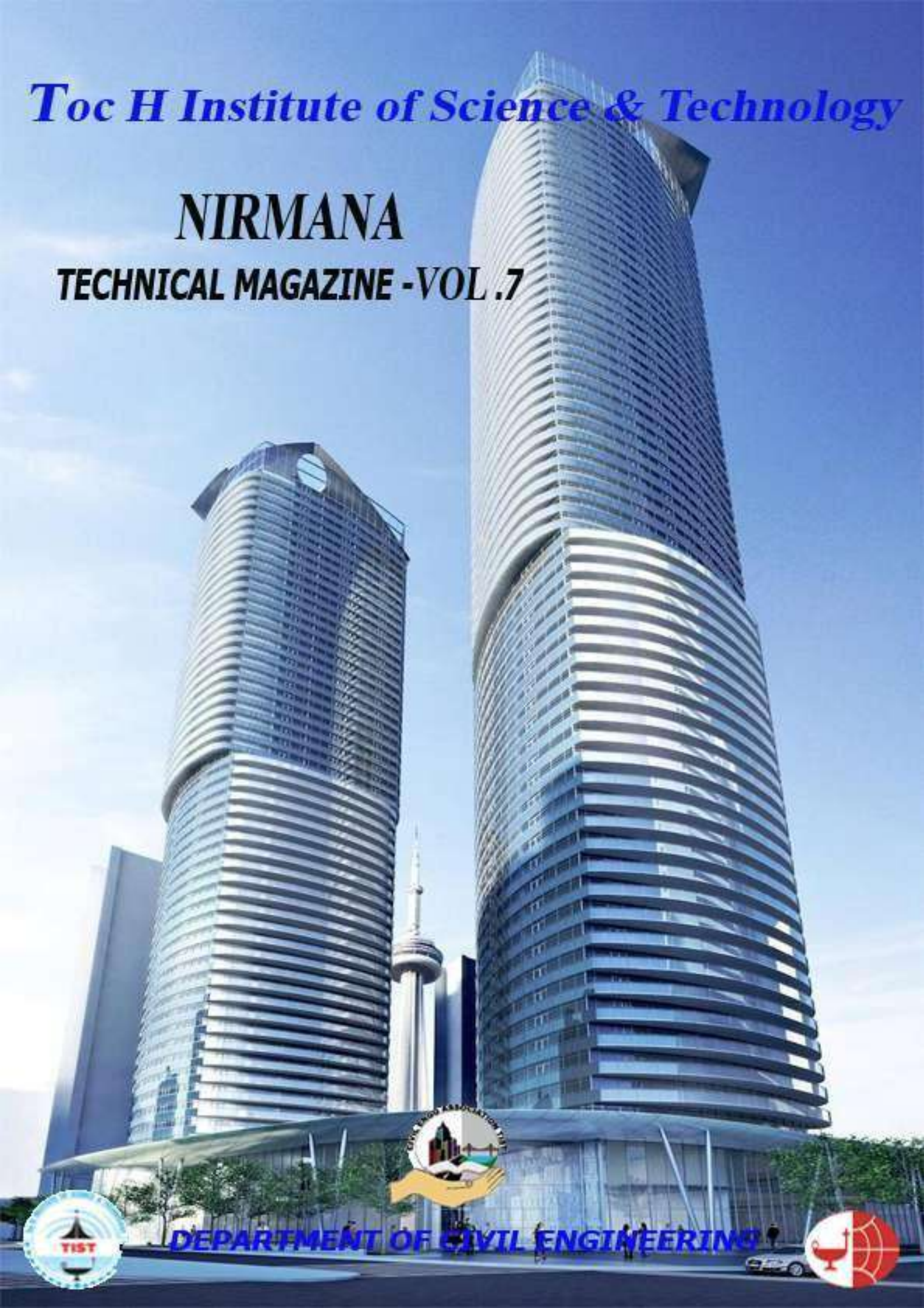


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DEPARTMENT OF CIVIL ENGINEERING



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- To provide the ambiance necessary to achieve professional and technological excellence at the global level.
- To undertake collaborative research that fosters new ideas for sustainable development.
- To instill in our graduate's ethical values and empathy for the needs of society.



VISION OF THE DEPARTMENT

To transform into a centre creating change agents in civil engineering with professional competency, integrity and ethical values for serving the society with the highest level of proficiency through their chosen domain.

MISSION OF THE DEPARTMENT

1. Provide ambience to create civil engineers of global standards to serve the society collaboratively, competently and ethically.
2. To provide an academic environment for lifelong learning nurturing the skills in research and development for the benefit of all stakeholders.
3. To inculcate professionalism in students through team work, effective communication and leadership skills.
4. To encourage and empower the faculty in the field of engineering education and mentoring for enhancing the teaching-learning process.
5. To impart hands on experience to aspiring undergraduates through interdisciplinary research projects, industrial training and consultancy work.

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The graduates of Civil Engineering will

1. Apply technical expertise to identify and resolve any complex civil engineering problems with the help of modern engineering tools and lifelong learning to meet the specified needs of their chosen domain viz. employment, higher studies or research and development.
2. Develop cost-effective solutions for a sustainable environment with deep insight in societal and ecological issues by adhering to professionalism.
3. Exhibit professional ethics, management and leadership qualities with good communication skills facilitating to work in a multidisciplinary team for evolving as an entrepreneur.

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STUDENTS ARTICLES

ECO FLOATING HOMES

Affordable housing and overcrowding in cities are putting pressure on urban populations to make changes. To combat these issues, Civil Engineers are designing floating homes—practical living spaces that sit upon the water. The homes are designed to resist floods by floating on top of water using a foundation of concrete and Styrofoam, which makes them virtually unsinkable. This approach means that homes can be built in spaces that were previously off-limits, like rivers, lakes and other bodies of water. Civil Engineers predict that modern floating home technology will lower the costs of flood damage in urban cities, while also providing compact inner-city populations with more diverse housing options.

The concept of floating buildings is not new, as they can be found all over the world, especially in traditional Asian villages. Although with modern engineering knowledge, these structures and the infrastructure needed to make them sustainable are gradually becoming more reliable and easier to maintain.

However, introducing this concept in urban environments with large populations will prove to be somewhat tricky, as structures being built within or on above-ground water sources could impact environments negatively by disturbing the natural state of the land beneath bodies of water (e.g. lake bottoms or the ocean floor). The effect of humans on the environment should not be underestimated either, so Civil Engineers will need to remain focused on creating systems that inhibit floating houses and their residents from disrupting local water ecosystems, while improving the viability of this technology for use in low-income areas.

Afnitha Muhammed

2015-2019 Batch



BLACK PLASTICS COULD CREATE RENEWABLE ENERGY

Research from Swansea University has found how plastics commonly found in food packaging can be recycled to create new materials like wires for electricity and could help to reduce the amount of plastic waste in the future. While a small proportion of the hundreds of types of plastics can be recycled by conventional technology, researchers found that there are other things that can be done to reuse plastics after they've served their original purpose.

The research, published in the Journal for Carbon Research, *focuses* on chemical recycling which uses the constituent elements of the plastic to make new materials. While all plastics are made of carbon, hydrogen and sometimes oxygen, the amounts and arrangements of these three elements make each plastic unique. As plastics are very pure and highly refined chemicals, they can be broken down into these elements and then bonded in different arrangements to make high value materials such as carbon nanotubes.

The structure of a carbon nanotube looks a piece of chicken wire wrapped into a cylinder and when carbon is arranged like this it can conduct both heat and electricity. These two different forms of energy are each very important to control and use in the right quantities, depending on your needs. Nanotubes can be used to make a huge range of things, such as conductive films for touch screen displays, flexible electronics fabrics that create energy, antennas for 5G networks while NASA has used them to prevent electric shocks on the Juno spacecraft. During the study, the research team tested plastics, in particular black plastics, which are commonly used as packaging for ready meals and fruit and vegetables in supermarkets, but can't be easily recycled. They removed the carbon and then constructed nanotube molecules from the bottom up using the carbon atoms and used the nanotubes to transmit electricity to a light bulb in a small demonstrator model. The research is significant as carbon nanotubes can be used to solve the problem of electricity cables overheating and failing, which is responsible for about 8% of electricity, is lost in transmission and distribution globally.

Reema K R

2015-2019 Batch

ADDED BACTERIAL FILM MAKES NEW MORTAR RESISTANT TO WATER UPTAKE

Nanostructures in material developed at Technical University of Munich (TUM) result in lotus effect. Moisture can destroy mortar over time, for example when cracks form as a result of frost. A team of scientists at the TUM has found an unusual way to protect mortar from moisture: When the material is being mixed, they add a biofilm produced by bacteria.

During a conversation with a colleague at TUM, Lieleg came up with the idea of using biofilms to alter the properties of construction materials. Among other things his colleague was investigating self-healing concrete whose cracks close autonomously was one. One variant of this concrete contains added bacteria. Activated by the ingress of moisture, the bacteria close the cracks with metabolic products containing calcium.

The key ingredient in the new material is biofilm produced by the bacterium *Bacillus subtilis*. The scientists added the moist biofilm to the mortar powder. In the hybrid mortar, water was significantly less to wet the surface. To evaluate this contact angle between water droplets and the surface was measured. The steeper this angle, the more spherical the drops are, and the less likely the liquid is soaked into the material.

The surface is covered with tiny crystalline spikes. This results in what is known as the lotus effect. The small uniform structures on the surface ensure that only a small part of a water droplet is actually in contact with the leaf surface. The surface tension of the droplet therefore is stronger than the forces that make it adhere to the leaf. Consequently, the droplet easily rolls off the leaf when the leaf is tilted. A cross-section of hybrid mortar shows that crystalline spikes are not only evenly distributed on the mortar surface but can also be found throughout the bulk volume of the mortar. This reduces the capillary forces that are normally responsible for the uptake of water in mortar when the material is immersed into liquid.

Although similar spikes also occur on untreated mortar, they are too long, rare and scattered for the lotus effect to occur. The researchers assume that the added biofilm stimulates uniform crystal growth throughout the volume of the hybrid material.

Kavya M Shenoy

2015-2019 Batch

SMART TECHNOLOGY FOR SYNCHRONIZED 3D PRINTING OF CONCRETE

A technology where two robots can work in unison to 3D-print a concrete structure. This method of concurrent 3D-printing, known as swarm printing, paves the way for a team of mobile robots to print even bigger structures in future. Using a specially formulated cement mix suitable for 3-D printing, this new development will allow for unique concrete designs currently not possible with conventional casting. Structures can also be produced on demand and in a much shorter period. Currently, 3D-printing of large concrete structures requires huge printers that are larger than the printed objects, which is unfeasible since most construction sites have space constraints. Having multiple mobile robots that can 3D print in sync means large structures like architectural features and specially-designed facades can be printed anywhere as long as there is enough space for the robots to move around the work site.

The NTU robots 3D-printed a concrete structure measuring 1.86m x 0.46m x 0.13m in eight minutes. It took two days to harden and one week for it to achieve its full strength before it was ready for installation. Printing concrete structures concurrently with two mobile robots was a huge challenge, as both robots have to move into place and start printing their parts without colliding into each other. Printing the concrete structure in segments is also not acceptable, as joints between the two parts will not bond properly if the concrete does not overlap during the printing process. This multi-step process starts by having the computer map out the design to be printed and assign a specific part of the printing to a robot. It then uses a special algorithm to ensure that each of robot arm will not collide with another during the concurrent printing.

Using precise location positioning, the robots then move into place and print the parts in good alignment, ensuring that the joints between the separate parts are overlapped. Finally, the mixing and pumping of the specialised liquid concrete mix have to be blended evenly and synchronised to ensure consistency.

Anand Jose Paul

2017-2019 Batch

SPHERES CAN MAKE CONCRETE LEANER, GREENER

Rice University scientists have developed micron-sized calcium silicate spheres that could lead to stronger and greener concrete, the world's most-used synthetic material. The spheres represent building blocks that can be made at low cost and promise to mitigate the energy-intensive techniques now used to make cement, the most common binder in concrete. The researchers formed the spheres in a solution around nano scale seeds of a common detergent-like surfactant. The spheres can be prompted to self-assemble into solids that are stronger, harder, more elastic and more durable than ubiquitous Portland cement.

"Cement particles are amorphous and disorganized, which makes it a bit vulnerable to cracks. We develop self-healing materials with porous, microscopic calcium silicate spheres. The new material is not porous, as a solid calcium silicate shell surrounds the surfactant seed. Because the spheres imitate that structure, they are considered biomimetic. The researchers discovered they could control the size of the spheres that range from 100 to 500 nanometers in diameter by manipulating surfactants, solutions, concentrations and temperatures during manufacture. That allows them to be tuned for applications. These are very simple but universal building blocks, two key traits of many biomaterials. They enable advanced functionalities in synthetic materials.

Sphere shapes are important because they are far easier to synthesize, self-assemble and scale up from chemistry and large-scale manufacturing standpoints. In tests, the researchers learned that DTAB-based pellets compacted best and were tougher, with a higher elastic modulus, than either CTAB pellets or common cement. They also showed high electrical resistance. It is very beneficial to have something you can control as opposed to a material that is random by nature. Further, one can mix spheres with different diameters to fill the gaps between the self-assembled structures, leading to higher packing densities and thus mechanical and durability properties. Because spheres pack more efficiently than the ragged particles found in common cement, the resulting material will be more resistant to damaging ions from water and other contaminants and should require less maintenance and less-frequent replacement.

Deepa V

2017-2019 Batch

A SOCIAL TOOL FOR EVALUATING THE ENVIRONMENTAL IMPACT OF RESIDENTIAL BUILDINGS

For the first time an open-source computing tool which can, simply and intuitively, calculate the CO₂ emissions in each phase of a building project, in order to obtain a global picture of its carbon footprint from its conception and to help decide every variable in the construction process. The first step in managing and reducing the CO₂ emissions associated with building construction is to calculate them, to know the importance of this environmental aspect and apply measures to improve the situation. To better understand the environmental impact and work on it, it is important to measure the CO₂ emissions from the design and conception of the building and, according to its measurements, know the different possibilities for reducing its carbon footprint and making a more sustainable, low-carbon building.

The experts point out that it is vital to be aware of the CO₂ emissions that are generated in the first phases of a project, so that early preventative actions can be taken by means of the choice of different materials, mean of transport, construction methods, use during the life of the building, deconstruction systems, reuse, etc., so contributing to reducing the building's emissions.

Scientists have tried to work towards the concept of sustainable construction, taking into account, also, concepts related to the recycling and reuse of materials, and putting this tool at the disposal of all the agents involved in the construction sector, such as students, professionals and the users of the house themselves. One of the applications of this online tool is that it allows for buildings of similar characteristics to be compared from an economic and environmental point of view, so knowing which of them is more sustainable and better respects the environment.

Elan Selassy

2017-2019 Batch

THE TOP 9 LONGEST TUNNELS IN THE WORLD

1. The Delaware Aqueduct is the longest tunnel in the world

The Delaware Aqueduct is the world's longest continuous tunnel in the world. It serves as the main water supply tunnel to New York City. The tunnel was drilled through solid rock and is, on average, around 4 meters wide for most of its course. The aqueduct was built during the Second World War and carries around 1.3 billion US gallons of water a day.

2. Päijänne Water Tunnel is the second longest tunnel in the world

The Päijänne Water Tunnel is the second longest tunnel in the world at just over 120,000 meters long. It is located in Southern Finland and runs between 30 and 100 meters underground-level. The tunnel transports fresh water for the millions of inhabitants of Southern Finland's major cities like Helsinki, Espoo, and Vantaa. Construction began in around 1972 and took a total of around 10 years to complete.

3. The Dahuofang Water Tunnel is the longest in China

The Dahuofang Water Tunnel is the third longest continuous tunnel in the world. It is located in the Liaoning Province of China and runs for around 85.3 km. The tunnel was built to provide fresh water from the Dahuofang Reservoir to the cities of Shenyang, Fushun, Liaoyang, Anshan, Panjin, Yingkou, and Dalian. Construction began in 2006 and was completed only three years later. Once the New York City Water Tunnel No. 3 is completed in around 2020, it will replace Dahuofang as the third longest tunnel in the world.

4. Orange–Fish River Tunnel consumed a lot of concrete

The Orange–Fish River Tunnel is an irrigation tunnel located in South Africa. Work began on its construction in 1966 and it was finally completed in 1975. When completed, the tunnel's length of over 82 km makes it the longest continuous enclosed aqueduct in the southern hemisphere. It took an estimated 842,000 m³ of concrete to line it.

5. The Bolmen Water Tunnel runs for around 82 km

The Bolmen Water Tunnel is another water supply tunnel in Scandinavia. It was built to transport water from Lake Bolmen in Kronoberg to the Swedish province of Skane. It

supplies water to around 700,000 Swedish citizens and has a cross-section area of around 8 m². Construction began in 1975 and took around 12 years to complete.

6. The Túnel Emisor Oriente is the world's longest wastewater tunnel

The Emisor Oriente Tunnel is a wastewater treatment tunnel located in Mexico City in Mexico. Its length of 62 km makes it the longest of its kind in the world. Construction began in 2008 and was completed in around 2014 using a tunnel boring machine. The tunnel serves around 20 million people as it runs from Mexico City to the Atotonilco Wastewater Treatment Plant in Hidalgo state.

7. Guangzhou Metro Line 3 is the longest metro tunnel in the world

The Guangzhou Metro Line 3 is the world's longest metro tunnel in the world. The longest continuous tunnel section of the metro's main branch line runs between Tianhe Coach Terminal and Tiyu Xilu. Construction of the entire Metro 3 project began in 2001 and was finally completed in 2005.

8. Gotthard Base Tunnel is the longest railway tunnel in the world

This has a total underground length of around 151 km. Because the total tunnel breaks out at certain points it is not one long continuous tunnel. For this reason, it is at 9th place and not 1st. Construction began in 1999 and the Gotthard tunnel finally opened in 2016.

9. Beijing Subway Line 10

The Beijing Subway Line 10 runs for around 57 km in total and is the second loop line in Beijing's rapid transit system. The whole tunnel runs underground and travels through the Haidian, Chaoyang, and Fengtai districts. Line 10 is the world's longest subway loop line and one of the longest entirely underground subway lines.

Veena K S

2015-2019 Batch

DUTCH ENGINEERS TEST FLOATING MEGA ISLANDS IN PREPARATION FOR RISING SEA LEVELS

Dutch engineers created a floating mega island. The impressive land mass includes 87 wood and polystyrene triangular platforms which are secured in place to the ocean floor.

MARIN

Rising sea levels are an unchanging reality that has been coming into greater focus more and more in recent years. The reactions of various countries have ranged from flat denial to frustratingly sluggish reactions. In the midst of this, leading the way are the efforts of countries like Belgium and the Netherlands.

The latest contribution scientists in the Netherlands have made is the creation of a floating mega island. The impressive land mass includes 87 wood and polystyrene triangular platforms which are secured in place to the ocean floor. Dutch engineers working in this field are perhaps motivated by the urgent reality that currently two-thirds of the country is under sea level.

A truly eco-friendly option, engineers also envision the islands being powered by only renewable energy resources, from offshore wind farms to floating solar panels. The answer also to overcrowding in cities, engineers hope to one day settle housing, ports, farms or even parks on the islands, eventually covering an area of up to 5 kilometers.



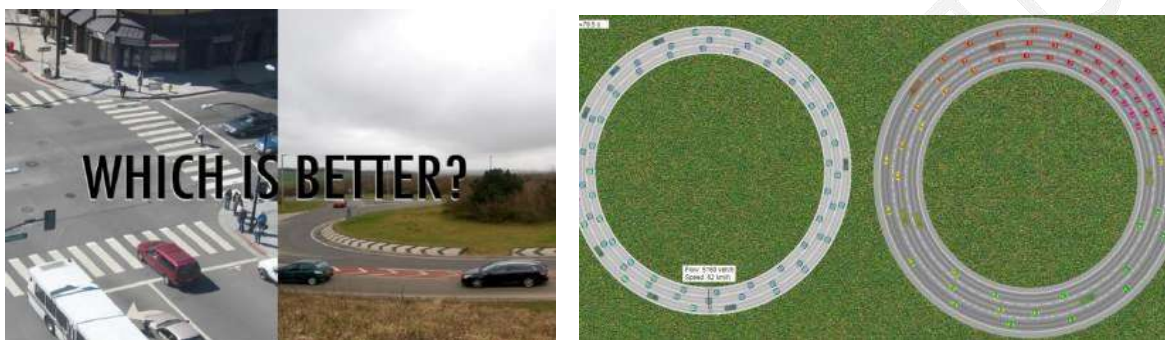
Sethulakshmi S Shajan

2015-2019 Batch

A MASSIVE, MULTIMILLION DOLLAR SKYSCRAPER IN SAN FRANCISCO IS SINKING FAST

The fourth-tallest building in San Francisco continues to sink after sinking over 17 inches already. The building was completed in 2008, and it includes some of the best amenities in the San Francisco area, including a wine cellar and tasting room, pristine restaurants, separate movie theater, and state-of-the-art fitness center.

Which is Better: A Roundabout or a 4-Way Stop?



When it comes to driving, the USA differs from the UK not only on the side of the road they drive on. One of the other major differences is the way intersections are handled. The UK uses the roundabout, whereas pretty much everywhere in America uses the 4-way stop. To the other, each sounds completely absurd, but which one is more efficient at moving traffic, and by how much. As it turns out, the best way to figure this out is to set up equivalent tests of each and see how many cars can make it through each intersection. Traffic and transportation design has a lot to do with the adoption of each intersection system. The USA adopted the 4-way stop because engineers believed it to be much safer than a roundabout intersection. If you have ever used a 4-way stop, you know that confusion abounds between drivers who arrived at the same time, making the method even slower. Even with these apparent inefficiencies, which intersection is faster is still a looming question. Going into the test, one could probably assume that the roundabout would be faster, but the question is, by how much? As it turns out, roundabouts are more than 20% more efficient than 4-way stops.

Hareesh K V

2015-2019 Batch

TOKYO'S FUTURISTIC UNDERGROUND FLOOD SYSTEM

Tokyo has built a giant network of underground tunnels and caverns all to keep the city safe during torrential downpours and floods.

Sprawling concrete jungle cities are especially vulnerable to flooding since they lack soil, rain-absorbing trees, and vegetation. Concrete makes a terrible flood sponge, and with weather occurrences tending to increase in severity in recent years, flooding has become a central pain point for most big metropolitan areas.



A gigantic underground flood system was constructed over the course of 17 years and with a price tag of 2.6 billion US dollars. It's the world's most advanced system to deal with flooding on a massive scale. Take a look inside the labyrinth-style underground chamber where flood water goes when Tokyo gets battered by a torrential downpour, a monsoon or typhoon: The project is called G-

Cans and it's comprised of gargantuan tunnels, colossal water tanks, massive pillars and enormous pumps that all work together to divert flood waters out to the Tokyo Bay and away from the city's 35 million inhabitants. The system works by channeling the overflowing floodwaters of rivers in and around Tokyo into the underground tunnels and silos. The facility is capable of withstanding a historic flood, the kind that only comes every 200 years. Tokyo exists on fairly low-lying ground and as a result, is particularly sensitive to flooding.

The tunnels run over 100 km in length and there are 213 foot tall flow-regulating silos connected to them. The main tank known as the "Underground Temple," is an 83 foot tall, 580 foot long area that resembles a sort of bizarre underground cathedral. Each of the 59 pillars in this "Temple" is 65 foot tall and weigh 500 tons. The humongous drainage system can pump over 200 tons of water per second. The underground tunnel system is also a tourist attraction during the dry season.

Ainu Jose

2017-2019 Batch

CIVIL ENGINEERING PROJECTS THAT MIGHT DEFINE THE FUTURE

Civil engineering has, since time immemorial, pushed the envelope of current thinking and technological know-how of the time. The following 11 projects are great examples of this and some of them might even become the de facto standard of future civil engineering in the future.



1. The Queensferry Crossing, Scotland Upped the Ante For Future Bridges

It is the longest of the bridges that comprise the cross-Forth corridor. It cost £1.3 billion, runs for 2.7 km (22km with

motorway upgrades) and is the longest three-tower, cable-stayed bridge in the world.

2. Jeddah Tower, Saudi Arabia Is a Skyscraper of the Future

When completed it will be the tallest skyscraper in the world by standing at 1 km tall. It will also be sustainable, and built under the auspices of the architectural philosophy of Global Environmental Contextualism.



3. Hong Kong-Zhuhai-Macau Bridge Is the Longest Sea-Bridge Ever Built

This civil engineering project is an interconnected system of bridges, artificial islands and tunnels that will eventually connect Hong Kong and Zhuhai to Macau. It will stretch over 50km and is designed to last at least 120 years before significant maintenance works will be needed. It is the longest sea-crossing bridge ever built.

4. Central Park Tower Is To Be 'Super-Sustainable'

Currently under construction, the new Central Park Tower in New York has been designed under the philosophy of Global Environmental Contextualism. Its construction is taking advantage of cutting-edge engineering to reduce emissions, optimize air circulation and internal climate control.

5. The Alvarado Water Treatment Plant Will Double San Diego's Water Filtration Capacity

The project is designed to double the current daily filtration capacity of San Deigo to 800,000 m³ a day, it will also be partially solar powered. It has also been designed to last at least 75 years and is being built in anticipation of the city's projected population growth. The plant will be built over a

period of 5 phases and will be one of three that will serve San Diego. These phases comprise a chemical treatment plant, flocculation and sedimentation basins and upgrades to electrical and control systems.

6. The Shanghai Tower Is Energy and Construction Material Efficient

The Shanghai Tower is one of the most energy-efficient buildings in the world and has the highest LEED rating possible - Platinum. It was designed to be wind resistant that saved thousands of tons of steel and relies heavily on renewable energy sources.

7. Lake Oswego Interceptor Sewer (LOIS) Could Be the Future of Pipelines Through Water

The original system was built in the 1960's, consists of thousands of meters of steel pipes that are believed to be seismically vulnerable and are beginning to corrode. The new system consists of buoyant pipes held in place with anchors and tethers to the lake bottom that float between about 2.4 and 5.8 meters above the lake bed.

8. MOSE, the Venetian Tidal Barrier, Could Be the Future of Flood Protection

The barrier is unique in its design of the use of mobile gates that can be raised to protect Venice from flood water. Although not huge in scale they could have future applications in other cities.

9. The Carlsbad Desalination Plant Could Solve A Future Fresh Water Crisis

This plant will completely redefine how a city meets its water needs in the future. Rather than pumping it from hundreds of kilometers away, this plant removes salt from saltwater to provide 50 millions gallons of fresh water a day.

10. NBBJ's 'Shadowless' Skyscrapers Could be the Future of Skycraper Fascade Design

NBBJ has created a concept for a mixed-use development of London's Greenwich Peninsula. Their design involves an innovative rethink of the buildings' exterior to redirect and diffuse sunlight 'to visibly reduce shadows at the towers' base by 60% over typical buildings, providing more daylight for pedestrians and people in nearby buildings.

Sagar Somi

2015-2019 Batch

TECHNICAL QUIZES

- 1. If the weight of a body immersed in a fluid exceeds the buoyant force, then the body will**
 - a) rise until its weight equals the buoyant force
 - b) tend to move downward and it may finally sink
 - c) float
 - d) none of the aboveAns: b

- 2. Metacentric height for small values of angle of heel is the distance between the**
 - a) centre of gravity and centre of buoyancy
 - b) centre of gravity and metacentre
 - c) centre of buoyancy and metacentre
 - d) free surface and centre of buoyancyAns: b

- 3. A floating body is said to be in a state of stable equilibrium**
 - a) when its metacentric height is zero
 - b) when the metacentre is above the centre of gravity
 - c) when the metacentre is below the centre of gravity
 - d) only when its centre of gravity is below its centre of buoyancyAns: b

- 4. Air entrainment in the concrete increases**
 - a) workability
 - b) strength
 - c) the effects of temperature variations
 - d) the unit weightAns: a

- 5. Increase in the moisture content in concrete**
 - a) reduces the strength
 - b) increases the strength
 - c) does not change the strength
 - d) all of the aboveAns: a

- 6. As compared to ordinary portland cement, use of pozzuolanic cement**
 - a) reduces workability
 - b) increases bleeding
 - c) increases shrinkage
 - d) increases strengthAns: c

7. Admixtures which cause early setting, and hardening of concrete are called

- a) workability admixtures
- b) accelerators
- c) retarders
- d) air entraining agents

Ans: b

8. The most commonly used admixture which prolongs the setting and hardening time is

- a) gypsum
- b) calcium chloride
- c) sodium silicate
- d) all of the above

9. Modulus of rupture of concrete is a measure of

- a) flexural tensile strength
- b) direct tensile strength
- c) compressive strength
- d) split tensile strength

Ans: a

10. In order to obtain the best workability of concrete, the preferred shape of aggregate is

- a) rounded
- b) elongated
- c) angular
- d) all of the above

Ans: a

11. Pascal-second is the unit of

- a) pressure
- b) kinematic viscosity
- c) dynamic viscosity
- d) surface tension

Ans: c

12. An ideal fluid is

- a) one which obeys Newton's law of viscosity
- b) frictionless and incompressible
- c) very viscous
- d) frictionless and compressible

Ans: b

Soumys S
2015-2019 Batch

SEMINAR AND PROJECT ABSTRACTS

CIVIL ENGINEERING TIST

EFFECTIVE TECHNIQUES FOR MATERIAL MANAGEMENT IN CONSTRUCTION INDUSTRY

The average material cost is 55-60 % of total project cost. Hence, efforts should be taken to reduce material cost. In actual practice most effort are done to reduce labour cost. The cost, quality & time are important objective of material management. If material is purchased too early, capital gets tied up as well as, interest charges incurred on excess inventory of material. On other hand if material availability at site is delayed it will affect scheduling of activities. Advance material procurement or delayed both can affect cost, quality & time. So it is very important to get material at right cost, at right quality & right time. This can be achieved by using material management techniques. The ABC analysis, VED analysis, SDE analysis and EOQ analysis are different techniques of material management. These techniques can lead to effective material management in construction projects. ABC analysis is based on inventory value of material. VED analysis gives priority to utility of material whereas SDE analysis gives availability of material in market. EOQ determines the ideal order quantity and DOQ orders as much as material as require.

KEYWORDS: Material Management, Material control, ABC, VED, SDE, EOQ, DOQ.

SUPPLIER SELECTION & SUPPLIER QUALITY MANAGEMENT USING AHP METHOD

Success in the construction projects can be simply described as finishing the construction work on time, within the budget and with the desired quality. Achieving the delivery of the right amount of materials on the right time and with the desired quality plays a critical role on the project success. Moreover, the cost of materials constitutes approximately 40% of the overall project budget. Therefore, selecting the right supplier for the right material is crucial. A trade-off between these tangible and intangible factors is essential in selecting the best supplier. The aim of this seminar is to apply analytic hierarchy process (AHP), to help construction companies in selecting the most appropriate supplier in their projects. The AHP method is used to find the weights of the selection criteria. The results from various studies suggest that AHP process makes it possible to introduce the optimum order quantities among the selected suppliers so that the total value of purchasing becomes maximum. Since the criteria are both qualitative and quantitative, AHP is used to evaluate decision process. According to AHP's results, The ranking of criteria is determined Service quality- General and organizational structure- Production capability-Price from the most important to the least important.

Keywords: Analytic Hierarchy Process (AHP), supplier selection, service quality

OCCUPANT BEHAVIOUR AND SHORT-TERM PREDICTION OF OCCUPANCY IN RESIDENTIAL BUILDINGS

Occupant behaviour is an important factor in building simulations. Occupants influence the energy usage of buildings through interactions with indoor appliances (e.g air-conditioning, lights etc.) in order to improve the indoor environment. The models of occupant behaviour are widely studied not only to estimate the energy consumption buildings but also to extent the building energy- saving potentials. Different from the models in office buildings, behaviour models in residential buildings are much more complicated due to the diversity of appliances and behaviour patterns. However, most previous studies of development of such model only focus on commercial buildings. The occupancy models of residential houses are usually based on Time User Survey data. This seminar focuses on providing a unique data set of four residential houses collected from occupancy sensors. A new inhomogeneous Markov model for occupancy presence prediction is proposed. It evaluates the predictive capability of the models by various temporal scenarios, including 15-min ahead, 30-min ahead, 1-hour ahead, and 24-hour ahead forecasts. The spatial- level comparison is additionally conducted by evaluating the prediction accuracy at both room- level and house-level with ANN, SVR and probability sampling method data's which are already done at the same residential buildings. Markov model outperforms the other methods in terms of average 5% correctness with 11% maximum difference in 15-min ahead forecast of the occupancy presence.

KEYWORDS: Occupancy, Human behaviour models, Residential building, Statistical modelling

STUDY ON QUALITY MANAGEMENT IN CONSTRUCTION SITE

Quality management is to ensure efforts to achieve the required level of quality for the product which are well planned and organized. The role of quality management for a construction company is not an isolated activity, but intertwined with all the operational and managerial processes of the company. Quality is one of the main factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfillment of expectations (i.e. the satisfaction) of the project participants. Quality, cost and time have been recognized as the main factors concerning the client. Quality management system (QMS) that focuses mainly on customer satisfaction contributes collective assistance and necessities for forming an appropriate quality management procedure, in order to reduce the cost. In construction industry, it assists the companies to achieve their objectives, and ensures that all stages of construction project consistently meet the quality requirements. Quality Management System (QMS) for concrete construction is considered as an important part of the construction project. The quality of a project will be dependent from the start to end activities involved in the whole project. This starts with the procurement of construction materials till the curing of the casted structural member. Every step between these stages must be performed with utmost quality.

Keywords: Quality management, construction project management, practices, management commitment, problems

APPLICATION OF FUZZY MATHEMATICAL MODELS FOR CONSTRUCTION PROJECT SCHEDULING

The Critical Path Method (CPM), which is used to schedule construction activities that depend on one another through network relationships, is deterministic with regard to the duration assigned to the execution of the activities and the results produced in certain values. Unfortunately, construction activities are performed under uncertain conditions. Project risks cause variations in activity duration, and in turn the entire network is affected by uncertainty. In this context, activity duration can be represented by fuzzy sets, and CPM network calculations can be performed by fuzzy operations through a method developed in this study. This study evaluates the viability of using fuzzy mathematical models for determining the duration of construction schedules and for evaluating the contingencies created by schedule compression and delays due to unforeseen material shortages. This study also aim to use heuristic material allocation and sensitivity analysis to test five cases of material constraints. Material constraints increase the cost of construction and delay the finish of projects. Mathematical models allow the multi objective optimization of project schedules, considering constraints such as time and cost defined in the project, and unexpected materials shortages to determine the fuzzy aspiration levels of Decision Makers.

Keywords: Scheduling, Construction materials, Multiple objective analysis, Optimization, Fuzzy sets, Construction management, Resource allocation.

CHANGE ORDERS IN CONSTRUCTION SITES

The construction process is a complex one and is associated with various changes. These changes usually lead to issuance of change orders. Change orders are usually issued to cover variations in scope of work, material quantities, design errors and unit rate changes. Change Orders in construction often have a serious impact on the quality, time, and cost of projects. Hence, Change Orders require proper analysis and action to measure the causes and effects of change orders. It is difficult and risky to manage them, but it is required to manage change order in construction projects. Change orders can also become unmanageable if the process is not sufficiently defined, or if the individuals involved in the preparation and administration of the change orders on a project are not properly addressed. Therefore, the timely resolution of change order issues is key to project's success.

Key Words: Change, Change order in Construction.

HAULING EQUIPMENT PRODUCTIVITY

Construction equipments are essential for the effective operation of any civil engineering works. Equipping the construction site with the correct equipment plays an essential role in achieving timely and good quality results. Hauling equipments are among material handling equipment used to move or transfer materials from one place to another. Hauling equipments are widely used in construction activities. Hence, a detailed investigation and analysis on hauling equipment productivity is needed. The factors that affect the productivity have to be evaluated, so that the equipments can be managed effectively to avoid losses. Different methods are used by different researchers to calculate and to improve the productivity. If construction equipment productivity increases, in turn increase labour productivity and this will contribute to overall productivity.

Keywords; Hauling equipment, Management, Productivity, Quality

ALKALINE ACTIVATION OF FLY ASH

Thermal power stations use pulverized coal as fuel. They produce enormous quantities of fly ash as a by-product of combustion. A number of applications of fly ash have been investigated and adopted in various fields. Among the various uses of fly ash, its bulk utilization is possible only in civil engineering applications.. The low hydration capacity of fly ash at initial period necessitated the introduction of activation techniques to enhance the fly ash activity towards improvement of initial concrete strength. Fly ash activation has been adopted through many activation techniques in the context of chemical, mechanical, thermal, mechano-chemical and physiochemical methods and many others. Activation of fly ash enhance several properties of fly ash such as improvement in density and strength, shrinkage characteristics, acid and fire resistance, cold weather resistance, great workability ,reduces CO2 emissions etc. The alkali activation of fly ash has become an important area of research because it is possible to use these materials to synthesize inexpensive and ecologically sound cement like construction materials

.This works describes a short review on various activation techniques on fly ash. Alkaline activation of fly ash,its mechanism ,merits and applications are described in detail in the present study.

Keywords-fly ash, activation techniques, railway sleeper, fire protection

EFFECT OF SILICA FUME ADDITION ON BEHAVIOUR OF CLAYEY SOILS

A difficult problem in civil engineering work exists when the subgrade is found to be clay. Clay soils have a tendency to swell when their moisture content is allowed to increase. This moisture may come from rains, floods, leaking sewer lines, or from the reduction of surface evaporation when an area is covered by a building or pavement. Frequently, these clayey soils cause the cracking and breaking up of pavements, railways, highway embankments, roadways, foundations and channel or reservoir linings. When civil engineers are faced with possible construction damage, a need for improving the engineering properties of the soil is justified using some sort of stabilization methods. Stabilization of pavement subgrade soils has traditionally relied on treatment with lime, cement, and special additives such as pozzolanic materials. Pozzolanic materials, such as Fly Ash, Silica Fume, and Rice Husk Ash, which are regarded as wastes may be used for soil improvement. The Silica Fume is found to be 40% cheaper than that of Portland cement. This seminar concentrates on the effect of silica fume on swelling pressure, compressive strength, permeability and cracks of silty-clayey soil.

Keywords; Clay, Silica fume, Stabilisation, Strength

REPEATED AUTOGENOUS HEALING IN CEMENTITIOUS COMPOSITES WITH MICROFIBRES AND SUPERABSORBENT POLYMERS

Cementitious materials are sensitive to crack formation and it would be beneficial if the material could stop the crack propagation, repair the damage and reach again the original liquid-tightness and/or strength. Therefore, a cementitious material with synthetic microfibres and superabsorbent polymers (SAPs) is proposed. Further cement hydration and calcium carbonate precipitation will seal the crack if sufficient building blocks and water are present. These polymers are able to extract moisture from the environment and to provide it to the cementitious matrix for autogenous healing. This healing will lead to the regain in mechanical properties. The healing efficiency was evaluated by reloading cracked and healed specimens. The crack width was limited to 50 μm at 1% strain. While specimens without SAPs showed a regain of mechanical properties of 40-55% in wet/dry cycles, specimens with SAPs showed a total regain of 80-95%. Even in humid air, those specimens show partial healing of 35-55%. SAP B, a cross-linked potassium salt polyacrylate, showed better healing properties compared to SAP A, a copolymer of acrylamide and sodium acrylate.

KEYWORDS: concrete, self-sealing, self-healing, superabsorbent polymers

COST OPTIMIZATION OF MATERIALS IN ROAD CONSTRUCTION THROUGH MATERIAL CONTROL TECHNIQUES

In a construction project, materials account for more than 40% of the total project cost. A small saving in material cost through efficient control of materials can result to a large saving in the total project cost. Most organizations face challenges of overstocking of materials, duplication of similar materials in different departments, large material size of item parts that are resource wastage. The difficulty is to acquire approaches that would enable minimization of such wastages and losses to improve on materials control performance. The objective of this study is to find the benefits of material control techniques by improving quality and minimization of cost on effective material variety. The material datas are collected from various sites which is then quantified, measured and analyzed through material control techniques thereby constraints of material productivity can be found out. A new measure is then suggested which is then validated through case studies. The study helps in reducing overstocking, duplication, wastage and cost of materials in road construction.

KEYWORDS: Material Control Techniques, Road Construction, Material Requirement Planning, EOQ, DOQ, PPB, SPSS Software.

ANALYSIS OF EQUIPMENT PRODUCTIVITY USING CYCLE TIME FOR TRANSIT MIXERS

Construction equipment are the most important and critical resource for a construction industry. The choice of construction equipment for a job site is a key factor to be considered for timely completion of the project within the stipulated budget. Cycle time of construction equipment has a significant impact on project productivity. Hence it is necessary to identify and quantify those factors which have impact on cycle time for calculating it and for implementing strategies to reduce it. In this study the factors that have a significant impact on the cycle time of hauling equipment are measured through time study and it is analyzed, in order to identify the influence of measured factors on the productivity. The primary outcomes of this study can be used in monitoring cycle time system to enhance and improve construction equipment productivity, from which remedies can be found out to reduce cycle time and thereby increase productivity.

Keywords: Cycle Time, Equipment, Productivity, Time Study, Transit Mixer

AN EXPERIMENTAL INVESTIGATION ON PHYSICAL AND MECHANICAL PROPERTIES OF BRICKS MADE OF ACTIVATED FLY ASH

Fly ash is an effluent from power plants where coal is fired. A huge amount of fly ash is generated every year in which its disposal is a critical threat. A vast quantity of fly ash disposed to environment will cause serious hazards, land usage issues, health risks etc. Therefore proper disposal of fly ash is a primary concern. Fly ash is adopted in several fields, among them fly ash take part a vital role in construction industry for producing more stronger and durable building materials. Brick is a very important building material. The unavailability of conventional brick making materials can be dealt with fly ash. Fly ash bricks are getting attention nowadays. In order to enhance the properties of fly ash bricks the fly ash can be chemically activated. For assessing the suitability of building material like brick, its compaction properties, strength parameters are the most important properties to be tested. Chemical activation like alkali and sulphate activation are effective in fly ash. In the present work alkalis like NaOH pellets, $\text{Ca}(\text{OH})_2$ and sulphates like CaSO_4 , Na_2SO_4 were added with fly ash and its effect are analysed to determine its suitability to be used as a building material. The index and engineering properties of fly ash and chemically activated fly ash mixture was assessed and from the assessment the best among alkali and sulphate activation was determined. The physical and engineering properties of the fly ash samples were studied by conducting specific gravity test, sieve analysis, standard proctor test, UCC test. From the results of the tests done activated fly ash bricks were casted and its applicability to be used as a building material was assessed by standard tests such as compressive strength, water absorption, soundness, hardness, bulk density, apparent density and efflorescence.

KEYWORDS: Activation, fly ash, alkalis, sulphates.

FEASIBILITY STUDY ON FLY ASH BRICKS USING AGRO-WASTE

Brick is a major construction material that is widely used in construction. Cost of clay brick has increased due to its higher demand, transportation, unavailability of raw materials and environmental restrictions. Utilization of industrial and agricultural waste products in construction industry has been the focus of research in recent times. Fly ash bricks is an alternative to the clay bricks due to its availability and superior performance. Agro waste has proven to be the most versatile and cost effective modification of building material. Rice husk ash (RHA) and Sugarcane bagasse ash (SBA), which is otherwise landfilled, can be utilized to develop energy efficient construction materials. In this study the suitability of developing agro-waste fly ash bricks is investigated. Control fly ash bricks contain varying proportions of fly ash, hydrated lime, gypsum and M-sand. Different compositions of brick mixes in which fly ash was partially replaced by 5%, 10%, 15% and 20% of SBA and RHA respectively and 15% liquid sodium silicate as an additive was tested to find the optimum composition of agro-wastes fly ash bricks. 10% SBA replaced brick mixture was found to be the optimum composition. Mechanical and durability properties of the agro-waste fly ash brick was found to be superior to that of control fly ash bricks. Compressive strength of agro-waste fly ash brick was found to be 7.57 N/mm^2 . Bulk density increased to 1390 kg/m^3 and apparent porosity decreased to 17.14%, these values indicated that the agro-waste fly ash bricks are denser and light weight bricks. Agro-waste fly ash bricks showed improved results for resistance against efflorescence, soundness and hardness. Cost analysis of the agro-waste fly ash bricks prepared was also included in the study. Based on the study, it was concluded that the agro-waste fly ash bricks can be effectively utilised in different construction purposes and it serves as a solution to solid waste management.

Keywords: Fly ash, Rice husk ash, Sodium Silicate, Sugarcane bagasse ash.

AUTOMATED TRAFFIC SIGNALLING SYSTEM USING LASER SENSOR

Traffic light control systems are widely used to monitor and control the flow of automobiles through the junction of many roads. They aim to realize smooth motion of cars in the transportation routes. In Conventional systems, traffic light signals works on the principle of fixed time, thus wastage of signal time occurs due to lack of vehicles. This leads to traffic jam and congestion. We propose a method to determine the duration of the signal timing distribution of signal system based on PCB circuits that evaluates the traffic density using laser sensors and accomplishes dynamic timing slots for different levels. It aims at reducing traffic congestion and unwanted long time delay during the traffic light switches especially when the traffic is very low. It keeps a track of the vehicles in each road and accordingly adjusts the time for each traffic light signals. The higher the number of vehicles on the road the longer will be the time delay allotted for that corresponding traffic light.

KEYWORDS: Traffic light signals, Traffic jam, LASER sensors, Traffic density.

EFFECT OF FIBRE ON STRENGTH AND DUCTILITY PROPERTIES OF FIBRE REINFORCED GEOPOLYMER CONCRETE STRUCTURAL MEMBERS

Geopolymer concrete is a recently emerged green construction material. Geopolymer binders are produced by polymeric reaction of alkaline liquid with alumino-silicate materials including the industrial wastes like fly ash, blast furnace slag, rice husk ash etc. A lot of studies and researches are being carried out to explore the possibility of using geopolymer concrete as a green building material in place of conventional concrete. Due to its better mechanical properties combined with significant chemical resistance, low shrinkage, creep in comparison with concrete manufactured with Ordinary Portland cement, it can be considered as a promising alternative to conventional cement concrete for sustainability. The studies done by others showed that the presence of fibre improved the strength and ductility properties of geopolymer concrete. This may be due to the resistance to crack growth and crack propagation after the first crack, and the ability to sustain very high strains due to the presence of fibres. This project focuses on the strength and ductility behaviour of hybrid fibre reinforced geopolymer concrete (HGC) and compared with plain geopolymer concrete (GPC). The hybrid fibre consists of polypropylene fibre 1% of total volume of concrete and 10% of this polypropylene fibre replaced by glass fibre is taken for the study. Based on the test results, it was observed that a maximum of 8.1 %, 7.1 % and 15.4% increase in compressive strength, split tensile strength and flexural strength respectively was obtained in HGC with respect to the GPC without fibres. Studies on ductility characteristics of plain geopolymer concrete and hybrid fibre reinforced geopolymer concrete were also conducted. There is an increment of 5.5 % and 5.6% in the ductility index values of HG C columns and beams compared to GPC columns and beams respectively. From the test results it can be inferred that the addition of fibres increased the load carrying capacity and ductility property of hybrid fibre reinforced beams and column specimens.

Keywords: Geopolymer concrete, Confinement, Crack propagation, Ductility, Compressive strength, Split tensile strength and Flexural strength

AN EXPERIMENTAL STUDY ON THE EFFECT OF SILICA FUME ON THE ENGINEERING PROPERTIES OF CLAY FLOOR TILES

Due to rapid growth of urbanization and industrialization, minimization of industrial waste is serious problem in present days. To encounter this innovative and non-traditional research on waste utilization is gaining importance now a days. Soil improvement using the waste material like Slag, Rice husk ash, Silica fume etc, in geotechnical engineering has been recommended from environmental point of view. The quest to modify the engineering properties of weak or expansive soils seem to be unending as these expansive soils pose a huge challenge to construction due to their poor geotechnical properties. Many materials have been attempted with the aim of trying to determine how effective these materials will be in improving the strength characteristics of expansive soils, while many have been found very useful, a few have been found wanting. Silica fume (SF) is an inorganic waste material which is generated during the elemental silicon and ferro-silicon alloy production. Objective of this study is to investigate the effect of silica fume on physical and mechanical and thermal properties of clay floor tiles (Clay 70%, laterite 30%). Silica fume is added in varying percentages (0%, 5%, 10%, 15% and 20%) to find the optimum mix proportion by replacing clay with silica fume. Clay floor tiles of size: 200x200x20mm are cast using the optimum value. Properties of clay floor tile such as breaking load, bulk density and water absorption, thermal properties are determined.

Keywords: Laterite, Tiles, Clay, Flexural strength

ANALYSIS OF COST METHODS TO ASCERTAIN COST EFFICIENCY IN BUILDING CONSTRUCTION

Quality Management System (QMS) for concrete construction is considered as an important part of the construction project. The quality of a project will be based on the start to end activities involved in the whole project. This starts with the procurement of construction materials till the curing of the casted structural member. Every step between these stages must be performed with utmost quality. Quality Cost is calculated using, PCM (Process Cost Model) and COQ (Cost of Quality). A Process Cost Model projects the mechanism for measuring the quality expenses of construction projects. Cost of quality is a methodology that allows an organization to determine the extent to which its resources are used for activities that prevent poor quality, that appraise the quality of the organization's products or services, and that result from internal and external failures. The project aims at comparing the various quality management systems to find the best method for quality cost calculation and remodelling this method for more accurate result. Thus a model is generated with the help of automatic linear modelling which helps to calculate the construction cost of residential building project. In addition to this, software is developed to calculate the construction cost with the help of a MIT app inventor.

Keywords: Cost of Quality (COQ), Process Cost Model (PCM), Quality Management System.

APPLICATION OF FUZZY LOGIC FOR CONSTRUCTION PROJECT SCHEDULING

The Critical Path Method (CPM), which is used to schedule construction activities that depends on one another through network relationships, is deterministic with regard to the duration assigned to the execution of the activities and the results produced in certain values. Unfortunately, construction activities are performed under uncertain conditions. These uncertainties are to be studied initially upon which the proposed method could be initialized. There are several ways to schedule projects including the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Due to problems in estimating durations of activities, these methods cannot accurately and completely model actual projects. The use of fuzzy theory is a basic way to improve scheduling and deal with such problems. Fuzzy theory approximates project scheduling models to reality by taking into account uncertainties in decision parameters and expert experience and mental models. This paper provides a step-by-step approach for accurate estimation of time or cost of projects using the Project Evaluation and Review Technique (PERT) and expert views as fuzzy numbers. The proposed method included several steps. In the first step, the necessary information for project time and cost is estimated using the Critical Path Method (CPM) and the Project Evaluation and Review Technique (PERT). The second step considers the duration or cost of the project activities as the trapezoidal fuzzy numbers. Then the duration of the activities are estimated using the questionnaires as well as weighing the expert opinions, averaging and defuzzification. The calculating procedures for evaluating these methods are applied in a real project; and the obtained results are explained.

Keywords: Construction management, delay factors, fuzzy logic, scheduling

SUPPLIER SELECTION USING AHP METHOD

Success in the construction projects can be simply described as finishing the construction work on time, within the budget and with the desired quality. Achieving the delivery of the right amount of materials on the right time and with the desired quality plays a critical role on the project success. Moreover, the cost of materials constitutes approximately 40% of the overall project budget. Therefore, selecting the right supplier for the right material is crucial. A trade-off between these tangible and intangible factors is essential in selecting the best supplier. The project aim to apply analytic hierarchy process (AHP), to help construction companies in selecting the most appropriate supplier in their projects. The AHP method is used to find the weights of the selection criteria. The results from various studies suggest that AHP process makes it possible to introduce the optimum order quantities among the selected suppliers so that the total value of purchasing becomes maximum. Since the criteria are both qualitative and quantitative, AHP is used to evaluate decision process. According to AHP's results, The ranking of criteria is determined quality- decreased defect rate- financial status-pricing-past performance from the most important to the least important.

Keywords: Analytic Hierarchy Process (AHP), supplier selection, ranking of criteria

EVALUATION OF 5S CONFORMITY IN CONSTRUCTION SITES

5S practice is one of the management techniques to improve workplace quality, productivity and safety at the workplace. It is found as a basic tool in enabling a worksite for lean transformations. 5S system is a method used for setting up and keeping quality of working environment in an organization. This methodology can manage space, human effort, time, quality and capital to make the end product with less faults and make the site a well ordered, disciplined and clean place to work. 5S application improves personal standards and motivation of workers in their workplace and has a high impact on work area, safety, quality, and efficiency. This project intends to create a framework for 5S audits for construction sites to assess the current condition and also the conformity towards 5S.

Keywords: 5S, lean tool, questionnaire framework, quality improvement.

****Note: Details of Project and Seminar report available in Department Library.***

FACULTY DEVELOPMENT
on
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SUSTAINABLE DEVELOPMENTS IN TRANSPORTATION

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