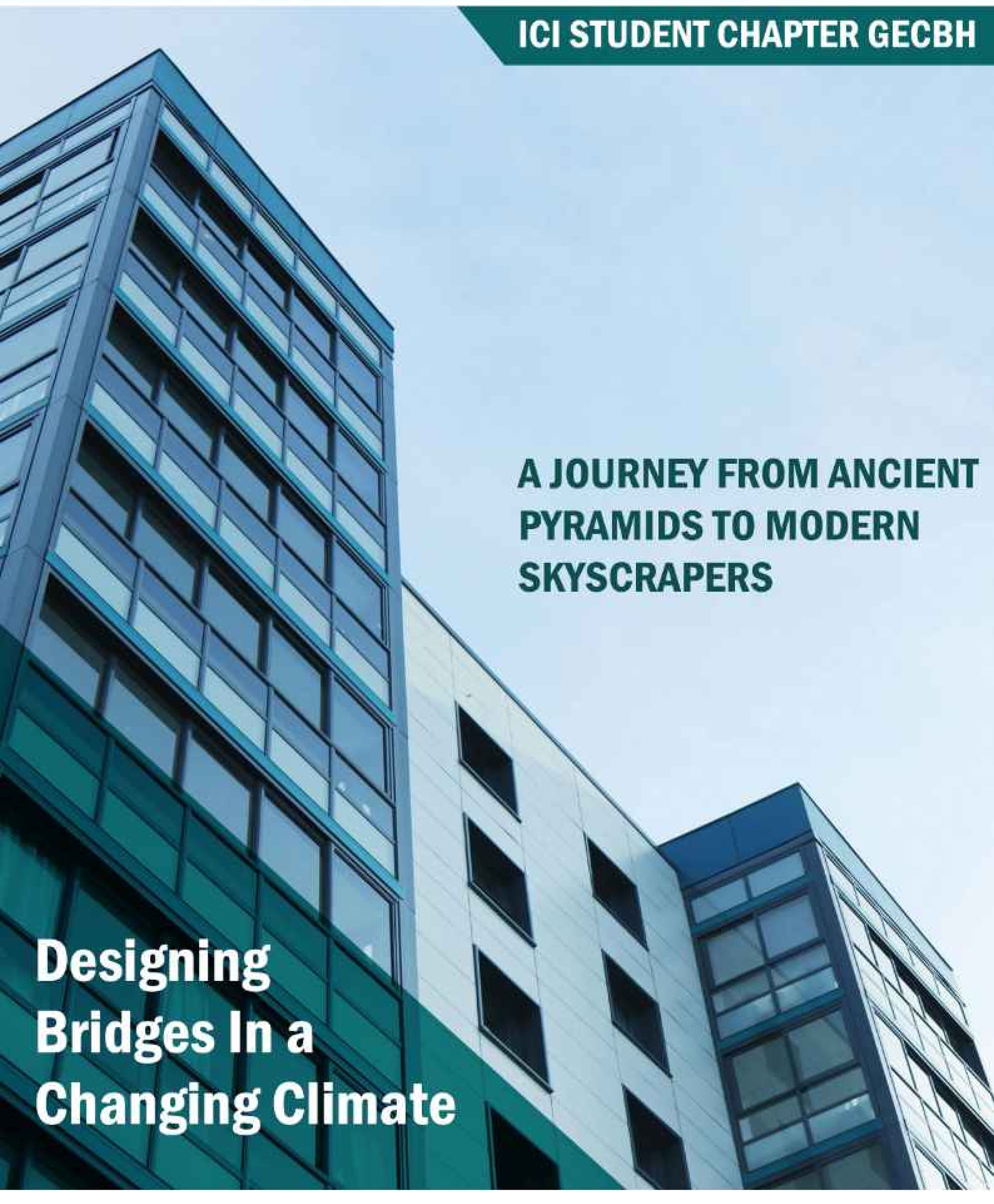
The Builders

Forge Your Path

3RD EDITION

ICI STUDENT CHAPTER GECBH



A JOURNEY FROM ANCIENT PYRAMIDS TO MODERN SKYSCRAPERS

Designing Bridges In a Changing Climate

WORDS

"The Builders 3.O" marks the third exciting release from the ICI Student Chapter at GEC Barton Hill. In today's world, civil engineering isn't just about buildings and roads; it's about shaping the world we live in, from improving infrastructure to boosting economies and making our lives easier. The history of civil engineering reflects the story of humanity's progress over time. Today's engineers don't just oversee projects; they use the latest technology to bring ideas to life.

I'm thrilled to announce this magazine, which gives readers a peek into the fascinating world of civil engineering and the amazing things happening in the field today. Led by Athira Ajay, the editor, and a dedicated team from GEC Barton Hill, this magazine is the result of hard work and teamwork. I'm sure the variety of articles will spark readers' curiosity and help them understand and appreciate civil engineering even more.

Mr.Kiran C.J.
Assistant Professor, Civil engineering and Staff Cordinator ICI Student Chapter GEC Barton Hill

From Editor's Desk,

I am filled with an overwhelming sense of gratitude and pleasure as I pen down this note for the 3rd Edition of 'THE BUILDERS' - the annual magazine of Indian Concrete Institute Students Chapter GEC Barton Hill for the year 2023-24. You will witness the collective efforts, shared knowledge and unwavering dedication of each and every one of the magazine board. At the heart of this magazine lies a commitment to the executive members who have worked for this dream come true moment. From brainstorming ideas to finalising layouts, dedication of young minds in producing high-quality content is evident on every page you leaf through.

I thank Mr Kiran CJ, staff coordinator of ICI GECBH for his constant support and valuable advice throughout the process. I feel immensely proud at this very moment for being able to complete this magazine with the help of a bunch of artistic minds. Their efforts in making each article presentable amidst handling various activities of the student branch makes the release of this magazine their glorious achievement. I also would like to thank all the readers whose support and enthusiasm for our publication fueled our passion to continually deliver insightful and engaging content. Hoping that this edition of 'THE BUILDERS' will be the legacy that we leave behind.

Thank You all for building life to this vision.

Athira Ajay
Cheif editor

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CONTENT

ICI REPORT 2023'24

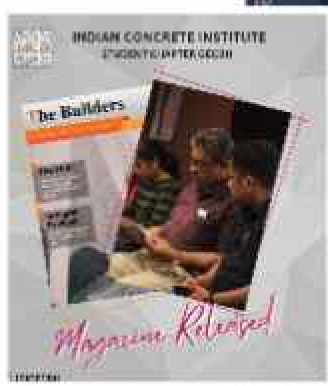
Indian Concrete Institute is one of the reputed civil engineering society devoted for the improvisation of the civil engineering sector.We work for the betterment of structural concrete, interested in advancement of concrete, construction technology, concrete products,Research and development, education in the field of concrete and construction technology. ICI began its journey in 1982 with around 500 members from 5 regional Centres. Today ICI is a strong professional body having more than 13, 000 enrolled members, from 45 regional Centres in all major cities, spread across the entire length and breadth of the country. The official student chapter of Indian Concrete Institute,Department of Civil Engineering, GEC Barton Hill was inaugurated on 12th October 2018.The present execom for the year 2023-24 has started its maiden journey with a series of events.

ANNUAL GENERAL BODY MEETING

The Annual General Body Meeting of ICI for the execom 2022-23 was held on 11th April 2023 in Zoom IT,with Mr. Anwar Hussain S, President, ICI Trivandrum Zone as the chief guest.The new execom for 2023-24 began the journey with Ms. Chandana Ajith as the Chairperson and Mr. P Nandakishore as the Vice-Chair. Mr. Kiran CJ, Assistant Professor, Department of Civil Engineering and staff coordinator of ICI, felicitated the occasion.

ICI MAGAZINE

The second edition of the ICI magazine Builders 2.0 was released during the Annual General Body Meeting of ICI.The Builders showcase a wide range of innovations, technologies, and developments in the field of civil engineering.The link for checking out the magazine is attached below.
https://bit.ly/TheBuilders2ndedition



TROUVER

ICI Student Chapter GECBH conducted TROUVER, an online picture puzzle game which truly invoked the gamers of GECB.The contestants were allowed to join as a team of two. Irrespective of their departments, the contest was open to all. After a series of healthy competition and anxieties, Vaishnavi M Anil & Geethika SS of S4 CE has bagged a first prize. Few of the teams were eligible for a special mention as well.

FUNFISTA

ICI Student Chapter GECBH organised FUNFISTA,a new series under the domain and shared many funfilled ideas.It continued to showcase some funny, anxious information every Saturday through Instagram stories.The special days in a week were introduced to the GECBians along with a glimpse of history behind it.

CADTASTIC

CADTASTIC - an Autocad Drawing Competition to unveil the designing experts.The participants were allowed to contest individually.The event was held via Google meet and witnessed participation of a handful of contestants.Winner was awarded prizes worth ₹500.Parvathy GR of S6 CE was the achiever of the event.

PHOTOSHOP ESSENTIAL

For all designing enthusiastic minds, ICI Student Chapter GECBH brought the workshop Photoshop Essentials : to empower creativity. The session was handled by Mr. Sai Krishnan R, Graphic Designer.The event was held via Gmeet platform on 12th of May 2023, 07 30 PM.

KNOCKOUT

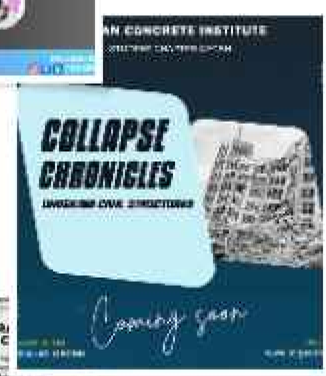
ICI Student Chapter GECBH organised KNOCK OUT - a debate competition. The event was open to all with a nil registration fee. It was held via Gmeet on 14th of May 2023 and witnessed satisfactory participation. The winner was awarded with an exciting prize. Muralee Krishnan Kartha P U, an Alumnus of GECB emerged as the triumphant victor amid eloquent arguments and insightful discussions. All the participants actively took part in the event and made it a grand success.

CODEWORD

ICI Student Chapter GECBH was there with CODEWORD, a crossword puzzle game to unravel the secrets concealed within the grid, armed with nothing but knowledge, wit, and passion for words.It was held via Whatsapp on 21th of May 2023 and witnessed satisfactory participation.

COLLAPSE CHRONICLES

ICI Student Chapter GECBH mainly deal with two series of which collapse chronicles addresses the world's most dreadful failures and collapses in civil engineering field.It pointing some of the mind-bending engineering mysteries happened around us.It aimed at the secrets behind massive structural failures and uncovering the whys.It is to learn from the past and pave the way for a safer future.



BRIQUE BLOGS

The most energetic and overwhelming feature of ICI Student Chapter GECBH which is continuing for the past years include The Brique Blog series in its newest form. Along with descriptions of the structure, now the series comprises related videos and graphics as well.The newest edition dealt with a series of prominent office buildings,metros and airports.

DU COEUR

ICI Student Chapter GECBH conducted DU COEUR, an online poetry game which truly invoked the poetic minds of GECB.The contestants were allowed to join individually. Irrespective of their departments, the contest was open to all. After a series of healthy competition, Rahul M D of S5 IT has bagged a first prize.

VOLUNTEER TEAM

After a series of selection and clearing processes, ICI Student Chapter GECBH selected the volunteers of our Execom 2023-24 from first year of the civil engineering department.

MINDFIZZ

ICI Student Chapter GECBH introduced Mindfizz, an online quiz competition designed to challenge participants' mental acuity, logical reasoning, and problem-solving abilities.The event was open to all the branches exclusively for GECB first year students.It was conducted for the previous years also,which received overwhelming responses.

GET TO GATE

Here presented a question-answer series on Instagram, dedicated to solving frequently asked questions for the GATE exam which aimed at assisting students aspiring to pursue higher studies.

MAGAZINE COLLECTION DRIVE

ICI Student Chapter GECBH was out with a collection drive for the newest edition of the ICI Mgazine - Builders 3.O.The drive was open for the collection of articles,sketches and photographs related to civil engineering field till February 20,2024.

ALL YOU NEEED TO KNOW ABOUT CIVIL SERVICE EXAMS

For all the civil service aspirants out there, ICI Student Chapter GECBH organised a talk session in collaboration with Academique - the learning platform. The session was taken by Madhavikutty M S IAS,Development commissioner, Kochi , Sibil Manha Co-founder of sociomentors and Shruthi T, founder of Academique. The event witnessed active participation of many participants via Gmeet.

INNOVATIVE INFRASTRUCTURE: SELF-REPAIRING ROAD TECHNOLOGIES FOR SUSTAINABLE TRANSPORTATION

The global road network, spanning an impressive 16.3 million kilometres, is a critical component of modern infrastructure. Maintaining the operational integrity of roads is of paramount importance, requiring a balance between durability and minimal disruption to daily commutes. Constant wear, tear, and stress contribute to the deterioration of roads, causing damage to vehicles, posing safety risks, and incurring unplanned expenses. In response, researchers have introduced the concept of self-healing roads.

Self-healing roads represent a noteworthy innovation in the infrastructure sector. Functioning akin to concrete, these roads autonomously repair cracks and minor damages, offering a sustainable approach to construction and maintenance by reducing raw material consumption by 60%. This reduction in the use of materials extracted from the lithosphere, responsible for nearly a third of greenhouse gases, aligns with the imperative of environmentally conscious infrastructure development. Notably, while traditional roads have a lifespan of 20 to 40 years, self-healing roads can extend this longevity up to 80 years.

Various methodologies exist for implementing self-healing capabilities on roads:

1. Encapsulated Healing Agent: Tiny capsules filled with healing agents, such as polymers or resins, are incorporated into the asphalt mixture. As cracks emerge, these capsules open, releasing the agent to fill and seal the crack.

2. Microvascular Network: This approach embeds a network of tiny channels within the asphalt, filled with a healing agent. Cracks trigger the flow of the agent through the channels, automatically repairing the damage.

3. Induction Heating: Steel fibres embedded in the asphalt respond to the formation of cracks by inducing external magnetic field heating. This process melts the surrounding asphalt, effectively fusing the crack shut.

Despite the promise of self-healing road technology, certain challenges persist. Cost implications, with current technologies incurring higher expenses than traditional asphalt, are expected to decrease with technological advancements and increased production scale. Ensuring the long-term durability and effectiveness of self-healing mechanisms in real-world conditions remains a crucial aspect, necessitating extensive field testing. Additionally, the establishment of standardized testing methods and performance criteria is essential for the widespread adoption of this technology.

In conclusion, the potential benefits of self-healing roads are substantial, offering a glimpse into the future of sustainable, cost-effective, and safer transportation infrastructure. Ongoing research and development endeavours are actively addressing challenges, paving the way for the broader implementation of self-healing roads on highways and streets as technology continues to advance.

- Asna Azad,
S2 CE

ENGINEERING MARVELS OF THE INCA RUINS:

MACHU PICCHU'S TIMELESS CONSTRUCTION

The Inca ruins of Machu Picchu stand as a testament to the advanced civil engineering skills of the ancient Inca, civilization. This UNESCO World Heritage site , nestled high in the Indes mountain of Peru, showcases unique construction techniques that continue to captivate engineers and historians alike.

Machu Picchu's structural brilliance lies in its ability to harmoniously blend with the natural landscape. The Incas employed precise stone-cutting methods, creating interlocking blocks that fit seemlessly together without the use of mortar. This not only ensures structural stability but also allowed the site to withstand centuries of earthquakes in this seismically active region.

The agricultural terraces at Machu Picchu showcase the Incas mastery of hydro engineering. The intricate irrigation system ingeniously controlled water flow, preventing erosion and facilitating sustainable farming practices. This careful balance of environmental integration and engineering powers highlights the Incas deep understanding of terrain and their commitment to sustainable urban planning.

Moreover Machu Picchu's complex network of finely crafted stone structure such as the temples of the sun and the Intihuatana stone, reveals an advanced understanding celestial alignments. The precise orientation of these constructions suggests an intricate knowledge of astronomy with implications for religious and ceremonial practices

Inca Engineers displayed remarkable skills in managing the site's topography. The strategic placement of structures, use of terracing and intricate stone- cutting allowed them to overcome challenges posed by the steep slopes, creating a city that seemlessly integrates with the natural contours of the landscape.

The preservation of Machu Picchu's structural integrity over centuries invite contemporary civil engineers to study and draw inspiration from these ancient techniques. It promotes reflection on sustainable design practices, adaptive land use, and the incorporation of cultural and environmental consideration into modern consideration.

In conclusion, Machu Picchu stands as a timeless example of the Inca civilization's engineering powers. The site's innovative construction techniques, sophisticated irrigation system and careful consideration of the environment provide valuable lessons for present day civil engineers. By examining and appreciating these ancient Marvels, we can gain insights that may inform and inspire sustainable engineering practices for generations to come.

- AMRITHA M. B
S2 CE

THE ROLE OF PREFABRICATED BRIDGE ELEMENTS AND SYSTEMS IN ADVANCING BRIDGE CONSTRUCTION

Bridges play a vital role in connecting communities and facilitating transportation networks. As the demand for infrastructure grows, innovative construction methods become imperative to expedite project timelines, reduce costs, and enhance structural integrity. Prefabricated bridge elements and systems (PBES) have emerged as a transformative approach in modern bridge construction, offering numerous advantages over traditional methods.

Prefabricated bridge elements and systems encompass various components, such as beams, decks, abutments, and piers, manufactured off-site and transported to the construction site for assembly. One of the primary advantages of PBES is accelerated construction. By prefabricating elements in controlled environments, construction schedules can be significantly reduced, minimising disruption to traffic flow and local communities. Additionally, PBES often leads to cost savings due to efficient use of materials, reduced labour expenses, and decreased construction time.

Furthermore, PBES offers enhanced quality control. Manufacturing components in factory settings allows for precise fabrication and rigorous quality assurance measures, resulting in higher-quality structures with improved durability and performance. This ensures that bridges built using PBES adhere to strict safety and engineering standards, ultimately enhancing public safety and infrastructure resilience.

PBES encompass a wide range of prefabricated components and systems tailored to specific project requirements. Modular bridge systems, for example, consist of pre-engineered modular units that can be quickly assembled to create various bridge configurations, offering versatility and adaptability to different site conditions. Prefabricated concrete elements, such as precast beams and decks, are commonly used in bridge construction, providing strength, durability, and rapid installation. Additionally, steel truss systems and composite materials offer lightweight and cost-effective solutions for long-span bridges.

Advancements in manufacturing technologies and construction techniques have further propelled the adoption of PBES in bridge construction. Computer-aided design (CAD) and building information modelling (BIM) facilitate the precise design and coordination of prefabricated components, optimising structural performance and minimising waste. Automated fabrication processes, such as robotic welding and 3D printing, enable the efficient production of complex bridge elements with high accuracy and consistency.

Moreover, the integration of advanced materials, such as ultra-high-performance concrete (UHPC) and fibre-reinforced polymers (FRP), enhances the strength, durability, and longevity of prefabricated bridge elements. These innovative materials offer superior resistance to corrosion, fatigue, and environmental factors, extending the service life of bridges and reducing maintenance cost over time.

Prefabricated bridge elements and systems have revolutionised the way bridges are designed, fabricated, and constructed. By offering accelerated construction, cost savings, enhanced quality control, and innovative solutions, PBES have become indispensable tools in advancing bridge construction. As infrastructure demands continue to grow, the widespread adoption of PBES will play a pivotal role in building resilient, sustainable, and safe transportation networks for the future.

CHANDANA AJITH
S8 CE

THE INVISIBLE THREAT:

MICROPLASTICS IN DRINKING WATER

Over the past few years, concerns regarding the potential health effects of microplastics in drinking water have been raised by several studies that have revealed the presence of microplastics in treated, tap and bottled water. Microplastics are tiny plastic particles measuring less than 5 millimetres that have infiltrated water bodies worldwide, leading to growing concerns. Several sources, including combined sewer overflows, industrial effluent, degraded plastic waste, surface runoff, and atmospheric deposition, are the main ways that microplastics enter freshwater environments. To measure the contribution of each of the various inputs and their upstream sources, there is only limited data. Furthermore, limited information suggests that tap water treatment and distribution systems may be the source of some of the microplastics detected in drinking water.

Microplastics originate from a variety of sources, including the breakdown of larger plastic debris, microbeads in personal care products, synthetic fibres from clothing, and particles from plastic packaging and materials. These particles enter water bodies through various pathways, such as runoff from urban areas and industrial sites, wastewater effluent, and atmospheric deposition. Once in the water, they can persist for extended periods, accumulating in aquatic environments and potentially contaminating drinking water sources.

The combination of hazard and exposure determines the risk of microplastics in drinking water to human health. There are three possible ways that microplastics can cause harm: the particles themselves, which can be physically dangerous; chemicals; and biofilms, which are microscopic organisms that can adhere to and colonize on microplastics. Studies have shown that microplastics can adsorb and transport harmful chemicals and pathogens, which may leach into drinking water and pose health risks upon ingestion. Furthermore, there are concerns that microplastics could cause inflammation, oxidative stress, and cellular damage in humans, potentially leading to chronic health issues over time.

Beyond the human health implications, the presence of microplastics in drinking water underscores the broader environmental crisis posed by plastic pollution. These persistent pollutants not only threaten marine life but also infiltrate terrestrial ecosystems, posing risks to wildlife and ecological balance. Additionally, microplastics can adsorb and transport toxic substances, magnifying their impact on the environment and potentially entering the food chain.

Addressing the issue of microplastics in drinking water requires a multi-faceted approach. Firstly, there is a pressing need for enhanced monitoring and research to better understand the sources, distribution, and impacts of microplastics. Improved wastewater treatment processes can help reduce the release of microplastics into water bodies, while promoting the use of biodegradable alternatives can mitigate their proliferation. Public awareness campaigns can also play a crucial role in reducing plastic consumption and encouraging responsible waste management practices.

Policy interventions are essential to drive systemic change, including regulations on plastic production, use, and disposal. Additionally, investments in infrastructure for water treatment and filtration can help remove microplastics from drinking water supplies. Collaboration between governments, industries, and civil society is paramount to tackle this complex issue comprehensively.

Microplastics in drinking water represent a modern-day environmental challenge with far-reaching implications for human health and ecological integrity. As we continue to grapple with the consequences of plastic pollution, concerted efforts are needed to stem the tide of microplastics entering our water systems. By adopting proactive measures, raising awareness, and fostering collective action, we can safeguard our drinking water sources and mitigate the harmful impacts of microplastics on both human well-being and the environment.

- ATHIRA AJAY
S8 CIVIL

UNLEASHING THE POWER OF DATA:
HOW CONSTRUCTION ANALYTICS TRANSFORMS PROJECTS

What if construction projects could be completed faster, with fewer cost overruns and delays? The answer lies in construction analytics. In this article, we explore how harnessing the power of data is revolutionizing the way construction companies operate, from project planning to execution. Construction analytics is the process of collecting, analyzing, and interpreting data from construction projects to improve decision-making, optimize performance, and mitigate risks. It involves gathering data from various sources, such as sensors, project management software, financial records, and historical data, and using techniques like predictive modeling, machine learning, and data visualization to extract meaningful patterns and trends that can inform decision-making and improve efficiency in construction projects. A recent study shows that construction projects typically overrun their budget by 30%. By analyzing these data, construction companies can gain valuable insights that can help them increase the productivity of both manpower and resources.

The collected data is then analyzed. There are a number of different analyses, such as:

Descriptive Analysis: Summarizes key metrics like project progress, resource utilization, and costs.

Diagnostic Analysis: Identifies root causes of delays, safety hazards, and cost overruns.

Predictive Analysis: Uses historical data and machine learning to predict future outcomes, risks, and opportunities.

Data visualization tools are used to create charts, graphs, and other visual representations of data, which provide various actionable insights to optimize project planning, resource allocation, risk mitigation, and quality control. Data-driven insights from the analyzed data help in better communication and collaboration among stakeholders. There are a number of different tools and technologies, and the specific tools and techniques used in construction analytics vary depending on the size and complexity of the project. Integration with other construction technologies, like Building Information Modeling (BIM), can further enhance data analysis and insights. On the downside, data security and privacy are crucial considerations when implementing construction analytics solutions.

The benefits of using construction analytics are numerous, such as improved project efficiency, reduced costs, improved safety, better decision-making, increased transparency and accountability, improved risk management, and enhanced collaboration. Construction analytics is a relatively new field, but it is becoming increasingly important as construction companies look for ways to improve their efficiency, productivity, and safety.

ASNA AZAD
S2 CE

THE CATALYTIC ROLE OF CIVIL ENGINEERING IN DRIVING ECONOMIC GROWTH

The discipline of civil engineering is essential to a nation's socioeconomic advancement. There is no denying its influence on the growth of infrastructure, urbanization, and general economic expansion. There are various ways that civil engineering has aided in the advancement of nations. India's economy, which is among the fastest-growing in the world, is an excellent case study for demonstrating how civil engineering promotes sustainable development and quickens the process of national prosperity. A country's transportation infrastructure is shaped in large part by civil engineering, which is essential for economic expansion. The construction of a vast road and rail network in India has linked isolated locations, made it easier for people and commodities to travel, and boosted economic activity. Initiated in 2001, the Golden Quadrilateral Project is an example of how thoughtful roadway improvements may improve connectivity and increase trade between regions. It is a national highway network in India connecting the country's four major cities, namely Delhi, Kolkata, Mumbai, and Chennai, while also serving Bengaluru, Pune, Ahmedabad, and Surat. Economic development relies heavily on the energy industry, and civil engineering is essential to its growth.

The National Solar Mission (JNNSM), initiated in 2010, is one of India's largest renewable energy projects and uses civil engineering methods to construct wind and solar energy infrastructure. These programs set the stage for a sustainable and environmentally friendly future, in addition to meeting current energy needs. One of the main forces behind economic growth is urbanization, to which civil engineering makes a substantial contribution. The swift urbanization of India has resulted in an increase in the need for homes and related facilities. In order to ensure that cities can support their growing population while maintaining environmental balance, civil engineers are at the forefront of developing and building sustainable and intelligent urban settings. Numerous jobs are created by the infrastructure development and building that civil engineering projects promote. The industry has a domino impact on employment, ranging from skilled labor to engineering specialists. Through the use of civil engineering projects, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in India has promoted inclusive growth by creating job opportunities in rural areas. The construction, steel, cement, and machinery industries are all boosted by civil engineering projects.

The economy is multiplied by the demand for products related to buildings and raw resources. For example, building a new airport benefits the entire economic ecosystem by stimulating demand for steel, concrete, and other materials in addition to the aviation industry. Leading the way in technology innovation, civil engineering applies new ideas to improve project sustainability and efficiency. Modern technology for waste management, energy conservation, and urban planning is used in India's smart city projects. In addition to quickening development, civil engineering adopts these innovations and establishes the nation as a center for technical innovation. Although it has spurred development, the field of civil engineering is not without its difficulties, especially when it comes to environmental sustainability. .

Maintaining ecological integrity while balancing development is essential. For civil engineers, this means combining eco-friendly building techniques, sustainable design principles, and eco-friendly materials to reduce environmental effects and build resilient infrastructure. India has made great strides, but there are still infrastructure gaps that require attention. These issues can be resolved with sufficient maintenance and upgrade funding and effective project management. Furthermore, integrating data-driven strategies and smart technology can improve the efficiency of current infrastructure

Civil engineering is a fundamental component for the development of a country, as the advancement of a nation's infrastructure, economic stimulation, technical innovation, and job creation are all made possible by it. India is a prime example of how the country has advanced due to smart investments and breakthroughs in this course. As a conclusion, I believe that civil engineering is essential to creating a robust and sustainable future as India moves closer to becoming a global economic force.

- AADHITH G. M.
S6 CE

ENHANCING CONCRETE DURABILITY THROUGH INTERNAL CURING

In recent years, the utilization of concrete has surged, consequently increasing the demand for cementitious materials. However, this surge has also brought to light certain challenges, particularly concerning the durability and longevity of concrete structures. One significant issue is the occurrence of cracks due to high autogenous shrinkage, primarily caused by a low water-to-cement ratio in the mix. These cracks serve as pathways for external materials to infiltrate, compromising the integrity of the structure and ultimately leading to failure. Traditional external curing methods have proven insufficient, especially in the case of high-density concrete with a low water-to-cement ratio. In such scenarios, infiltration is challenging, exacerbating the risk of crack formation. To address this challenge, internal curing (IC) has emerged as a promising solution. By incorporating lightweight aggregates (LWAs) into the concrete mix, internal curing effectively mitigates shrinkage-related issues. The utilization of LWAs for internal curing offers several advantages. These lightweight materials facilitate the retention and release of water during cement hydration, thereby reducing shrinkage and enhancing cracking resistance. Moreover, optimizing the proportion of expansive agents and employing cooling treatments can further maximize the efficacy of LWAs as internal curing materials. The significance of the water-to-cement ratio can trigger significant autogenous shrinkage, leading to the gradual buildup of tensile stress and eventual cracking when subjected to restraint. Therefore, achieving an optimal balance between water and cement is crucial for ensuring the durability and longevity of concrete structures. Proper post-casting curing plays a pivotal role in enhancing the performance and durability of concrete. Through sustained hydration in the presence of water and heat, cement attains its mature level of hardened properties, thereby maximizing its strength potential and minimizing shrinkage-related issues. Various curing techniques, including external and internal methods, are employed to promote moisture penetration and mitigate the risk of cracking. Internal curing, in particular, has demonstrated notable advantages, such as reduced early-age cracking and enhanced durability. By fostering continued hydration through internal water retention, internal curing addresses critical challenges associated with traditional external curing methods. In conclusion, the incorporation of internal curing techniques, particularly through the utilization of lightweight aggregates, represents a significant advancement in concrete technology. By effectively mitigating shrinkage-related issues and enhancing durability, internal curing offers a promising pathway towards the development of more resilient and long-lasting concrete structures.

-SURABHI S
S8 CE

HAWA MAHAL

The Hawa Mahal, a five-story landmark in Jaipur renowned for its intricate design, is a testament to Rajput's architectural mastery. Its honeycombed facade, adorned with numerous windows and jharokhas, ornate overhanging balconies, gave it the name "Palace of the Winds." The constant breeze channeled through these openings provides natural ventilation, rendering the interior pleasantly cool during the summer months. Built in 1799 by Maharaja Sawai Pratap Singh, the Kachwaha ruler of Jaipur, the Hawa Mahal served as an extension to the Royal City Palace. It has 953 Jharokhas, that are designed to allow the royal court ladies to watch the streets without being seen. They were built using the Venturi effect, which causes a pressure drop and a velocity increase when a gas or fluid passes through a pipe. It is the world's highest structure, constructed without a foundation. Its pyramidal design and curved construction, which tilt at an 87-degree angle, have contributed to its centuries-long stability. The Hawa Mahal is dedicated to Lord Krishna. The building's shape is considered to be reminiscent of Krishna's crown. The Hawa Mahal is more than just a palace; it is a work of cultural and architectural art that harmoniously combines Islamic Mughal and Hindu Rajput architectural forms. The arches and the stone inlay filigree work are excellent representations of Mughal architecture, while the fluted pillars and the dome canopies are typical of Rajput architecture.

While the Hawa Mahal lacks a conventional entrance, visitors can access its upper stories through an ornate doorway situated at the rear of the structure. The ascent is rewarded with breathtaking panoramic views of Jaipur, encompassing landmarks like Jantar Mantar, Sireh Deori Bazaar, and the City Palace itself. This unique architectural marvel, serving as both a historical landmark and an observational vantage point, continues to captivate visitors as a prominent emblem of the Pink City.

Surabhi Chandra K J,
S6 CE

IDENTIFYING AND REPAIRING STRUCTURAL DAMAGE IN BUILDING FOUNDATIONS:

A NOVEL APPROACH USING GENETIC ALGORITHMS

An innovative methodology for identifying and repairing structural damage in building foundations is discussed here. The approach leverages the power of genetic algorithms, a bio-inspired optimization technique, to analyze sensor data and efficiently pinpoint damage locations and severity. This means that instead of relying solely on visual inspections, this method uses tiny sensors placed on the foundation of structure, to constantly gather information. This data is then analysed by a special computer program that is inspired by how things evolve in nature. By examining the information, the program can pinpoint the exact location and severity of any damage.

Maintaining the structural integrity of building foundations is crucial for ensuring safety and longevity. Traditional methods for damage detection often rely on visual inspections like Crack inspection, Levelling checks, etc., which can be time-consuming, subjective, and prone to missing hidden issues. This method proposes a data-driven and objective approach for identifying and repairing structural damage in building foundations.
The proposed methodology comprises several key stages:

1. Data Collection: Various sensors, such as vibration meters, strain gauges, and tiltmeters, are strategically deployed to continuously monitor the structural behaviour of the foundation. This data provides valuable insights into potential damage indicators.

2. Feature Extraction: The collected raw sensor data undergoes preprocessing and feature extraction, transforming it into meaningful features that represent the foundation's health.

3. Anomaly Detection: Statistical methods or machine learning algorithms are employed to analyze the extracted features and identify anomalies that deviate from the expected structural behaviour, potentially indicating damage.

4. Damage Localization and Quantification: The identified anomalies are further analysed to pinpoint the exact location and quantify the severity of the damage.

6. Visualization and Reporting: The final stage involves visualizing the identified damage locations, extent, and severity using techniques like heat maps or 3D models. Additionally, a comprehensive report is generated, summarizing the findings and recommended repair strategies.

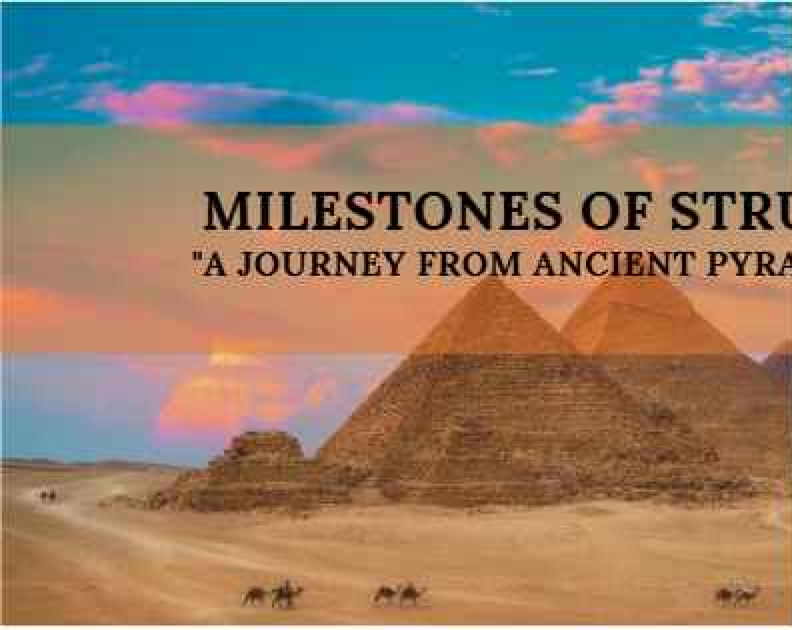
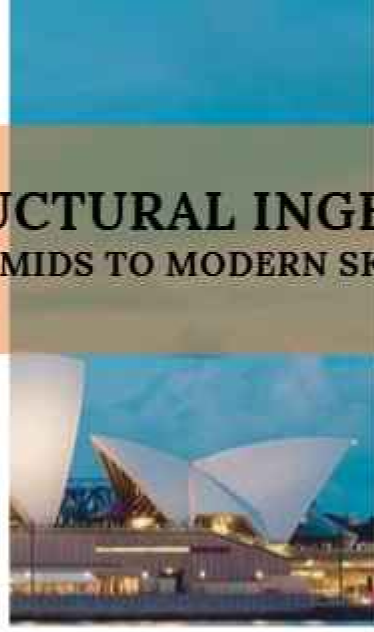
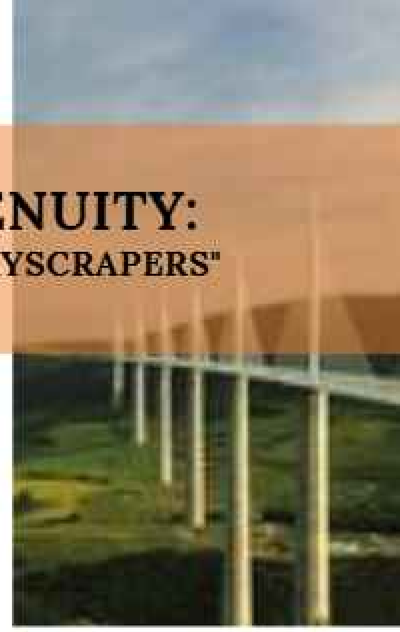
Advantages of this method over the traditional methods are enhanced accuracy and objectivity meaning that the data-driven approach provides a more objective and accurate assessment of foundation health compared to traditional visual inspections. It also ensures an early damage detection by continuous sensor monitoring the identification of damage at its early stages and by facilitating timely intervention, helps in preventing further deterioration.

It is also an cost-effective method as the early detection and repair can significantly reduce long-term repair costs associated with extensive structural damage; and it can provide optimal repair strategies as the genetic algorithm optimizes the repair process by identifying the most effective and efficient repair strategies for the specific damage scenario.

The proposed methodology has been validated through simulation studies using MATLAB, demonstrating its effectiveness in identifying and repairing damage across diverse building foundations. Further research is ongoing to refine the algorithm, while exploring the integration of additional sensor data and investigating its application in real-world scenarios.

This technique, using smart sensors and a clever genetic algorithm inspired from nature, offers a promising future for building safety. By analysing data instead of relying solely on visual inspections, this approach allows for earlier detection of damage, leading to more efficient repairs and ultimately, ensuring the longevity of our buildings.

Meenu Mohan
S6 CE

MILESTONES OF STRUCTURAL INGENUITY:
"A JOURNEY FROM ANCIENT PYRAMIDS TO MODERN SKYSCRAPERS"

The history of structural engineering is a testimony to human creativity, resourcefulness, and technological change. From the mind-boggling ancient pyramids of Egypt to the towering skyscrapers of recent metropolises, structural engineering has always pushed the limits of architectural design and construction. This historical journey not only underscores the advances made in engineering but also attests to the strength, inventiveness, as well as foresight of humanity.

1. The Pyramids of Giza – Ancient Wonders

The pyramids of Giza are evidence from centuries ago that could prove how advanced Egyptian mathematics and methods were used in constructing buildings. More so, the Great Pyramid of Khufu vividly demonstrates early structural engineering accomplishments by using precisely cut limestone blocks with clever internal passages that show an excellent grasp of principles associated with load bearing plus stability.

2. Indus Valley and Indian Architecture: The Great Bath and Temples

The ancient architectural marvels of Indus Valley civilization and India, including Mohenjo-daro's Great Bath and temples like Brihadeeswarar Temple, testify to a profound comprehension of structural engineering as well as materials employed. The careful planning in the use of bricks results in uniformity, with clean lines, while the Great Bath boasts astonishing hydraulic engineering; it was planned to have a good drainage system. Conversely, the monolithic cupola that is intricately carved from stone in Brihadeeswarar Temple showcases its mastery in stone construction coupled with architectural grandeur.

3. Roman Engineering Marvels: The Colosseum and Aqueducts

In terms of structural engineering, Romans gave their best to such buildings as aqueducts or the Colosseum. This is why the Colosseum takes an elliptical shape that makes effective use of innovative arches as well as vaults for advanced principles of structural designs and constructions. By contrast, these Hydraulic Engineering materials show how efficient aqueducts are known to have transported water over long distances.

4. Gothic Cathedrals: The Notre-Dame Cathedral and Chartres Cathedral

Structural engineering limits were pushed by medieval Europe's gothic cathedrals during their construction time. To allow for the creation of soaring internal spaces and intricate stained-glass windows it became necessary to use flying buttresses, pointed arches, and ribbed vaults. The Notre Dame Cathedral in Paris, as well as the Chartres Cathedral in France, are prime examples of how innovative structural designs were applied during this period.

5. Sydney Opera House

A UNESCO World Heritage site, the Sydney Opera House is a masterpiece of modern architectural design created by Danish architect Jørn Utzon. These iconic roofs made up of sail-like shells are formed from pre-cast cement panels that create continuous interlocking domed "shells" which demonstrate innovative uses of concrete materials and stretching construction techniques beyond limits possible before now.

6. The Millau Viaduct

The highest bridge in the world, known as the Millau Viaduct, can be found in southern France and spans across the Tarn Valley. This slender yet beautiful-looking structure uses very strong self-compacting concrete to show how aesthetics and structural efficiency can merge in bridge engineering.

8. The Palm Islands, Dubai

The Palm Islands located in Dubai are a marvel of modern engineering and construction. These artificial archipelagos have changed the coastline of Dubai through an innovative dredging and reclamation process which has been a hallmark of its ventures into mega structural developments.

The evolution of structural engineering, from the ingenious wonders of ancient civilizations to the soaring heights of modern architectural marvels, not only showcases the remarkable advancements in engineering and construction but also serves as a testament to the creative spirit of humanity. The enduring legacies of the Pyramids of Giza, the great architectural wonders of the Indus Valley, the Roman amphitheaters and aqueducts, the Gothic cathedrals, and the revolutionary feats of modern engineering such as the Sydney Opera House, the Millau Viaduct, and the Palm Islands in Dubai, all illustrate the timeless pursuit of innovation, efficiency, and sustainability in structural design.

As we look to the future, the principles and lessons from these iconic structures will continue to inspire and shape the next generation of architectural and engineering achievements. The evolution of structural engineering stands as a lasting testament to human potential, reflecting our ability to continuously push the boundaries of what is possible and create enduring marvels that define the built environment and our collective human legacy

APARNA A S
S8 CE

THE WORLD'S LARGESTPRIVATE APOCALYPSE SHELTER- THE OPPIDUM

The The Oppidum is a massive underground bunker complex located in the Czech Republic, often known as one of the most luxuriousand secure bunkersin the world. Built in secret over several years,it was designed to be a high-end retreat for the wealthy elite in case of global catastrophe.The construction of the Oppidum began in the early 1980s, during the height of Cold War ,as a Classified joint venture between the governments of Czechoslovakia and The Soviet Union. It was built between 1984 and 1994, at a time when global instability and the possibility of weapons of mass destruction were entirely real.The bunker was built in secret, with most of the work done underground to avoid detection. The exact location of the bunkeris a closely guarded as secret.

The bunker is massive, covering an area of over 77,500 square feet with 13 foot high ceilings. The layout features one large 6,750 square feet apartment and six 1,720 square feet apartments. It is builtto withstand a wide range of threats, including nuclear blasts, biological attacks, and natural disasters. The walls of the bunker are several feet thick and made of reinforced concrete, while the entrances are protected by heavy blast doors.The Oppidum is designed to be entirely self-sufficient, with its own power generation, water supply, and air filtration systems. It has enough supplies to sustain its occupantsfor several years. The bunker is also equipped with state of the art communication systems,allowing its occupantsto stay in touch with the outsideworld.

The luxury features of bunker are an underground garden with simulated natural light, as well as a spa, swimming pool, cinema, library, and other leisure facilities.There are also residential areas with comfortable living quarters for the occupants.There will be offices and a conference room as well as medical and surgical facilities and supplies.

Custom private vaults will also be designed to store valuablesand personal art collections.Security is a top priority at the Oppidumbunker. In additionto its heavy blast doors and reinforced walls, the bunker is equipped with advanced security systems, including surveillance cameras, motion detectors, and armed guards. Access to the bunker is strictly controlled, with only authorized personnel allowed entry.

The Oppidumbunker is a remarkable work of engineering and design, offeringa luxurious and secure retreat for the wealthy elite in the event of a global catastrophe. Its construction and design reflect a desire to provide the highest level of comfort and security for its occupants, making it one of the most impressive bunkers in the world.

- FathimaS N
S8 CE

SOLAR ROADWAYS - THE FUTURE TRANSPORT SYSTEM

Solar roadways represent an innovative approach to harnessing solar energy for sustainable and efficient transportation infrastructure. These roadways are equipped with solar panels that can convert sunlight into electricity, offering a dual purpose of providing a robust surface for vehicles while generating clean energy.

Solar roadways aim to address two critical challenges facing modern societies: the need for renewable energy sources and the maintenance of transportation infrastructure. Traditional roadways are primarily made of asphalt, which, while durable, does not contribute to energy production. Solar roadways, on the other hand, integrate solar panels into their structure, presenting an opportunity to generate electricity from sunlight.

The key component of solar roadways is the solar panel itself. These panels are designed to withstand the weight of vehicles while efficiently capturing solar energy. Solar roadways often include LEDs and sensors that can illuminate road markings, providing improved visibility during different weather conditions and times of the day. Some solar roadways incorporate heating elements to melt snow and ice, enhancing safety in colder climates.

By utilizing the vast road network, solar roadways can contribute significantly to the generation of renewable energy. The integration of solar roadways can reduce the dependence on fossil fuels for electricity generation, subsequently lowering carbon emissions associated with traditional energy sources. Features like LED road markings and sensors can enhance road safety by providing better visibility and real-time information to drivers.The development, installation, and maintenance of solar roadways can create job opportunities in the renewable energy sector.

SOne of the primary challenges is the initial cost of implementing solar roadways, which can be considerably higher than traditional road construction. Solar panels must withstand heavy loads, extreme weather conditions, and constant wear from traffic to ensure long-term durability. Regular maintenance is crucial to ensure the optimal performance of solar roadways, raising questions about the feasibility of widespread adoption. The efficiency of solar panels integrated into road surfaces is generally lower than traditional rooftop installations due to various factors like orientation and shading.

Solar roadways present an exciting avenue for combining transportation infrastructure with renewable energy generation. While the concept holds promise, addressing challenges related to cost, durability, and efficiency is essential for successful implementation on a larger scale. Continued research and development are crucial to realizing the full potential of solar roadways in contributing to a sustainable and clean energy future.

- Amisha Ajith
S2 CE

CLOUD AND MOBILE TECHNOLOGY IN CIVIL ENGINEERING

loud and mobile technology have revolutionized the landscape of civil engineering, bringing about transformative changes in project management, collaboration, and field operations. The integration of these technologies has significantly enhancedthe efficiency, accuracy, and overall effectiveness of civil engineering projects. Cloud computing in civil engineering allows for the centralized storage of vast amounts of project data. Engineers can access this information from anywhere with an internet connection, facilitating seamless collaboration and reducing the limitations of traditional file-based systems. Real-time updates and version control ensure that all team members are working with the latest information, promoting accuracy in decision-making.

Project management in civil engineering has witnessed a paradigm shift with the adoption of cloud-based solutions. These platforms offer collaborative tools, project planning software, and communication channels, enabling teams to coordinate seamlessly. Engineers can track project progress, manage schedules, and allocate resources efficiently. The cloud also provides a scalable infrastructure, allowingprojects to adapt to changingrequirements without the need for extensive hardwareinvestments.

Mobile technology plays a crucial role in bringing the power of civil engineering to the field. Mobile apps enable on-site data collection, allowing engineers to input measurements, record observations, and update project information in real time. This not only improves accuracy but also accelerates decision-making processes. Field engineers can access project drawings, specifications, and communication tools directly from their mobiledevices, reducing the reliance on paper-based documentation.

Furthermore, mobile technology enhances communication among project stakeholders. Instant messaging, video conferencing, and collaborative platformsenable swift information exchange, fostering better decision-making and issue resolution. This is particularly valuable in situations where quick responses are essential to keep projectson track.

Athira shaji
S8 CE

COASTAL ENGINEERING IN A CHANGING WORLD

Coastal engineering is the field of engineering that deals with the study of the behavior of coastlines and the design and construction of structures to protect them. In a world that is constantly changing, coastal engineering is becoming increasingly important as we face challenges such as sea level rise, extreme weather events, and coastal erosion.

Challenges of coastal engineering in a changing world:

·Sea level rise: Sea level rise is one of the most significant challenges facing coastal communities. As the sea level rises, it inundates low-lying areas, increases coastal erosion, and exacerbates storm surge flooding. Coastal engineers are working to develop solutions to protect coastal communities from theimpacts of sea level rise, such as seawalls, levees,and beach nourishment.

·Extreme weather events: Extreme weather events, such as hurricanes, typhoons, and cyclones, are becoming more frequent and intense due to climate change. These eventscan cause significant damage to coastalinfrastructure and property. Coastal engineers are working to design structures that can withstand the forces of these extreme weather events.

·Coastal erosion: Coastal erosion is the natural process of the wearing away of land by waves, tides, and currents. However, climate change is accelerating the rate of coastal erosion. Coastal engineers are working to develop solutions to slow the rate of coastalerosion, such as beach nourishment, groins, and offshore breakwaters.

New approaches to coastal engineering:

In order to address the challenges of a changing world, coastal engineers are developing new approaches to their work. These approaches include:

• Nature-based solutions: Nature-based solutions are those that use natural materials and processes to protect coastlines. Examples of nature-based

·solutions includeliving shorelines, which use vegetation to stabilize shorelines, kand oyster reefs, which can help to reduce wave energy and storm surge.

·Adaptive management: Adaptive management is a process of continually monitoring and evaluating the performance of coastal protection measures and making adjustments as needed. This is important because the conditions that coastal engineers are designing for are constantly changing.

Athul SA
S8 civil

BRIDGING DREAMS AND PROGRESS: THE MAGNIFICENT ATAL SETU

Atal Setu is an architectural masterpiece that stands tall in the heart of India, a place where tradition and modernity collide; on the banks of the Chambal River in Madhya Pradesh and symbolizes not only the connection between two shores, but also the connection between dreams and development. The 21.8-kilometer-long bridge, constructed at a cost exceeding Rs 17,840 crore, stands as a testament to Indian engineering brilliance.

Named after the dynamic former Prime Minister of India, Atal Bihari Vajpayee, this bridge is a tribute to his vision of connecting remote regions and fostering development. The Atal Setu is not just a physical structure but a bridge of hope, uniting communities that were once separated by the meandering waters of the Chambal.

The bridge begins in Mumbai's Sewri and finishes at the Uran taluka of the Raigad district at Nhava Sheva. It is anticipated to stimulate economic growth in Navi Mumbai and the neighboring regions. The two hours it used to take to travel between Mumbai and Navi Mumbai have now been reduced to just 20 minutes. According to the authorities, it will also solve the region's traffic congestion issue.

There were three parts to its construction. 165,000 tonnes of reinforcement steel, 96,250 tonnes of structural steel, and 830,000 cubic meters of concrete were needed for the bridge's construction. The bridge is the first in India to use orthotropic decks. The bridge can span greater distances than would be feasible with conventional girders, thanks to the unique steel decks. On the bridge, a total of 70 orthotropic decks were utilized, needing 96,250 tonnes of steel. The bridge is composed of 60-meter-long concrete spans that can weigh up to 130 tonnes apiece, making up the remaining 4.7 km of the bridge's length. The steel spans, on the other hand, weigh up to 2,600 tonnes.

The longest steel span in India, measuring 180 meters, is found in this 4.7 km segment, which is located at the highest point of the MTHL. On the Mumbai Trans Harbour Link (MTHL), the shortest steel span is 110 meters long. The Mumbai Metropolitan Region Development Authority (MMRDA) made the decision to employ steel spans in these areas rather than build pillars to support the bridge, which would have impeded ship traffic in the vicinity.

When you include the foundations and the cement pouring over the metal girders, only roughly 3 percent of the bridge construction was constructed on-site. The remaining portion of the bridge was shipped to the building site, ready for installation after being prefabricated.

The orthotropic deck components were assembled at Karanja Port in Uran after being manufactured in Taiwan, Vietnam, Myanmar, and Japan. Each deck took roughly three days to erect after being transported by barge to the building site. The deck was loaded onto the barge using a self-propelled transporter that was programmed, and it was installed on the bridge using computer-controlled jacks that operated within a precise 5 mm band.

The barge that was utilized to move the decks was constructed especially for the MTHL project at Larsen & Toubro's Kattupalli Shipyard. The more than 12,000 concrete boxes that make up the bridge's concrete portion were pre-cast in a casting yard. A mobile crane was used to install the 60-meter-long concrete spans on the bridge's pillars after the concrete segments were linked. To maintain the weight of the bridge, the MTHL's foundations are 47 meters deep at their deepest points. The bridge's foundation was laid using an automated girder launching technology, which was implemented for the first time in India. The Reverse Circulation Drilling (RCD) construction technique was also utilized for the first time in India, in order to reduce disturbance to migratory birds.

One of the most significant impacts of the Atal Setu is the newfound connectivity it brings to the people of Madhya Pradesh. Previously isolated villages now have a lifeline to economic opportunities, education, and healthcare. The bridge serves as a conduit for progress, transforming the lives of those who reside on either side of the Chambal.

The Atal Setu is not merely a structure of steel and concrete; it is an economic catalyst for the region. The improved accessibility has opened up avenues for trade and commerce, boosting the local economy. Farmers can now transport their produce more efficiently, and businesses can tap into new markets. The bridge is a symbol of economic empowerment for the people it serves.

Beyond its economic and social impact, the Atal Setu also takes into account environmental sustainability. The bridge incorporates eco-friendly design elements, minimizing its ecological footprint. This commitment to environmental responsibility showcases a harmonious balance between progress and nature.

One cannot help but be amazed at the harmony that exists between human creativity and the natural environment as the sun sets over the Chambal, bathing the Atal Setu in a warm glow. The bridge connects two beaches and a community's goals, serving as a testament to progress. An example of how infrastructure may promote growth and close the gap between aspirations and reality is the Atal Setu.

-Aadhith G M,
S6 CE.

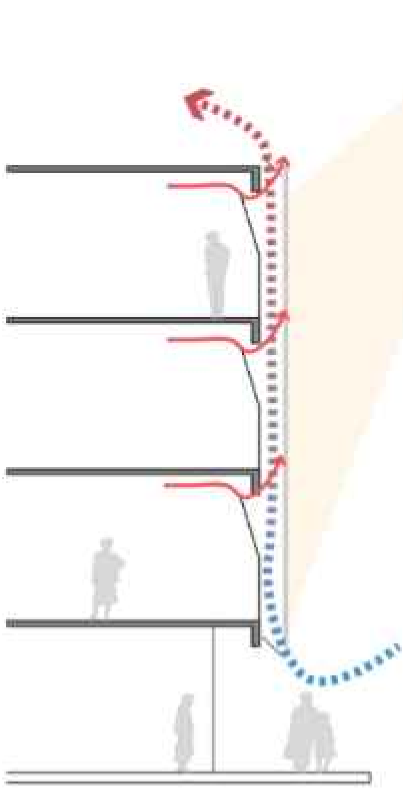
PETRA

Petra is a historical and archaeological City in Jordan, famous for its rock-cut architecture and ancient Nabataean civilization. Petra's Structures were carved into rose-red cliffs by the Nabataeans, an ancient Arab Civilization. The iconic structures, like Al-Khaznch and the Monastery, were carved from the existing rock, showcasing intricate craftsmanship. The Nabataeans utilized a mix of Helleni's tic, Roman and indigenous architectural influences in their Construction, blending artistic and cultural elements. The city's water management System, including channels and cisterns was a remarkable feat, enabling survival in the arid region. Petra is often referred to as the Lost City because it remained unknown to the Western world for centuries. It was a flourishing City of the Nabataean civilization but was abandoned and eventually forgotten by the Outside world. The remote location and the fact that Petra's structures were carved into the rock Contributed to its hidden nature.

It Rediscovered by a Swiss explorer, Johann Ludwig Burckhardt, in 1812, bringing the last city' to global attention and sparking renewed interest in its historical and archaeological significance Petra boasts remarkable Structural features, Primarily carved into rose-red cliffs. Notable Structures include: Al-Khazneh, The Siq, The Monastery, The Royal Tombs, The Great Temple, The Byzantine Church. These structures collectively highlight the advanced engineering and artistic skills of the Nabataeans. Petra's constructional features reflect a harmonious blend of artistry, functionality, and adaptability to the environment.

Ashna J P
S2 CE

Double Skin Facades: A Sustainable and Adaptable Approach to Building Design



Double skin facades are Technological Marvel Inspired by Nature and are aptly named for their two-layer structure, are rapidly gaining popularity in the architectural world. These ingenious systems, consisting of two glass skins separated by an air cavity, offer a unique blend of aesthetics, sustainability, and adaptability.

Its main objective lies in harnessing the Power of Air, by cleverly using the natural properties of air i.e., insulation and natural convection, this helps buildings to self-sufficiently maintain comfortable temperatures without relying solely on energy-hungry heating and cooling systems.

The key innovation lies in the air cavity, which can range from a mere 20 centimeters to several meters. This seemingly simple space acts as a powerful insulator, protecting the building from extreme temperatures, wind, and noise. During hot summers, the cavity vents excess heat out of the building through a chimney effect, where heated air rises naturally. Conversely, in cold winters, the trapped solar warmth within the cavity acts as a buffer, reducing heating needs.

The facades also provides a plethora of benefits beyond thermal comfort. Their transparent design maximizes natural light penetration while offering superior acoustic insulation, creating a pleasant and healthy indoor environment. Additionally, they eliminate the need for external window treatments, contributing to a clean and sleek aesthetic.

One of the most fascinating aspects of double skin facades is their adaptability. By incorporating elements like operable vents, sunshades, and air circulation systems, the behaviour of the facade can be modified to suit specific climate conditions and building use. This allows for efficient control of temperature, ventilation, and natural light penetration throughout the year.

While the advantages are numerous, it's important to acknowledge the potential drawbacks. Their high upfront cost, increased space requirements, and ongoing maintenance needs must be carefully considered during the design and construction phases. Additionally, their effectiveness can be hampered by changes in the surrounding environment, such as new structures blocking sunlight.

Some examples include the Gherkin, London, this iconic skyscraper by Foster + Partners is a prime example of how double skin facades can be both visually striking and environmentally responsible. In India the KMC Corporate Office, Hyderabad is a project by RMA Architects showcases a practical and cost-effective approach to double skin facades. The use of locally sourced materials and efficient construction methods helped maintain affordability while achieving significant energy savings.

Despite such limitations, the idea represents a significant advancement in sustainable and adaptable building designs. As technology advancements continue to improve their efficiency and cost-effectiveness, they are poised to play an increasingly significant role in shaping the future of sustainable and user-friendly architecture such as the double skin facades.

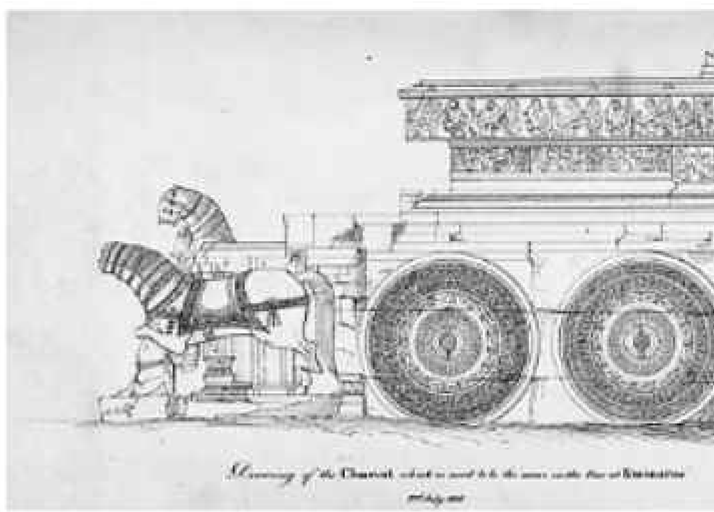
- Niranjana S. Nair,
S6 CE.

KONARK SUN TEMPLE

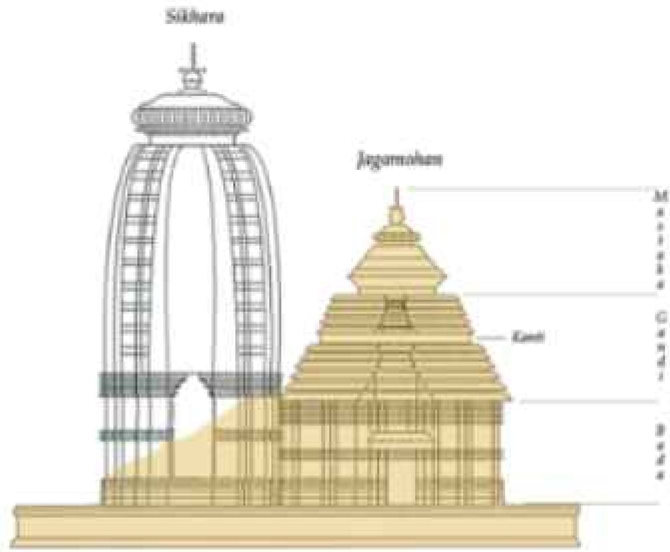
The Konark Sun Temple dates back to the 13th century CE, or the year 1250. It is located on the Puri district's shoreline around 35 kilometres (22 miles) northeast of Puri city.About 1250 CE, King Narasimhadeva I of the Eastern Ganga dynasty is credited with building the temple.

What's left of the temple complex is devoted to the Hindu Sun God Surya and resembles a gigantic stone chariot with enormous wheels and horses, standing thirty metres (one hundred feet) high. A substantial portion of the temple, including the shikara tower that once towered over the sanctuary at a height of nearly 200 feet (61 metres), is now in ruins. This was once much higher than the mandapa that still stands. Renowned for their exquisite artwork, iconography, and motifs, which include sensual depictions of kama and mithuna, are the structures and aspects that have endured. It is often referred to as the Surya Devalaya and is a prime example of Kalinga or Odisha architecture.

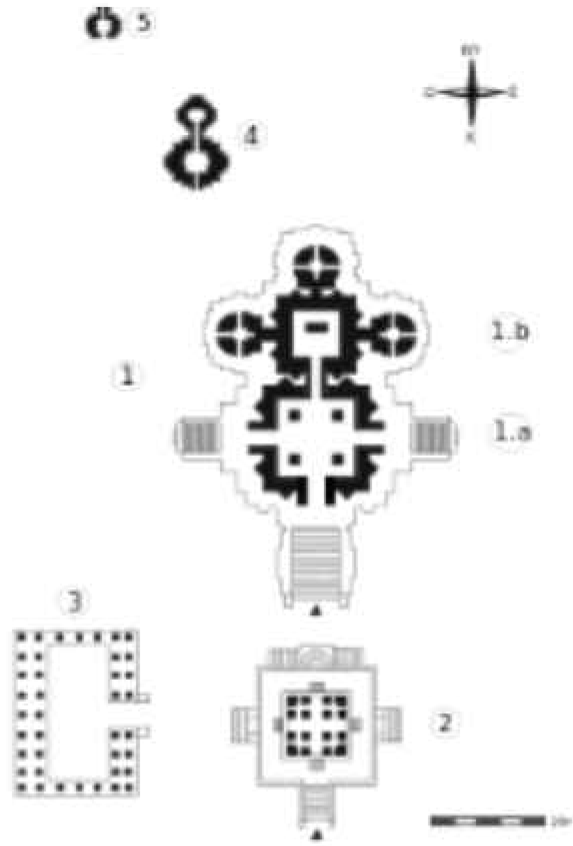
This iconography is displayed magnificently at the Konark temple. It is drawn by a group of seven horses and features twenty-four intricately carved stone wheels, each measuring about twelve feet (3.7 metres) in diameter.The temple in the shape of a chariot seems to rise bearing the sun from the blue sea when viewed from inland during dawn and sunrise.



There were three kinds of stone used to build the sun temple.The door lintel, frames, and a few sculptures were made of chlorite. The staircases close to the foundation and the platform's centre were constructed out of laterite. Other sections of the temple were made of khondalite. Mitra claims that because Khondalite stone weathers more quickly than other stones, erosion may have hastened destruction when portions of the temples were destroyed. Since none of these stones are found in the area naturally, the designers and craftspeople had to transport the stones a considerable distance, most likely by using the neighbouring rivers and waterways.After that, the masons produced ashlar, polishing and finishing the stones to almost completely hide any joints.



The vimana, or main sanctum sanctorum, of the original temple is thought to have been 229 feet (70 meters) tall. In 1837, the main vimana collapsed. The primary building in the remaining ruins is the main mandapa audience hall, or jagamohana, which is approximately 128 feet (39 metres) high. The eating hall (Bhoga mandapa) and dance hall (Nata mandira) are two of the buildings that have endured to this day.



The temple plan is a square layout with all the typical components of a Hindu temple. As per Kapila Vatsyayan, the arrangement of sculptures and reliefs, along with the ground plan, adhere to the geometric forms of squares and circles, which are prevalent in Odisha temple design manuals like the Silpasarini.The designs of other Hindu temples in Odisha and abroad are influenced by this mandala structure.

The deul, the primary temple at Konark known locally, is no longer standing. It was encircled by smaller shrines with niches that featured images of Hindu deities, especially Surya in several of his guises. The deul was constructed on a tall terrace.Originally, the temple was a complex made up of the main sanctuary, known as the bada deul (lit. large sanctum) or rekha deul.

DENNIES THOMAS

INTEGRATION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN CIVIL ENGINEERING

The World is running behind artificial intelligence, machine learning and augmented reality. Civil engineering is the vast branch of engineering which builds the world, its infrastructure, facilities and develops the world nations for a prosperous future. Similar to all the other branches of all the fields, civil engineering is also under changes. The development of science and technology has paved its foundation.

Artificial intelligence, similar to all its applications in other fields, tries to imitate and execute functions of the brain more logically and effectively under the civil engineering domain.In January 1990, Robert J. Schalkoff defined artificial intelligence as "a field of study that seeks to explain and emulate intelligent behavior in terms of computational processes" in his book "Artificial Intelligence Engine."

In structural systems,structural health monitoring can be done using artificial intelligence aid.In this method, data is collected and analysed to access the vulnerabilities in the structural system.Any type of the structural framework can be analysed using this system like bridges, pipelines or dams.The incorporation of Artificial Neural Network in artificial intelligence can be used to find maximum dry density and unconfined compressive strength of cement stabilized soil. The inputs of the study include liquidity limit, moisture content, cement content, plasticity index and fractions of sand, gravel and clay.The Support vector machine (SVM) techniques results that unconfined compressive strength and maximum dry density of cement stabilized soil is very accurate.Artificial neural networks and genetic modelling can also be used to measure the slump of ready-mix concrete.Fuzzy polynomial neural networks are used extensively for the approximation of the compressive strength of concrete.

Not only in construction management but also in many other fields like transportation engineering and hydrology, artificial intelligence and machine learning is widely used.AI can be used effectively in transportation management for implementation of Traffic Signal timing and optimization system, based on evolutionary algorithms,fuzzy logic control artificial neural network and reinforcement learning algorithms.Short term traffic and travel time prediction models,signal control of traffic at road intersections,ramp metering on freeways,dynamic route guidance, positive train control on railroads and air traffic control are the main applications of AI in Transportation field.In traffic signal technology, camera can be installed which can detect different types of vehicle,if a bus is detected,Green lights can be triggered to ease its passage.Ambulances or cyclists can be given priority or the right turn phase skipped when there are no vehicles turning right to ease congestion.Smart traffic aided with CCTVs and ANPR ensures the system's accuracy.
AI can be used effectively in implementation of 3D printing technology and Building Information Modelling (BIM).It is ensured that an intelligent and effective 3D model can be ensured with peculiar features in architecture,engineering and construction (AEC) professionals to create efficient plan,design and manage infrastructure.

AI has a tremendous opportunity to disrupt the AEC space. Komatsu's Smart Construction drives the usage of autonomous equipment up with the benefit of having a safer environment.Autodesk's product line on generative design opens a new world of design possibilities for architects and engineers.As the field of science and technology is rapidly developing, the innovations of AI and ML in construction field is also increasing day by day.As every method has its on merit and demerits, it should be well assessed and calibrated before implementation.

Anusree Anilkumar
S8 CE

DEEP LEARNING THROUGH PROGRAMMED ALGORITHMS: A GAME CHANGER FOR STRUCTURAL HEALTH MONITORING?

The safety of our infrastructure is paramount, and the early detection of cracks in structures like bridges and buildings is crucial. These hidden flaws can lead to catastrophic failures, putting lives and livelihoods at risk. Traditionally, visual inspections have been the primary method for detecting cracks, but this approach can be time-consuming, subjective, and even dangerous. However, the field of artificial intelligence offers a beacon of hope. A recent study has yielded promising results in the realm of structural health monitoring by utilizing deep learning and seismic waves. Imagine sending sound waves through a structure and using them to identify hidden cracks, similar to an ultrasound in medical imaging. This futuristic concept is no longer just a dream. Researchers are actively exploring this innovative approach, leveraging the power of deep learning to analyze these sound waves and pinpoint the location of potential cracks with remarkable accuracy.

This study paves the way for a future where structures are equipped with intelligent monitoring systems, capable of continuously assessing their own health and alerting engineers to any potential problems before they escalate into major issues. This advancement not only enhance the safety of our infrastructure but also lead to significant cost savings through proactive maintenance and prevention strategies. The potential impact of deep learning on structural health monitoring is undeniable, and this study represents a significant step towards a future where our built environment is not only robust but also intelligent and self-aware.

The researchers did this by sending sound waves through a structure, like a bridge or building, and using them to identify hidden cracks and then by analysing the sound waves and pinpointing the location of potential cracks with remarkable accuracy. This study utilized deep learning algorithms, essentially powerful computers trained to learn and recognize complex patterns from vast amounts of data. These algorithms were trained on a massive dataset of sound waves that had travelled through both cracked and non-cracked structures. This training allowed them to learn the subtle differences in the sound waves caused by cracks, ultimately enabling them to identify cracks with high precision. They went beyond simply training the deep learners. They meticulously analyzed different components within the deep learning model, i.e., fine-tuning the algorithm's tools and techniques. This involved exploring various network architectures, which essentially define the structure and organization of the deep learning system. Different architectures excel at different tasks, and the researchers identified one called DenseNet as particularly adept at extracting crack-related features from the sound waves.

Additionally, the researchers introduced a novel data preprocessing technique called reference wave field normalization, this technique essentially involved adjusting the sound waves in a specific way to further enhance the detection of smaller cracks. These smaller cracks can often be particularly challenging to identify using traditional methods, highlighting the potential of this new technique.

This study conducted showcases the potential of combining deep learning and seismic waves for revolutionizing infrastructure health monitoring. The use of DenseNets and reference wave field normalization proves effective in detecting cracks in flat structures. The approach opens the door to continuous monitoring of structures using sound waves, promising improved safety and proactive maintenance.

Looking forward, researchers aim to extend this method to analyze 3D structures, making it more versatile. This advancement could transform structural health monitoring, enabling real-time, cost-effective diagnostic systems. The ultimate goal is to develop smart structures with self-monitoring capabilities, enhancing safety, longevity, and cost savings through proactive maintenance. The future of structural health monitoring looks promising, with deep learning playing a crucial role in ensuring the resilience of our infrastructure.

- Archa S Kumar,
S4 CE.

BIM IN INDIA

Building Information Modelling (BIM) is a highly collaborative method that enables architects, engineers, contractors, and other AEC professionals to work and collaborate on the same 3D model. The crucial word that must be highlighted in BIM is "information". BIM is all about sharing and managing information, and a single BIM model contains massive amounts of data. BIM is gradually becoming a critical and mandatory process for the planning, design, and construction of buildings around the world.

According to studies, BIM projects enhance production by 75 to 240%. Countries are progressively adopting BIM because of the significant benefits it provides, such as cost savings, increased productivity, clash detection, and so on.

India has a high population density, surpassing even China. This population will require additional infrastructure, educational facilities, and social housing. According to the BIM Academy, a 2017-2018 Economic Survey predicts that by 2040, India will need to invest approximately 4.5 trillion dollars in infrastructure to achieve its predicted economic development.
This means that without BIM, India will be unable to achieve its lofty aspirations. In the next few years, BIM will be a multibillion-dollar company in India. The ability to adopt new technology will quickly become the bread and butter of innovative architects.
BIM found its way into the Indian construction industry at the end of the first decade of this millennium. The early interest in BIM in India stemmed from a desire for an interactive tool that precisely simulates the complexities of the project, consolidates all information in one location, and cross-links the data. However, there was a lot of resistance to BIM adoption at first since people were unwilling to abandon their established processes.

For the next 5-7 years, people saw BIM as a "nice-to-have" tool. By 2023, the topic had shifted to advanced BIM applications. However, there is still a long way to go in terms of completely eliminating resistance.

- CHRISTINA ANN PHILIP
S4 CE

RAM MANDIR

INDIA'S MASTERPIECE

The Ram Mandir, a revered religious and cultural landmark in India dedicated to Lord Rama, beyond its spiritual significance is a marvel of civil engineering, showcasing the ingenuity and craftsmanship of ancient builders. The civil engineering features of the Ram Mandir are a testament to the advanced skills and knowledge of its creators, making it a masterpiece of architectural design and construction.

THE FOUNDATION

One of the key civil engineering features of the Ram Mandir is its foundation. A 14-metre thick layer of roller-compacted concrete, looking like an artificial rock, has been used to construct the foundation of the temple. Builders meticulously planned and constructed this solid base so that it could withstand the test of time and provide stability to the temple's superstructure. The foundation of the Ram Mandir is a critical aspect of its structural integrity, ensuring that the temple stands strong for generations to come.

THE STRUCTURAL DESIGN

The temple's architecture features intricate carvings, tall spires, and elaborate sculptures that required precise planning and execution. Skilled artisans and craftsmen worked diligently to create the intricate details and decorative elements that adorn the temple's walls and pillars. The structural design of the Ram Mandir not only showcases the artistic prowess of its builders but also demonstrates their engineering expertise in creating a structurally sound and aesthetically pleasing temple.

CONSTRUCTION MATERIALS

The materials used in the construction of the Ram Mandir reflect the builders' attention to detail and commitment to quality. Locally sourced stones, such as sandstone and granite, known for their strength and durability, were carefully selected for the temple's construction. These materials were expertly carved and assembled to create the intricate architectural elements that adorn the Ram Mandir. The use of high-quality materials ensured that the temple would withstand the test of time and remain a symbol of architectural excellence for centuries to come.

CONSTRUCTION TECHNIQUES

Construction techniques employed in building the Ram Mandir highlight the advanced skills and craftsmanship of ancient builders. Stone blocks were meticulously cut, shaped, and fitted together using traditional methods such as mortise and tenon joints, dovetail joints, and corbeling. Skilled artisans worked with precision to create the intricate carvings and sculptures that adorn the temple's walls and pillars. The construction techniques used in building the Ram Mandir demonstrate the builders' mastery of their craft and their ability to create a structure of enduring beauty and strength.

The civil engineering features of the Ram Mandir are a testament to the advanced skills and knowledge of its creators. The foundation, structural design, materials used, and construction techniques employed in building the temple all contribute to its status as a masterpiece of architectural design and engineering. The Ram Mandir stands as a remarkable example of India's rich architectural heritage, showcasing the ingenuity and craftsmanship of ancient builders who created this magnificent structure with meticulous attention to detail.

- NEHA B THOMAS
S4 CE

THE INFLUENCE OF BIOPHILIC DESIGNS ON HUMAN WELL-BEING AND ENVIRONMENTAL SUSTAINABILITY

Biophilic design, rooted in the innate human connection with nature, seeks to integrate natural elements and processes into the built environment. From incorporating green spaces and natural light to utilising organic materials and biomimetic forms, biophilic design aims to enhance human well-being and environmental sustainability. This essay explores the profound influence of biophilic designs on both individuals and the planet.

Enhanced Health and Well-being:

Biophilic design has been shown to have numerous positive effects on human health and well-being. Access to nature, whether through indoor plants, outdoor views, or natural materials, has been linked to reduced stress, improved cognitive function, and enhanced mood. Incorporating elements such as daylighting and natural ventilation not only enhances comfort but also promotes circadian rhythms and sleep patterns, leading to better overall health outcomes.

Moreover, biophilic design encourages physical activity and social interaction by creating inviting outdoor spaces and pedestrian-friendly environments. Green roofs, urban parks, and community gardens not only provide opportunities for recreation but also foster a sense of connection to nature and community, promoting mental and emotional well-being.

Environmental Sustainability:

In addition to benefiting human health, biophilic design contributes to environmental sustainability by reducing energy consumption, mitigating urban heat island effects, and promoting biodiversity. Green building practices, such as passive solar design, green roofs, and natural ventilation, optimize energy efficiency and reduce reliance on mechanical systems, lowering carbon emissions and operational costs.

Furthermore, biophilic design integrates ecological principles into the built environment, creating habitats for wildlife and preserving biodiversity in urban areas. Green infrastructure, such as bioswales, rain gardens, and permeable pavement, manages stormwater runoff, improves water quality, and enhances urban ecosystems. By mimicking natural processes and ecosystems, biophilic design fosters resilience to climate change and promotes the long-term sustainability of human settlements.

Social and Economic Benefits:

Biophilic design not only enhances human health and environmental sustainability but also yields social and economic benefits for communities and businesses. By creating attractive and desirable

spaces, biophilic design enhances property values, attracts tenants, and fosters economic development. Parks, greenways, and natural amenities contribute to tourism and recreational activities, supporting local economies and cultural vitality.

Moreover, biophilic workplaces have been shown to increase productivity, creativity, and employee satisfaction, leading to higher retention rates and improved organizational performance. Incorporating natural elements into educational environments improves learning outcomes and student engagement, nurturing future generations of environmentally conscious citizens.

Biophilic design offers a holistic approach to creating healthy, sustainable, and resilient built environments. By reconnecting people with nature and integrating natural elements into the urban fabric, biophilic design enhances human well-being, environmental sustainability, and economic prosperity. As cities continue to grow and evolve, embracing biophilic principles will be essential in fostering thriving communities and safeguarding the planet for generations to come.

- P NANDAKISHORE
S8 CE

DESIGNING BRIDGES IN A CHANGING CLIMATE

Under a changing climate, there are changes in bridge engineering to ensure the durability and sustainability of this vital infrastructure. Rising sea levels, increased occurrence of extreme weather events and changing temperatures require a proactive approach.

One important factor is material selection; engineers are researching for advanced materials with better durability and resistance to environmental influences. Fiber-reinforced composites, corrosion-resistant alloys and self-healing concrete are becoming prominent. These materials can extend service life and reduce the need for frequent repair and replacement.

Innovative design strategies play a key role in climate-responsive structures that have characters such as flexibility and adaptability to account for temperature fluctuations and structural stresses. Rising sea levels are managed with raised bridge foundations or floating structures that can adapt to changes in water level and ensure continuous functionality in coastal areas. Sustainable practices are an integrated part of climate conscious bridge engineering, like green infrastructure concepts such as adding vegetation to bridge surfaces or using recycled materials promote environmental sustainability . In addition, engineers are integrating smart technologies into real-time monitoring, which enables preventive maintenance and rapid response to new problems.

Regular maintenance is evolving to address climate challenges. Predictive Maintenance Models based on climate data and performance analysis enable timely action. Routine inspections are enhanced to identify vulnerabilities related to climate impacts, to ensure the safety and performance of bridges under changing conditions.

Public awareness and community participation are also important factors. Educating communities about climate-resilient bridge design and promoting sustainable practices promotes shared responsibility for infrastructure sustainability.

In conclusion, bridge design in a changing climate involves a multifaceted approach,encompassing material innovation, adaptive design, sustainable practices, advanced technologies and community engagement. Together, these measures will help build bridges that can withstand the challenges of a dynamic and evolving climate and environment.

- SHARON RAJEEVAN
S8 CE

GOLDEN GATE BRIDGE.

The Golden Gate Bridge, with its majestic halls reaching 746 bases (227 m) and its suspense lines stretching 4,200 bases (1,280 m) across the Golden Gate strait, is extensively honored as one of the most beautiful bridges ever created.

This suspended infrastructure connects San Francisco, California on the northern tip of the San Francisco Peninsula, to Marin County. It carries both U.S. Route 101 and California State Route 1, as well as rambler and bike business, making it a vital transportation link.

The bridge's status as a transnational symbol is due to several factors. When it opened in 1937, it held the title of both the longest and altitudinous suspense bridge in the world. This emotional feat of engineering was achieved despite significant challenges.

The now- iconic" international orange" color of the ground was not the original plan. The Military and Navy wanted the bridge painted with bright contrasting stripes to enhance visibility for vessels navigating through the fog. The eventual Orange tinge was choosen by mastermind Irving Morrow for its superior visibility in foggy conditions, its aesthetic complement to the girding geography, and its vibrant discrepancy with the blue sky and bay waters. Interestingly, this bold orange color, firstly intended as a temporary choice, proved so effective that it came the permanent choice.

Safety was the highest priority during the bridge's construction, a remarkable achievement considering the period. Principal mastermind Joseph Strauss enforced several innovative safety measures, including making hard headdresses obligatory for workers (a first in theU.S. at the time) and installing a massive safety net under the construction point. This net, credited with saving the lives of 19 workers who came known as part of the" Half to Hell Club," serves as a important testament to the prioritization of worker safety.

Despite its beauty, the Golden Gate Bridge is unfortunately known for being a position for self-murder attempts. To address this woeful issue, the bridge is equipped with 11 extremity comforting telephones that connect guests directly to trained self-murder forestallment counselors. Also, an endless self-murder forestallment net is presently under construction and is anticipated to be completed by the end of 2023.

While the ground's association with self-murder is a serious concern, its stirring beauty remains its defining characteristic. As Frommer's travel guide aptly states, the Golden Gate Bridge is" possibly the most beautiful, certainly the most photographed, bridge in the world."

- ABHIDHU D S
S8 CE

BRIHADESHWARA TEMPLE:

MAGNIFICENT EPITOME OF CHOLA ARCHITECTURE

India's architectural heritage includes a significant amount of temple building, with varied styles found throughout the nation. Indian temples are highly revered by believers and are an essential component of Indian culture. Brihadeshwara Temple (Thanjai Periya Kovil) is one such beautiful temple enhancing Southern India's architectural legacy. This extravagant architectural marvel, which radiates majesty and richness, is so magnificent that it draws attention from all directions in the Thanjavur district. Another name for the Brihadeshwara temple is Thanjai Periya Kovil.

Situated on the southern bank of the Kaveri river in Tamil Nadu's Thanjavur district, this temple has a Dravidian architectural style. The locals refer to this temple, which is devoted to Lord Shiva, by different names, including Thanjai Periya Kovil, Rajarajeswaram, and Dakshina Meru. Rajaraja I, the Chola dynasty's emperor, conceived the temple between 1003 and 1010 AD, including elements of their culture and fashion. One of the biggest Hindu temples, it is also one of the Great Living Chola temples, UNESCO World Heritage Sites. It was designed by Kunjara Mallan Raja Rama Perunthachan.

The temple's opulent structure redefines scale and grandeur, and its architecture radiates brightness. It took 12 years to construct and is renowned for both its stunning architecture and for being the location where Lord Shiva's dance form, Brass Lord Nataraj, was commissioned. It's a large temple constructed in accordance with geometry and symmetry on top of a raised mound. The temple complex measures 790 feet by 400 feet in a rectangular shape.

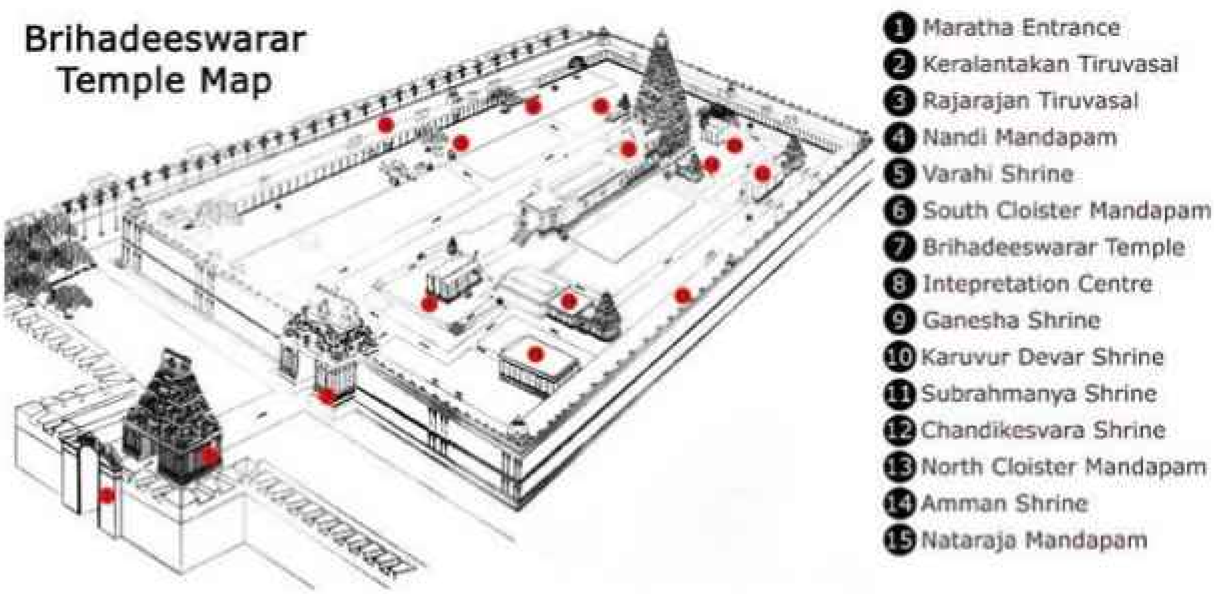
The complex of the Brihadeshwara temple (also known as Thanjai Periya Kovil) consists of five main sections: the sanctum, also known as Garbhagriha, which is the main block housing the idol of the deity with a Srivimana on top; the front nandi hall, or Nandi Mandapam; the main community hall, Mukha Mandapam; the great gathering hall, Maha Mandapam; and finally, the pavilion, known as Antrala, which connects the sanctum and great hall. There's a 450-meter-long covered verandah with pillars in the courtyard for the long-practiced parikrama circumambulation rite. At 208 feet tall, the Vimana Tower is among the highest in South India and was built out of granite.

The original barrel-vaulted gopuram is located on the east end peripheral of the Brihadeshwara temple (Thanjai Periya Kovil); other gopurams were later erected to give the temple with various entries and exits. Axially aligned with the main temple, the complex features numerous additional shrines that were erected later on, such as the shrines dedicated to Goddess Parvati and Lord Kartikeya. A 25-ton single-stone Nandi bull, representing Nandi watching over the Temple, is positioned facing the Sanctum in the Nandi mandapam. The entire complex is built on an elevated platform, and because of the 208-foot-tall Vimana, the courtyard floor always reflects the sun's heat.

The western square is centered on the garbhagriha, or sanctum. The huge walls surrounding the sanctum are divided into multiple levels by deeply carved sculptures and pilasters that create bays and recesses. The Shiv Linga is located in the innermost chamber of the Brihadeshwara Temple, known as the Karuvarai or womb chamber, which is exclusively accessible by priests. The vimana above is 16 stories tall, with 13 tapering squares. It is situated on a 99-foot-square. Perched atop the vimana is Sikhara, shaped like a cupola sculpted from a single granite stone. It is an engineering marvel since it is nothing short than astonishing that 80 tons of weight could be transported to the top of Vimana using the methods that were available at the time.

The Brihadeshwara Temple's maha mandapam and mukh mandapam have colonnade architecture with Dwarpalas on either side. The eight deities represented by the shrines of the mandapas are guardian angels for each of the eight cardinal directions. The walls of the corridor are decorated with mural paintings and various sculptures depicting the dancing Lord Shiva. It also contains numerous inscriptions in Grantha and Tamil scripts that provide information on the rulers who oversaw the temple's construction as well as renovations made in the years that followed. The temple architecture was repeatedly devastated by conflict and invasions by many invaders, but the governing kingdoms would always rebuild or restore it.

AADHITH G M
S6 CE



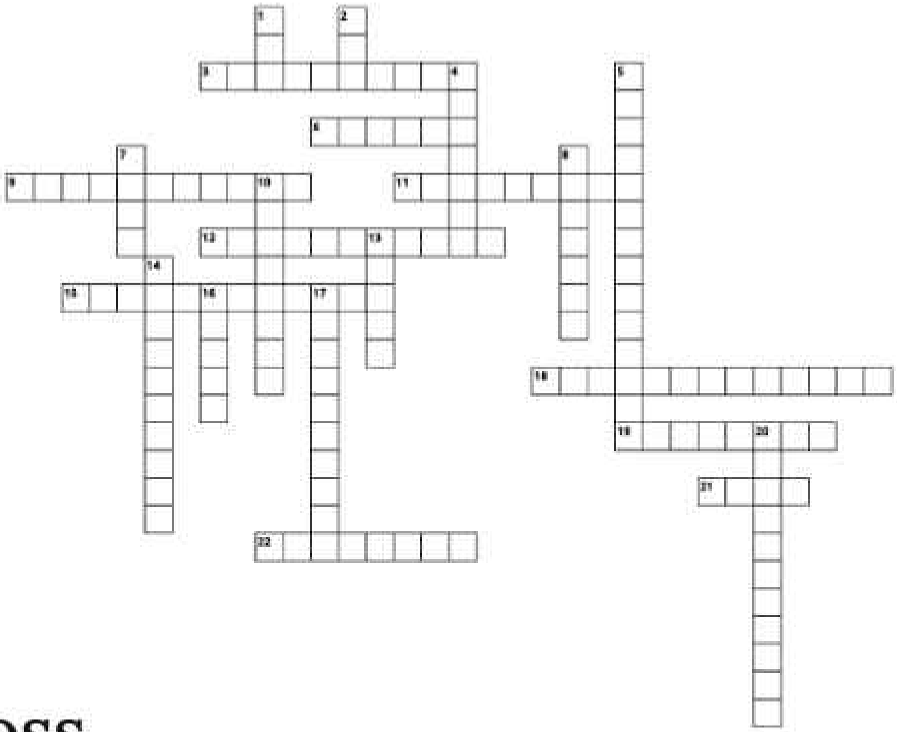
SAFEGUARDING STRUCTURES AGAINST NATURE'S FURY:
THE EFFECTS OF EARTHQUAKE-RESISTANT BUILDING DESIGN

In the face of nature's relentless power, the quest to fortify our buildings against the catastrophic forces of earthquakes stands as a testament to human ingenuity and resilience. From bustling urban centers to remote villages nestled amidst rugged terrain, the threat of seismic activity looms large, underscoring the critical need for robust and innovative building design. In response, engineers have meticulously crafted a comprehensive framework of design criteria, seamlessly blending cutting-edge technology with time-honored principles to create structures capable of withstanding the formidable challenges posed by earthquakes. At the heart of earthquake-resistant building design lies the art and science of site selection and soil analysis. Every structure's journey begins with a careful examination of its geological surroundings, where engineers meticulously probe the earth beneath to uncover its secrets. Through sophisticated analyses and geological surveys, potential hazards such as liquefaction and soil amplification are identified, guiding engineers in choosing stable ground and crafting resilient foundation systems. This foundation, both literal and metaphorical, serves as the bedrock upon which the edifice of seismic resilience is built, providing a solid footing amidst the tremors of uncertainty. Yet the strength of a structure extends far beyond its foundation, echoing through every beam, column, and brace. Structural integrity stands as the cornerstone of earthquake-resistant design, where engineers weave together an intricate tapestry of materials and methodologies to create structures capable of withstanding nature's relentless onslaught. Robust structural systems, such as reinforced concrete or steel frames, are meticulously engineered to bear the brunt of seismic forces, while the principle of ductility ensures that buildings can bend without breaking, flexing, and dissipating energy like a mighty oak swaying in the tempest.

In the quest for resilience, redundancy and continuity emerge as guiding principles, weaving a web of interconnectedness throughout the structure. By incorporating multiple load paths and ensuring the seamless transfer of forces, engineers create a symphony of strength that echoes through every corner of the building. This symphony, composed of steel and concrete, resonates with the harmonious hum of resilience, where the whole is truly greater than the sum of its parts, and the structure stands as a testament to human ingenuity and collaboration. But resilience knows no bounds, transcending the confines of mere structure to embrace the very essence of innovation and adaptation. Seismic isolation and damping systems emerge as the vanguard of resilience, employing cutting-edge technologies to decouple structures from ground motion and dissipate seismic energy with surgical precision. Retrofitting existing structures with strengthened elements and enhanced connections breathes new life into aging edifices, transforming them into bastions of resilience that stand as beacons of hope amidst the tumult of seismic uncertainty. In conclusion, earthquake-resistant building design represents not merely a technical endeavor but a testament to the human spirit, a testament to our unwavering resolve to overcome the greatest challenges nature throws our way. Through meticulous planning, relentless innovation, and unwavering collaboration, engineers stand as guardians of resilience, crafting structures that stand as monuments to human ingenuity and resilience. As seismic risks continue to evolve, so too must our resolve as we chart a course towards a future where every building, every community, stands as a bastion of resilience against the relentless forces of nature's fury.

Navaneeth.k
S2 CE

CROSSWORD



ACROSS

3. One of the earliest examples of a scientific approach to physical and mathematical problems applicable to civil engineering is the work of this man

6. The first engineering school, The National School of Bridges and Highways was located

9. The first International convention was held in this country on May 20 to 24, 1975

11. are a type of structure in coastal engineering used to prevent erosion caused by weather and long shore drift, primarily to enforce coastal structures such as seawalls and breakwaters

12. has been an aspect of life since the beginnings of human existence

15. This engineering analyze soil and rock that affect the behavior of structures, pavements, underground facilities, and containment structures for solid and liquid wastes. Design foundations, retaining walls, roadway cuts, etc.

18. This engineering apply fluid mechanics, biology and chemistry to the design and operation of environmental control systems, e.g., municipal and industrial wastewater systems. Model and monitor the movement and behavior of water pollutants in natural waters.

19. Civil Engineering Month

21. All registered civil engineers shall obtain this which will be stamped to all the plans and specifications prepared by, or under the direct supervision of a registered civil engineer.

22. Identifying the compositional requirements needed to obtain "hydraulicity" in lime; work which led ultimately to the invention of this type of cement

DOWN

1. Recognized the PICE as the only official organization of civil engineers in the Philippines

2. This engineering manage the design formwork, scaffolding, lifting apparatus, etc. Management of construction resources: labor, materials, equipment, money and time. Maybe employed as: Project Engineers, Project Managers, Field & Office Engineers, Estimators, other position related to this track

4. the "father of civil engineering"

5. This engineering analyze movement of persons and goods. Plan, design, construct, maintain and operate various transportation modes (e.g., highway, railway, air, water, etc.) Design traffic management systems

7. professional organization for civil engineers in the Philippines

8. engineering is concerned with managing coastal areas

10. who drew up the plans and specifications for a building is liable for damages if within fifteen years from the completion of the structure

13. developed the theory explaining the buckling of columns

14. This engineering focus on design and analyse all man-made objects whose primary function is load resistance: buildings, bridges, aircraft, transmission towers, radar domes and antennas, drilling platforms, etc.

16. This field of engineering focuses on knowledge of structures, materials science, geography, geology, soils, hydrology, environment, mechanics, and other fields.

17. responsible for the damages if the edifice falls, within the same period, on account of defects in the construction or the use of materials of inferior quality furnished by him, or due to any violation of the terms of the contract

20. Indian mathematician, used arithmetic in the 7th century AD, based on HinduArabic numerals, for excavation (volume) computations

ANSWER KEY

ACROSS

3.ARCHIMEDES
6. FRANCE
9. Philippines
11. TETRAPODS
12.ENGINEERING
15. GEOTECHNICAL
18. ENVIRONMENTAL
19. NOVEMBER
21. SAID
22 PORTLAND

DOWN

1. PRC
2. CPM
4. SMEATON
5. TRANSPORTATION
7. PICE
8. COASTAL
10. ARCHITECT
13. EULER
14. STRUCUTRAL
16. CIVIL
17. ARCHITECT
20. BHRAHMAGUPTA

FAMOUS STRUCTURES OF INDIA

Q	R	K	R	N	N	A	U	Z	Z	Y	H	M	Z	U	I	T	K	X	D
Q	U	Q	S	Q	L	Z	U	S	I	L	F	G	L	G	Z	Z	O	A	I
L	Y	K	Z	F	O	A	F	E	O	V	C	F	L	X	W	D	N	E	J
S	S	T	P	N	F	I	H	T	K	E	T	A	J	M	A	H	A	L	S
E	F	Y	O	U	V	W	U	A	C	D	N	X	K	Y	M	I	R	P	A
I	C	L	T	X	R	S	Q	A	M	H	O	H	Z	S	B	I	K	M	M
H	H	B	H	H	T	A	L	Q	U	L	I	O	Q	O	K	Y	S	E	I
Y	A	L	O	E	R	A	N	I	M	R	A	H	C	R	Y	N	U	T	T
X	J	W	M	F	P	K	R	A	K	D	L	J	R	E	L	R	N	R	O
C	Q	P	A	R	E	W	L	I	Q	H	G	R	Q	P	I	J	T	U	M
R	L	D	E	M	L	L	M	H	Y	U	H	F	T	A	S	W	E	Y	Y
E	A	B	F	V	A	A	A	K	W	L	I	V	G	L	E	I	M	A	E
X	M	Z	O	R	S	H	H	J	V	S	H	L	B	A	N	U	P	V	J
A	V	H	I	J	U	V	A	B	U	Y	R	E	A	C	H	B	L	U	H
Q	H	D	I	K	T	J	I	L	P	N	I	C	P	E	G	P	E	R	G
L	R	D	T	R	O	F	A	D	N	O	C	L	O	G	W	H	P	U	L
G	W	A	L	I	O	R	F	O	R	T	B	F	F	Y	B	D	F	G	S
B	P	X	C	S	D	Y	B	N	B	X	F	T	T	A	O	M	U	G	E
E	T	W	B	F	P	X	U	M	L	K	I	C	R	F	R	C	V	K	R
Q	P	G	D	S	S	N	Z	Y	B	D	K	U	D	S	T	E	S	X	O

WORD SEARCH

AMBER PALACE
CHARMINAR
GOLCONDA FORT
GURUVAYUR TEMPLE
GWALIOR FORT
HAWA MAHAL
JAL MAHAL
KHIRKI MASJID
KONARK SUN TEMPLE
LOTUS TEMPLE
MOTI MASJID
MYSORE PALACE
PURANA QUILA
TAJ MAHAL

ANSWER KEY