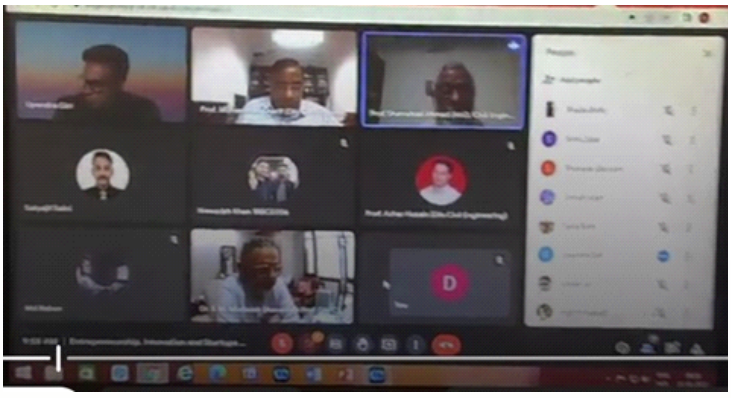
Seminar by Ultra Tech Cement

World Environment Day 2023

Demolition of Building and Pile Foundation (01/09/2023)



Internship and placement guidance (18/11/2023)



Entrepreneurship, Innovation Seminar

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Professor & HoD
Transportation Engineering

Dr. Gauhar Mehmood
Professor
Engineering Geology

Dr. Nazrul Islam
Professor
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Dr. Mohammad Shakeel
Professor
Water Resources Engineering

Dr. Shamshad Ahmed
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Remote Sensing & GIS

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Dr Nabeel Ahmad Khan
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Dr. Mohd. Aamir Mazhar
Assistant Professor
Environmental Engineering

Vision of the Department

To emerge as centre of excellence for education and research in civil engineering and to produce professionally competent and ethically sound engineers of global standards, ready to serve the community and the nation with dedication.

Mission of the Department

M1 To provide rigorous hands-on civil engineering education through learner centric teaching pedagogy.

M2 To establish state-of-the art facilities for teaching and research in civil engineering domain.

M3 To motivate students to develop low-cost and sustainable ethical solutions to problems faced by the society.

M4 To provide opportunities to students to enable them to develop leadership and interpersonal skills.

Program Educational Objectives

PEO 1 The graduates shall demonstrate the ability to use professional skills including software tools and computational methodologies for the analysis, design, and management of infrastructure projects.

PEO 2 The graduates shall practice high ethical values and effective communication skills so as to participate as a member of a multidisciplinary team working on various projects.

PEO 3 The graduates shall continue lifelong learning and take up leadership roles in professional and entrepreneurial settings.

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