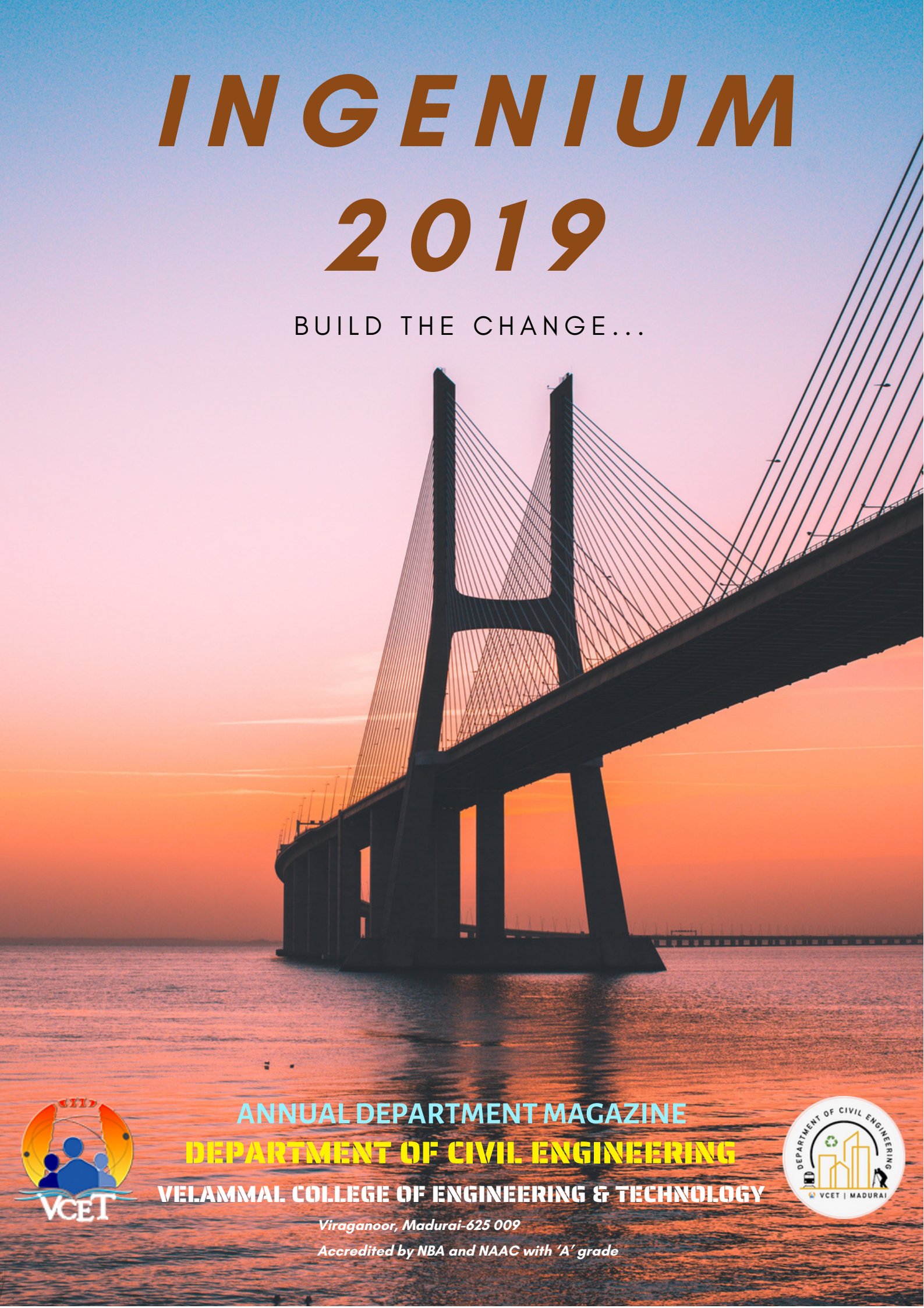
# INGENIUM 2019

BUILD THE CHANGE...



ANNUAL DEPARTMENT MAGAZINE

## DEPARTMENT OF CIVIL ENGINEERING

### VELAMMAL COLLEGE OF ENGINEERING & TECHNOLOGY

*Viraganoor, Madurai-625 009*

*Accredited by NBA and NAAC with 'A' grade*


## INSTITUTE VISTION

- To emerge and sustain as a centre of excellence for technical and managerial education upholding social values

## INSTITUTE MISSION

Imparted with comprehensive, innovative and value based educaton

Exposed to technical, managerial and soft skilled resources with emphasis on research and professionalism

Inculcated with the need for a disciplined, happy, married and peaceful life

## DEPARTMENT VISION

To inspire and mould civil engineering aspirants as competent and dynamic infrastructure developers

## DEPARTMENT MISSION

Our mission is to

1. Integrate high Quality civil engineering education and research
2. keep the students abreast with the state of art, theory and practice
3. Create a supportive environment to meet professional challenges

# CONTENTS


| | |
|---|---|
| **Message from Principal** | **i** |
| **Message from HoD** | **ii** |
| **Department Faculty** | **iii** |
| **Editorial Team** | iv |
| **Technical Articles** | **1-14** |
| **Non-Technical Articles** | **15-17** |


# Message from the Principal

**Dr. N. Suresh Kumar**
**Principal**
**Velammal College of Engineering and Technology**

**Engineering Education is now an integral and indispensable component of contemporary society. A nation's level of development is proportional to the availability of quality engineering education. Velammal College of Engineering and Technology is a pioneering engineering institution that ranks among the best in the nation. Among the numerous engineering institutions in the southern districts of Tamil Nadu, VCET stands tall. Students can anticipate the finest infrastructure, highly qualified and experienced faculty, and pedagogical ideals of the highest order.**

**While I am proud to be affiliated with the institution and its administration, I assure all stakeholders that they will receive an engineering education of the highest quality.**

# Message from the HoD

**Dr. L. Andal**
**Professor & Head**
**Department of Civil Engineering**
**Velammal College of Engineering and Technology**

**Velammal College of Engineering and Technology's Department of Civil and Environmental Engineering extends a cordial greeting. Our work as practising and aspiring engineers is crucial for a world that is constantly evolving. The infrastructure of our modern society, such as roads, bridges, buildings, and water distribution systems, is designed by civil engineers. Environmental engineers develop solutions for the responsible utilisation of resources and energy in order to protect our air and water supplies. Together, civil and environmental engineers are creating the Built Environment, a world that is stronger, safer, and more sustainable.**

**Our department provides academic programmes of the highest calibre, supported by facilities of the highest calibre. Our faculty are committed to teaching excellence while fostering an inclusive learning environment where all students can flourish. We offer coursework and research opportunities in five engineering disciplines: Environmental Engineering, Geotechnical Engineering, Structural Engineering, Transportation Engineering, and Water Engineering.**

**Our alums have exciting careers and leadership positions around the world, addressing the complex engineering challenges of the present. If you envision yourself in a dynamic and rewarding career, a degree in civil and environmental engineering may be the right choice for you. Explore our academic programmes or get in touch with us to meet with a recruiter. We anticipate seeing you at VCET**

# MESSAGE FROM THE EDITORIAL TEAM

It gives us immense pleasure to introduce the first edition of “Ingenium” dedicated to the department of civil engineering. The department of civil engineering is one of the founding departments of the Institute, holding vital importance and international recognition. In the following pages, we attempt to provide a glimpse into what the department entails, and we hope this magazine becomes a valuable read for everyone who wishes to get a concise overview of the department. It highlights major events and activities that took place during the academic year 2019-20. The team is extremely grateful to all of the faculty, staff, and students who gave their valuable time to the magazine and contributed to its diverse content. We would also like to express our heartfelt gratitude to the HoD, Prof. L.Andal , and the faculty advisor, Mr.S.Sathyanarayanan (Asst.Prof-III) for their invaluable suggestions. We hope that the magazine will appeal to a wide range of readers' interests. Please accept our sincere apologies if readers encounter errors or typos despite the team's best efforts to ensure that the contents are error-proof. We hope this magazine fulfils its intended purpose and provides the graduating class with a valued memory to carry with them.

## CHIEF ADVISOR

***Dr. L. Andal***
***Professor & Head***
***Dept of Civil Engg***

## FACULTY ADVISOR

***Mr. S. Sathyanarayanan***
***Assistant Professor-III***
***Dept of Civil Engg***

## EDITORIAL MEMBERS

Chief Editor:
***Mr. G. Saravana Kumar***
***Dept of Civil Engg***
***2019-23 Batch***

Co-Editor:
***Mr. M. Ageshwaran***
***Dept of Civil Engg***
***2019-23 Batch***

***"The desire to create is one of the deepest yearnings of the human soul."***
***- Dieter F. Uchtdorf***

# Department Faculty

*Dr. L. Andal , PhD*
*(Structural Engineering)*
*Professor & Head*
*Dept of Civil Engg*

*Mrs. J. P. Annie Sweetlin M.E*
*(Structural Engineering)*
*Associate Professor*
*Dept of Civil Engg*

*Dr. T. Naveen Raj M.Tech, PhD*
*(Remote Sensing)*
*Assistant Professor-III*
*Dept of Civil Engg*

*Mr. Deepan Chakravarthi M.E*
*(Structural Engineering)*
*Assistant Professor-III*
*Dept of Civil Engg*

*Mr. M. Sathish Kumar M.E*
*(Structural Engineering)*
*Assistant Professor-III*
*Dept of Civil Engg*

*Mr. S. Sathyanarayanan M.E*
*(Structural Engineering)*
*Assistant Professor-III*
*Dept of Civil Engg*

*Mrs. S. Venkada Priya M.E*
*(Structural Engineering)*
*Assistant Professor-III*
*Dept of Civil Engg*

*Ms. R. Rajapriya M.E*
*(Environmental Engineering)*
*Assistant Professor-III*
*Dept of Civil Engg*

*Ms. Anumeena M.Tech*
*(Structural Engineering)*
*Assistant Professor-III*
*Dept of Civil Engg*

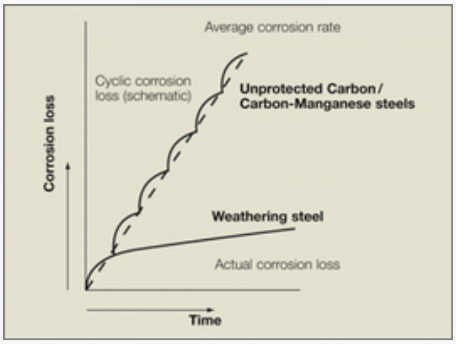
# TECHNICAL ARTICLES

# WEATHERING STEEL

Weathering steel is a high strength low alloy steel that was originally developed by United States Steel in the 1930s to resist corrosion and abrasion in their ore wagons. It was given the trade name Cor-ten, and was first used in construction on the John Deere World Headquarters building in Moline, Illinois, which opened in 1964. Since then, the use of weathering steel has spread worldwide and in Europe it is available as "structural steel with improved atmospheric corrosion resistance" and is a non-proprietary product.

The first weathering steel bridge in the UK was a footbridge at York University in 1967 and the material was used for many bridges around the UK in the following 30 years or so. However, the use of weathering steel on bridges has increased significantly since 2001 when a former restriction on the use of the material over highways with less than 7.5m headroom was removed.

In the presence of moisture and air, all low alloy steels have a tendency to rust, the rate of which depends on the access of oxygen, moisture and atmospheric contaminants to the metal surface. As the process progresses, the rust layer forms a barrier to the ingress of oxygen, moisture and contaminants, and the rate of rusting slows down.




The rust layers formed on most ordinary structural steels are porous and detach from the metal surface after a certain time, and the corrosion cycle commences again. Hence, the rusting rate progresses as a series of incremental curves approximating to a straight line, the slope of which depends on the aggressiveness of the environment.

With weathering steel, the rusting process is initiated in the same way, but the specific alloying elements in the steel produce a stable rust layer that adheres to the base metal, and is much less porous. This rust 'patina' develops under conditions of alternate wetting and drying to produce a protective barrier that impedes further access of oxygen, moisture, and pollutants. The result is a much lower corrosion rate than would be found on ordinary structural steel.

## ***Benefits of using weathering steel:***

### *1. Very low maintenance*

Periodic inspection and cleaning should be the only maintenance required to ensure the bridge continues to perform satisfactorily. Hence, weathering Steel bridges are ideal where access for future maintenance is difficult or dangerous, and where traffic disruption needs to be minimized, such as over major roads or railways

### *2. Speed of constructions:*

Overall construction durations are reduced, as both factory and site painting operations are eliminated

### *3. Attractive appearance:*

The attractive appearance of weathering steel bridges often blends pleasingly with the environment, and improves with age.

### *4.. Cost benefits:*

Although weathering steel is slightly more expensive than ordinary structural steel, savings from elimination of the paint system offsets the additional material cost. Hence, the initial cost of a weathering steel bridge is very similar to that of a conventional painted steel alternative.

### *5. Environmental benefits:*

The environmental problems associated with Volatile Organic Compound (VOC) emissions from paint coatings and the disposal of blast cleaning debris from future maintenance work, are avoided.

### *6. Safety benefits:*

With little maintenance, the risks associated with future maintenance are clearly minimised. The health and safety issues relating to initial painting are also avoided.

### *7. Long term performance:*

Weathering steel bridges have a good track record in the UK. A study by TRL [4] indicates that weathering steel bridges built over the last 20 years are generally performing well. Where problems have been encountered, they have typically been the direct result of specific faults such as leaking deck joints,rather than any general inadequacy in corrosion performance.

### *8. Limitations on use:*

Weathering Steel Bridges are suitable for use in most locations. However, as with other forms of construction, there are certain environments that can lead to durability problems. The performance of weathering steel in extreme environments will not be satisfactory, and its use should be avoided in such situations.

***By:***
***K. Abinash***
***3rd year***

# STATUE OF UNITY

*(Salient features of the world's 'tallest statue' )*

Prime Minister Narendra Modi unveiled the 'Statue of Unity' in Kevadiya town in the Narmada district of Gujarat on the birth anniversary of Sardar Vallabh Bhai Patel. This project was first announced on 10 October 2010 by the then Gujarat government by a special purpose vehicle-Sardar Vallabhabhai Patel Rashtriya Ekta Trust (SVPRET). The iron needed for the statue and other structures was collected from farmers of villages all around India in a form of donations of their used farming instruments.

***Features of 'Statue of Unity':***

- Height– 182 meters, this makes the statue almost twice the height of the iconic Statue of Liberty in New York.
- Location– around 3.5 km downstream from Sardar Sarovar Dam, on an islet Sadhu, Bet on the bed of River Narmada.
- Cost– Rs. 2989 crore.
- Sculptor– Padmama Bhushan Ram V. Suthar, a 93-year-old acclaimed sculptor.
- Construction period– 34 months of work began on December 19,
- 2015. Materials consumed- 70,000 tons of cement, 18,500 tons of reinforcement steel, 6,000 tons of structural steel, and 1700 tons of bronze which were used as outer cladding of the structure.
- Specialties: The statue is slender most at the base, which goes against the norms of what other tall statues have followed. The walking pose also opened up a gap of 6.4 meters

*Fig: During the construction of : "Statue of Unity"*

between the two feet which then had to be tested to withstand wind velocity.

It is constructed by L&T and has 5 zones of the statue. Up to its shin is the first zone, comprising three levels, including an exhibit floor, mezzanine, and roof. This zone will contain a Memorial Garden and a large museum. Zone 2 extends up to the statue's thighs at 149 meters, while Zone 3 goes up to the viewing gallery at 153 meters. Zone 4 comprises the maintenance area and Zone 5 the head and shoulders.

Engineered to withstand wind speeds of up to 50 m per second (almost 180 km per hour wind speed)

The viewing gallery can accommodate up to 200 people at a time.

***By:***

***G.Saravana Kumar***

***1st year***

# NEW MATERIALS USED IN THE CONSTRUCTION

Innovation in building materials is an unceasing reality of our construction industry – largely dominated by invincible technology and knowledge. Our comforts and desire to achieve new heights continuously thrives us to explore deeper and further – new or existing. Innovation is not always about creating new technologies or materials but evolving what we already have, evolving the given and experimenting with it. In architecture, it could either be using waste materials artistically, using the basic construction materials in a more cultivated manner following the rule of sustainability or using them in a more designated or expressive way.

## LIGHT-GENERATING CONCRETE:

Light-emitting concrete can trap solar energy during the daytime and convert it into visible light in the night. According to the manufacture methods, light-emitting concrete can be divided into three main categories: the luminous component mixed, the microstructure modified, and the surface coated. The concrete emits soft light all the night without any electricity and contributes to energy conservation and low-carbon eco-friendly environment. Light-emitting concrete enjoys promising application prospect in building environment decoration, roads/lanes lighting, and expressway signs/safety. The light-emitting cement, when combined with water, changes completely to gel form so that it absorbs solar energy and releases it in the form of light. Light-emitting cement is a green construction material designed to illuminate highways, roads, and bicycle lanes without the use of electricity. Light-emitting cement follows the principle of absorbing solar energy during the day and emitting lights at night.

## BENDING CONCRETE:

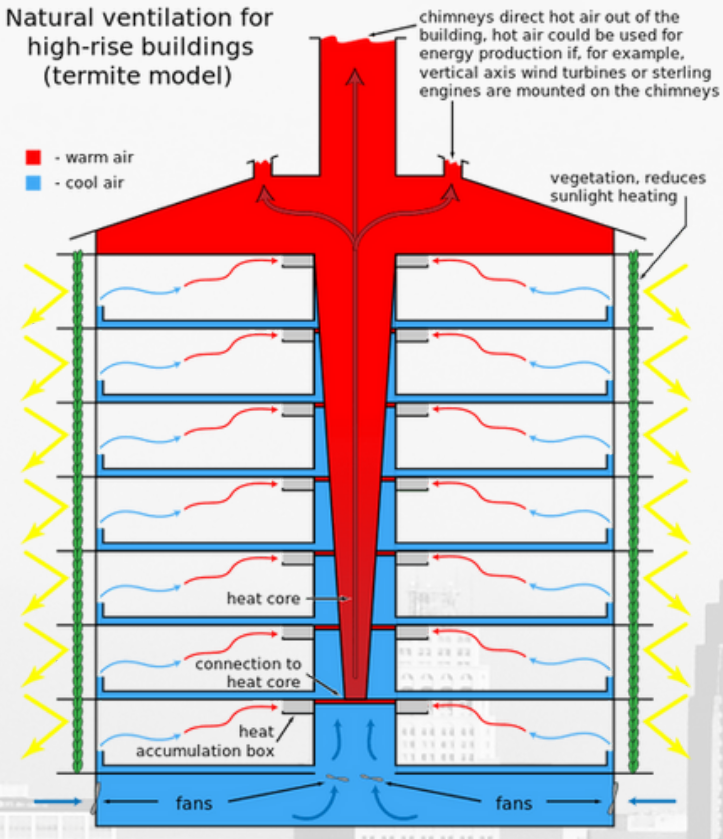
Normally concrete is a very brittle material; any buckling or bending will cause it to crack. This problem of concrete can be removed by new fiber-reinforced bendable concrete might just be putting an end to that issue. The new fiber–reinforced bendable concrete is around 500 times more resistant to cracking than regular concrete thanks to the tiny fibers, which account for two percent of its makeup. There are new construction materials in civil engineering. The fibers inside the concrete slide within the concrete when bending occurs, providing it with enough give to prevent breakage. In addition, this concrete has a much longer life expectancy, which means it will cost less in the long run too. it is important Innovative Construction Materials.

***By:***
***M.Ageshwaran***
***1st year***

# BIOMIMICRY IN CIVIL ENGINEERING

The term biomimetics comprises the Greek words “bios” and “mimesis”, which mean “life” and “to imitate” respectively. Biomimetics is also termed bionics or biomimicry. Biomimicry in civil engineering is a creative and innovative way inspired by the nature to solve the engineering problem and transform it into new inventions. Biomimicry is an emerging and rapidly developing field, which focuses on alternative ways of implementing sustainable engineering solutions, and following are the some practical application of biomimicry.

## Passive cooling in buildings:



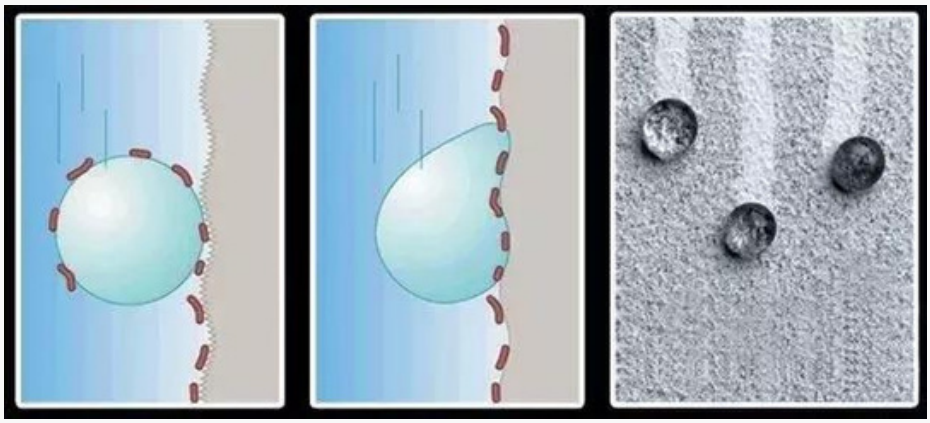

The Eastgate Centre is a shopping center and office building located in Harare, Zimbabwe. Rather than using a traditional fuel-based air-conditioning system to regulate the temperature within the building, the Eastgate Centre is designed to exploit more passive and energy-efficient mechanisms of climate control. The building’s construction materials have a high thermal capacity, which enables it to store and release heat gained from the surrounding environment. This process is facilitated by fans that operate on a cycle timed to enhance heat storage during the warm daytime and heat release during the cool nighttime. Internal heat generated by the building’s occupants and appliances also helps to drive airflow within the building’s large, internal open spaces, as it rises from offices and shops on lower floors toward open rooftop chimneys. Various openings throughout the building further enable passive internal airflow driven by outside winds. These design features work together to reduce temperature changes within the building interior as temperatures outside fluctuate.

The $35 million building saved 10% on costs up-front by not purchasing an air-conditioning system. Rents are less expensive in this building compared to nearby buildings because of the savings in energy costs. At the time of the building's design, researchers had proposed that termite mounds maintained stable internal climates by having a physical structure that enables passive internal airflow. While subsequent research on termite mounds has altered our understanding of the function of mound structures, the Eastgate Centre still achieves a controlled internal climate with the help of cost-effective and energy-efficient mechanisms originally inspired by termite mounds.

## Honeycomb structure:

Bees produce more honey than they actually need and store it in honeycombs. The hexagonal structure of the honeycomb is well-known to everyone. Have you ever wondered why bees construct hexagonal honeycombs rather than octagonal, or pentagonal? Mathematicians looking for answer to this question reached an interesting conclusion: " A hexagon is the most appropriate geometric form for the maximum use of a given area.& quot; A hexagonal cell requires the minimum amount of wax for construction while it stores the maximum amount of honey. So the bee uses the most appropriate form possible. Efficiency, strength, and controlled heat loss are all important for human structures as well, so it's no wonder that honeycombs inspire human design. Sino steel plaza is located in Tianjin, China.It is high-rise commercial building which is totally made of glass.The inspiration of the outer structure of the building is from the bee hive(honey comb). The external structure consists of hexagonal honeycomb windows in five different sizes. They were arranged according to wind and sun direction in its context in order to regulate the temperature inside the towers and to minimise heat loss in the winter and heat gain in the summer.

## Self-cleaning paints:



A German company, Sto AG, has developed a biomimicry-inspired exterior coating with a water-repellant surface based on that of the lotus leaf. Professor Wilhelm Barthlott, from the University of Bonn in Germany, developed the surface after looking for environmentally benign alternatives to toxic cleaning detergents in order to reduce environmental impacts. He asked the question 'How does nature clean surfaces?' It became obvious that nature doesn't use detergents at all – instead, it designs self-cleaning surfaces with hydrophobic properties. Lotusan is an eco-friendly house paint developed by a German company called ISPO. Lotusan has the properties of hydrophobic leaves to minimize the contact area for water and dirt.

***By:***
***V.Shrinidhi***
***1st year***

# BUILDING INFORMATION MODELING (BIM)

*Trends, Benefits, Risks, and Challenges for the AEC Industry*

Building information modeling (BIM) is one of the most promising recent developments in the architecture, engineering, and construction (AEC) industry. With BIM technology, an accurate virtual model of a building is digitally constructed. This model, known as a building information model, can be used for planning, design, construction, and operation of the facility. It helps architects, engineers, and constructors visualize what is to be built in a simulated environment to identify any potential design, construction, or operational issues. BIM represents a new paradigm within AEC, one that encourages the integration of the roles of all stakeholders on a project. In this paper, current trends, benefits, possible risks, and future challenges of BIM for the AEC industry are discussed. The findings of this study provide useful information for AEC industry practitioners considering implementing BIM technology in their projects.

## Role of BIM:

Kunz and Gilligan ( 2007 ) conducted a questionnaire survey to determine the value from BIM use and factors that contribute to success. The main findings of their study are as follows:

- The use of BIM had significantly increased across all phases of design and construction during the past year.
- BIM users represented all segments of the design and construction industry, and they operated throughout the United States.
- The major application areas of BIM were construction document development, conceptual design support, and preproject planning services.
- The use of BIM lowered overall risk distributed with a similar contract structure.
- At the time of the survey, most companies used BIM for 3D and 4D clash detections and for planning and visualization services.
- The use of BIM led to increased productivity, better engagement of project staff, and reduced contingencies.
- A shortage was noted of competent building information modelers in the construction industry, and demand was expected to grow exponentially with time.

## APPLICATIONS OF BIM MODELLING:

A building information model can be used for the following purposes:

• Visualization: 3D renderings can be easily generated in-house with little additional effort.
• Fabrication/shop drawings: It is easy to generate shop drawings for various building systems. For example, the sheet metal ductwork shop drawings can be quickly produced once the model is complete.
• Code reviews: Fire departments and other officials may use these models for their review of building projects.
• Cost estimating: BIM software has built-in cost estimating features. Material quantities are automatically extracted and updated when any changes are made in the model.
• Construction sequencing: A building information model can be effectively used to coordinate material ordering, fabrication, and delivery schedules for all building components.
• Conflict, interference, and collision detection: Because building information models are created to scale in 3D space, all major systems can be instantly and automatically checked for interferences. For example, this process can verify that piping does not intersect with steel beams, ducts, or walls.
• Forensic analysis: A building information model can be easily adapted to graphically illustrate potential failures, leaks, evacuation plans, and so forth.
• Facilities management: Facilities management departments can use it for renovations, space planning, and maintenance operations.

## BIM FUTURE CHALLENGES:

The productivity and economic benefits of BIM to the AEC industry are widely acknowledged and increasingly well understood. Further, the technology to implement BIM is readily available and rapidly maturing. Yet BIM adoption has been much slower than anticipated ( Azhar, Hein etal. 2008 ). There are two main reasons, technical and managerial. The technical reasons can be broadly classified into three categories (Bernstein and Pittman 2005 ):

1. The need for well-defined transactional construction process models to eliminate data interoperability issues,
2. The requirement that digital design data be computable, and
3. The need for well-developed practical strategies for the purposeful exchange and integration of meaningful information among the building information model components.

The management issues cluster around the implementation and use of BIM. Right now, there is no clear consensus on how to implement or use BIM. Unlike many other construction practices, there is no single BIM document providing instruction on its application and use (Associated General Contractors of America 2005). Furthermore, little progress has been made in establishing model BIM contract documents ( Post 2009 ). Several software firms are cashing in on the “buzz” of BIM and have programs to address certain quantitative aspects of it, but they do not treat the process as a whole. There is a need to standardize the BIM process and to define guidelines for its implementation. Another contentious issue among the AEC industry stakeholders (i.e., owners, designers, and constructors) is who should develop and operate the building information models and how the developmental and operational costs should be distributed.

***By:***
***S.Dharsha***
***1st year***

# PUMICE CONCRETE

**PUMICE CONCRETE** is composed of Portland cement, pumice stones, pumice sand, pumice powder (pozzolan), and water. Compared to standard concrete, pumice concrete offers roughly a one-third reduction in weight and four times the r-value. Proportioning, mixing, and placing are done in a similar manner to that of standard concrete. Pumice Concrete Tip Sheet) Pumice concrete is placed and finished with typical concrete equipment and tools and is used, with one exception, for the same applications as sand and gravel concrete. That exception: due to the grippy nature of pumice aggregate and sand, pumice concrete takes more effort and patience to work to a standard surface finish, and for that reason is rarely used for extensive flatwork. But for limited flatwork projects and all applications where pumice concrete is vibrated into forms, (like precast applications) it presents no placement challenges beyond standard concrete and actually presents several advantages.

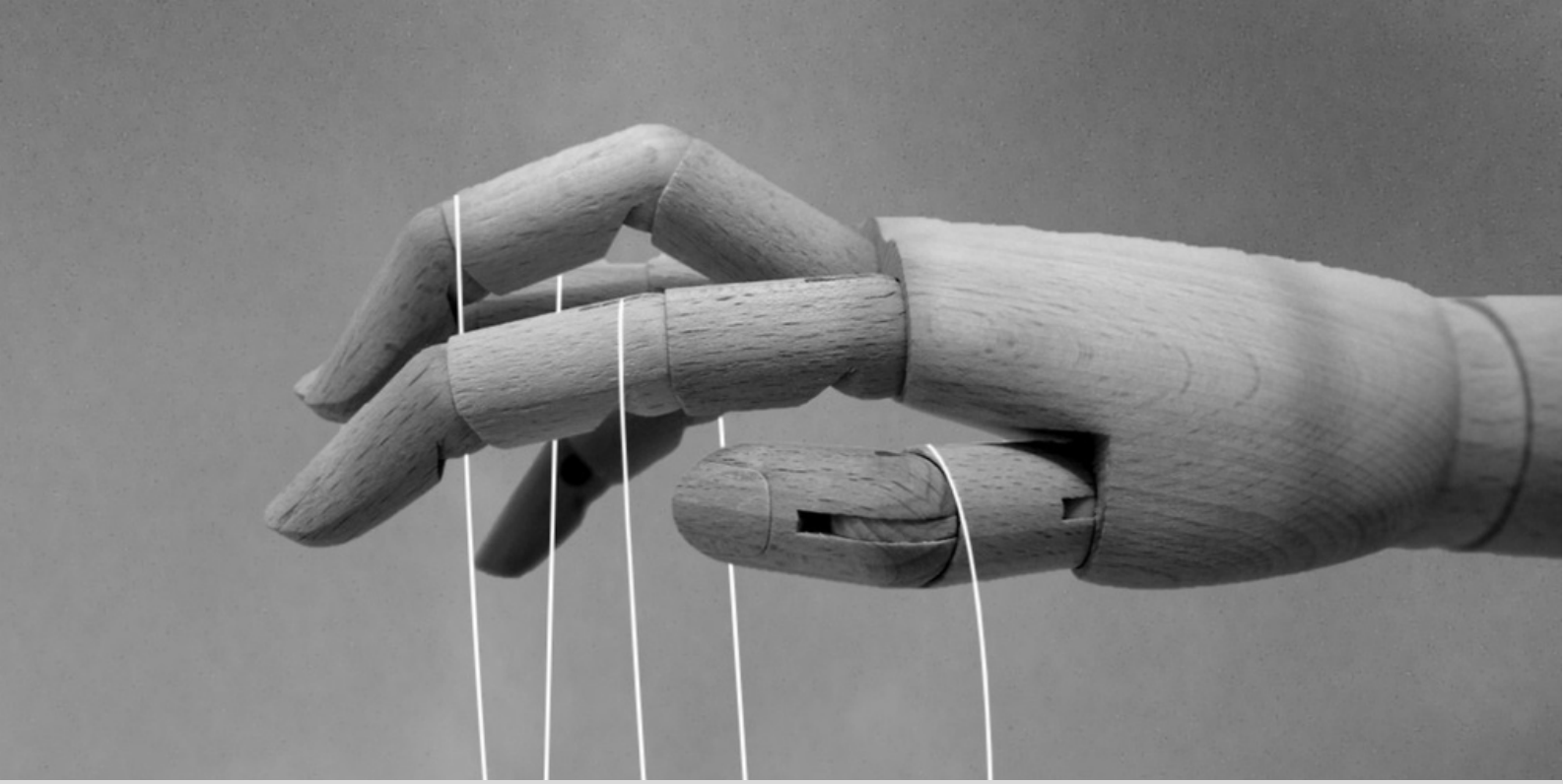
Pumice concrete has superior resistance to harsh weather conditions like freezing and thawing and an R-value some four times that of ordinary sand and gravel concrete—making pumice concrete ideal for colder climates and locations that experience dramatic fluctuations in the weather and temperature. Pumice concrete is also sound absorptive, more elastic than conventional concrete, and will not spall under direct contact with flame.

Pumice is a porous, naturally-occurring volcanic glass, riven with air-filled vesicles formed by the expansion of trapped gasses when the molten lava is expelled into the air and flash cools. It is this amorphous, cell-filled nature of each stone that give pumice its lightweight and insulative characteristics. Pumice is also an inert material and therefore will not react with the reinforcing steel or any other concrete component.

***By:***

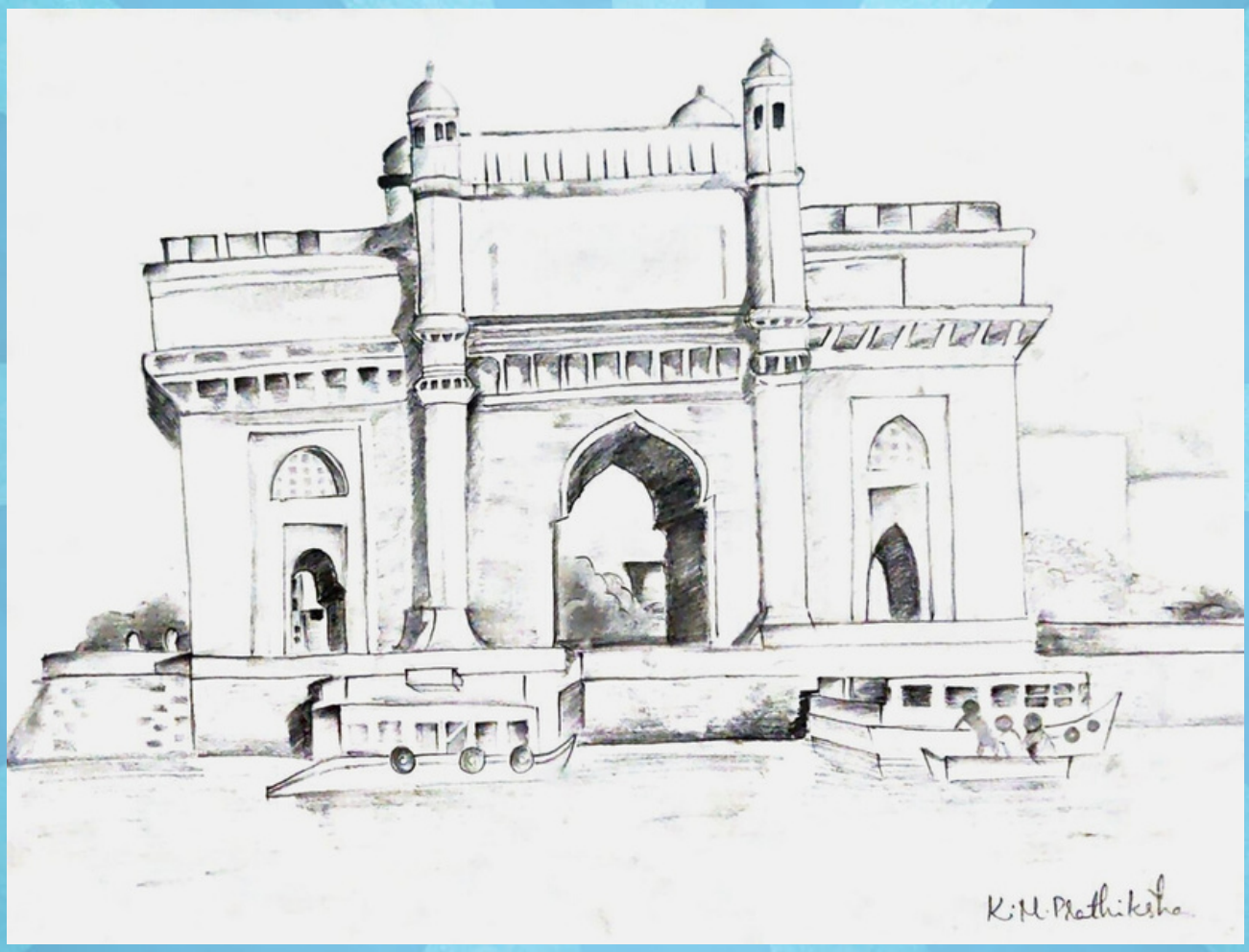
***H. Ganesan***

***1st year***



# NON-TECHNICAL ARTICLES

# SKETCHES




**Gateway of India is a great historical monument built during British rule. It is a monument built in Indo-Sarcenic style to commemorate the visit of King George V and Queen Mary to Bombay. Gateway of India was built at Apollo Bunder, a popular meeting place. The gateway of India was designed by the British architect George Wittet. It was opened for general public in 1924.**

***By:***

***K.M. Prathiksha***

***1st year***

# ARCHITECTURE PHOTOGRAPHY

## Chidambara Vilas Palace, Chettinad, Karaikudi

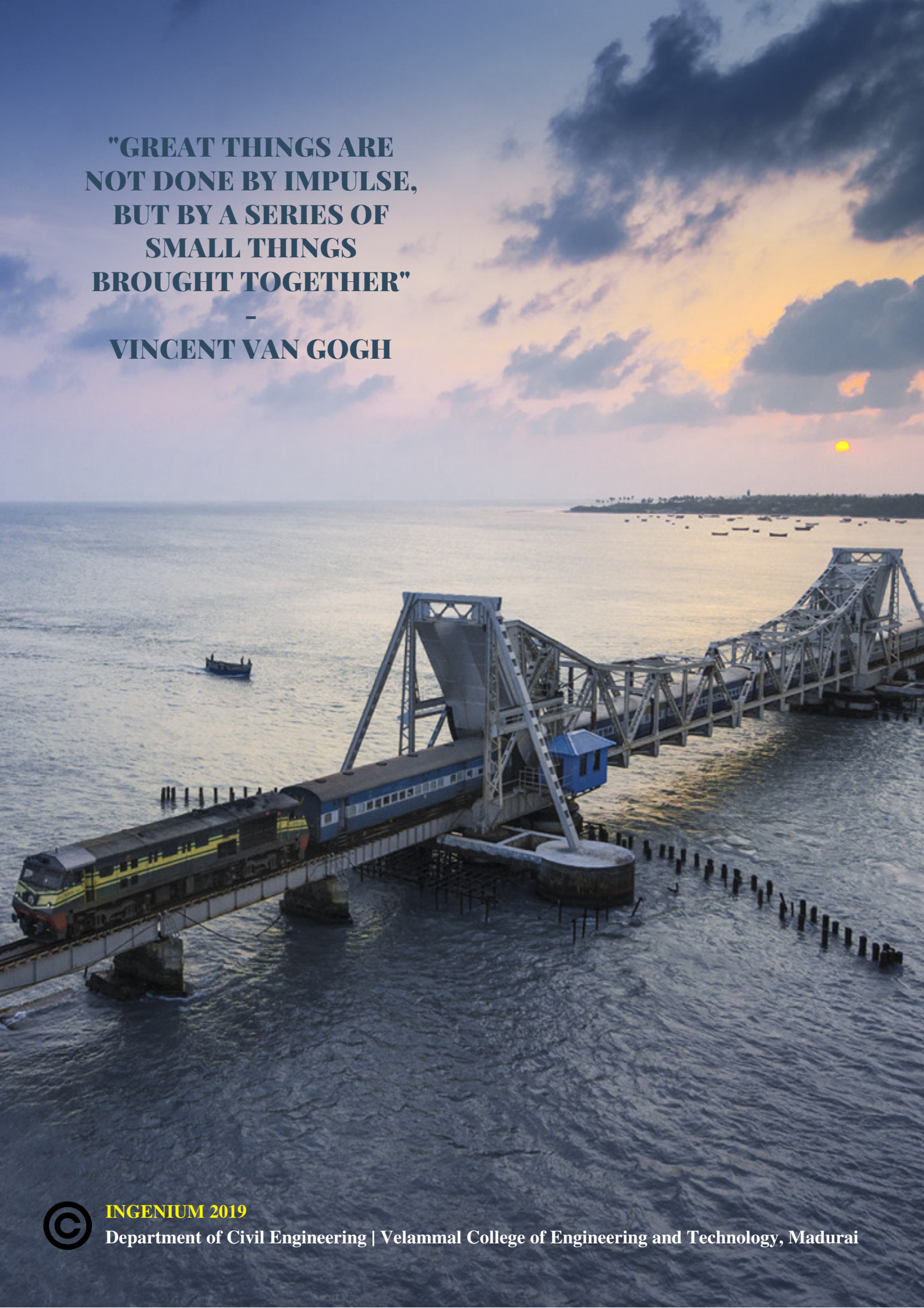
**Chidambara Vilas Palace, Chettinad: The Chettiars were an ancient class of Chola merchant princes who migrated inland after a tsunami wiped out the Chola port of Kaveripattinam (Puhar). The Chettiars are famous for their palaces, their financial acumen, and the Chettinad cuisine. It is common to see entire villages filled with palaces in Chettinad.**

**Chidambara Vilas palace was built by a Chettiar family on a land gifted by the Maharaja of Pudukottai. This sprawling palace was built with wood from Burma, glass from Belgium, tiles from Italy, and Chandeliers from Daman and Diu. The mansion is built in a fusion architectural style mixing traditional Dravidian interiors with Indo-Saracenic and European exteriors.**

***By:***

***A.C. Vijay***

***2nd year***






**INGENIUM 2019**

**Department of Civil Engineering | Velammal College of Engineering and Technology, Madurai**