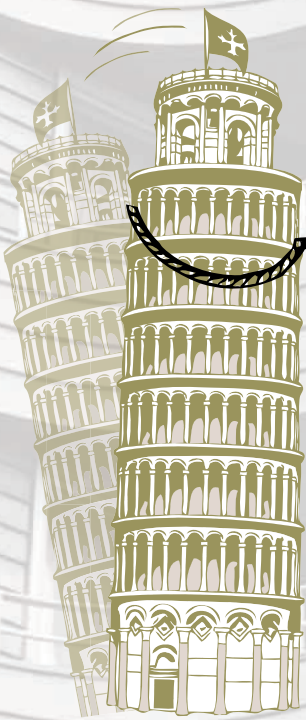


EMAARAT



INNOVATION, INSPIRATION & IMPACT



A MAGAZINE BY CIVIL DEPARTMENT
ACADEMIC YEAR 2020-2021

VOLUME 5

THAKUR COLLEGE OF ENGINEERING



THE THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY (TCET) WAS ESTABLISHED IN ACADEMIC YEAR 2001-02 WITH A CLEAR OBJECTIVE OF PROVIDING QUALITY TECHNICAL EDUCATION IN TUNE WITH INTERNATIONAL STANDARDS AND CONTEMPORARY GLOBAL REQUIREMENTS. THE COLLEGE IS RECOGNIZED BY ALL INDIA COUNCIL FOR TECHNICAL EDUCATION (AICTE) & GOVT. OF MAHARASHTRA AND IS AFFILIATED TO THE UNIVERSITY OF MUMBAI (UOM). ALL THE COURSES AT THE U.G. LEVEL, ELIGIBLE FOR ACCREDITATION IN 2011 I.E. ELECTRONICS & TELECOMMUNICATION (EXTC), INFORMATION TECHNOLOGY (IT) AND COMPUTER ENGINEERING (CMPN) WERE ACCREDITED BY NBA FOR THREE YEARS W.E.F. 16.9.2011. MOREOVER, THESE PROGRAMMES ARE ALSO GIVEN PERMANENT AFFILIATION W.E.F. A.Y. 2015-16. THE MANAGEMENT'S COMMITMENT TO EXCELLENCE AND RELEVANCE IN TECHNICAL EDUCATION IS REFLECTED IN THE MARVELLOUS INFRASTRUCTURE THAT IS COMPARABLE TO THE FINEST INSTITUTION OF ITS TYPE IN THE COUNTRY. THE IMPOSING FIVESTORIED BUILDING, HOUSING STATE-OF-THE-ART COMPUTER LABORATORIES, SPACIOUS CLASSROOMS, WELL EQUIPPED LABORATORIES, WORKSHOPS, COMPUTER CENTRE WITH SERVER ROOM, A WELLSTOCKED LIBRARY, WIDE AND WELL LIT CLEAN CORRIDORS AND A LARGE CANTEEN, CONFERENCE HALL, SEMINAR HALLS HAS SET NEW STANDARDS IN PROVIDING FACILITIES OF INTERNATIONAL LEVEL. APPLICATION OF MODERN TECHNOLOGY IN TEACHING- LEARNING PROCESS AND EFFECTIVE DAY-TODAY GOVERNANCE OF THE COLLEGE MAKES TCET UNIQUE. KEY INITIATIVES LIKE TEACHERGUARDIAN SCHEME, BOOK BANK SCHEME, INDUCTION OF RESOURCE BOOKS, YEARLY ORGANISATION OF EVENTS (LIKE MULTICON-W, TECHNICAL AND CULTURAL FESTIVALS ETC.) MAKE TCET AN INSTITUTE WITH A DIFFERENCE. THUS, WITHIN JUST 15 YEARS OF ITS EXISTENCE, TCET HAS CARVED OUT A NICHE FOR ITSELF AS ONE OF THE LEADING ENGINEERING COLLEGES UNDER UNIVERSITY OF MUMBAI IN MAHARASHTRA

DEPARTMENT VISION

**"TO BECOME A DEPARTMENT OF NATIONAL
RELEVANCE IN THE FIELD OF CIVIL ENGINEERING"**



DEPARTMENT MISSION

**THE DEPARTMENT OF CIVIL ENGINEERING IS COMMITTED TO PROVIDE
UNDERGRADUATE STUDENTS WITH SOUND KNOWLEDGE IN THE FIELD OF
CIVIL ENGINEERING, AND BUILD IN THEM LEADERSHIP AND MANAGERIAL
SKILLS ALONG WITH INCULCATING THE CULTURE OF LIFELONG LEARNING
AND SOCIAL SENSITIVITY.**



DR . SANJAY KUMAR

PhD (Mechanical Engg.)

M.Tech (Industrial Engg. & Management)

B.E (Production Engg.)

A weak link is better than a strong memory

Nothing exemplifies it better than the nostalgic feeling one gets when leafing through the dusty old pages of his/her college magazine. It can make a reader travel down the lanes of memory, giving rise to a surge of emotions of many hues and colors. The Department of Civil Engineering TCET's EMAARAT is going to give the same pleasure to all the brilliant minds that traverse through the portals of this temple of learning.

I am happy to see the amount of enthusiasm of eminent members of the college to contribute to the magazine. Not to be outdone, our students have devoted time and plunged into creating powerful and informative articles. I stand awed by the sheer number of articles that have come pouring in for the magazine. This shows the positive and creative energy of faculty members and students present in the college.

We proudly publish the fifth volume of our departmental magazine in order to show to the outside world, and also to remind the denizens of TCET, the progress we have made so far. We intend to continue presenting the talent and creativity of our staff and students through EMAARAT every year. I invite you to read and immerse yourself in the unfolding art and be exulted.



DR. SEEMA JAGTAP

Ph.D. Technology (Civil Engineering)
M.Tech Civil (Hydraulics Engineering)
B. E.(Civil Engineering)

“There is nothing I believe more strongly than getting young people interested in science and engineering, for a better tomorrow, for all humankind.” - Bill Nye

As a preacher of science since the beginning of my higher studies, it has amused me with its process of evolution everyday. And we all have devoted a part of our lives to science and understanding it, we've been following the traditional way of learning and understanding i.e. through books and studies, but over the period of time all these processes stand incomplete without the process of analysis and introspection. We as the essential parts of the science and civil engineering fraternity, it becomes our duty to look through the horizon of any information we receive, appreciate and acknowledge the findings of our civilization, and to also address its flaws.

The system has provided us with numerous ways of doing so, but the most simple and basic way is to print your thoughts in the form of an article/report. And we here at TCET Civil Department are proud to provide the students with a platform through our departmental magazine “EMAARAT” to showcase and share their curiosities and findings.

I feel privileged to be a part of such a fascinating venture, our students, behind the editorial and digitization of the magazine, and those who have provided us with their thoughts, both have done a spectacular job, and deserve an enormous amount of gratitude that I here want to convey on the behalf of the department. Also, throughout the academic year our ASCE Students Chapter has provided us with the best opportunities and experiences the student fraternity could ask for. Finally, I congratulate all the students and the concerned faculty for their work and I am sure that this magazine will help the students make the world a better place.



MRS. RUTUJA SHINDE

M.E (Water Resources &
Environmental Engineering)
B.Tech (Civil)

“One man’s “magic” is another man’s engineering. “Supernatural” is a null word. – Robert A. Heinlein

I remember, back then when my engineering journey started, I barely had any idea about the world that I was walking into, but after spending a little time in that space of knowledge, I realised something that I feel has helped me look and understand engineering better.

“There are two types of education: education for a living and education for life.” When we study in college to become an engineer this education is for living. On the other hand, education for life requires an understanding of the essential principles of humanity. And I was privileged that engineering helped me understand life in a better way. For me engineering is not just a degree, it’s a way of life, it’s a philosophy. And I am thankful to TCET and the rest of its fraternity and extended family for letting me nurture it here, with numerous ventures like this magazine.

It is always a pleasure to be a part of a team which strives to bring out the talents of students and staff. TCET has always been striving to keep itself ahead of the competition and the results are now for everyone to see. The essential purpose of a college magazine is to inform, engage, inspire and entertain a diverse readership – including alumni, parents, students, faculty, staff and other friends of the college – by telling powerful stories that present a compelling, timely and honest portrait of the Civil engineering fraternity and its extended family. This magazine has made an earnest attempt in this direction and brought out certain aspects of the college to the eyes of the public so that they may understand and know the college even better. I am sure the college will scale even greater heights in the years to come and serve many more millions in the society.

KABIR JANGAM

Student T.E



“The only people for me are the mad ones, the ones who are mad to live, mad to talk, mad to be saved, desirous of everything at the same time, the ones who never yawn or say a commonplace thing, but burn, burn, burn like fabulous yellow roman candles exploding like spiders across the stars.”

What Kerouac says of his people in his book, “On the Road” is what EMAARAT would say of its editorial team. There were days when we brainstormed over inspiring ideas and days when the only thing we had to offer was our own confusion. But through it all, each desk maintained its equanimity while proof-reading, editing and coordinating with every contributor to ensure they have nothing short of best. We skipped along, marking mails as important, approaching students, faculty and industry experts while the design team meticulously matched fonts and colours to make this masterpiece beautiful, inside and out.

As we completed our tasks and began laying them out, our wonderful faculty editors helped us stitch the loose ends together - missing articles, overlooked spelling errors, grammatically incorrect sentences were quickly rectified. Behind every coherent page and every orderly section, there is a story of raggedy madness of our EMARAT team. As you take heart from our lives and leaf through these pages, we leave you with a little inspiration from Yeats,

“Let us go forth, the tellers of tales, and seize whatever prey the heart long for, and have no fear. Everything exists, everything is true, and the earth is only a little dust under our feet.”

NIMISH VARDAM

Student S.E

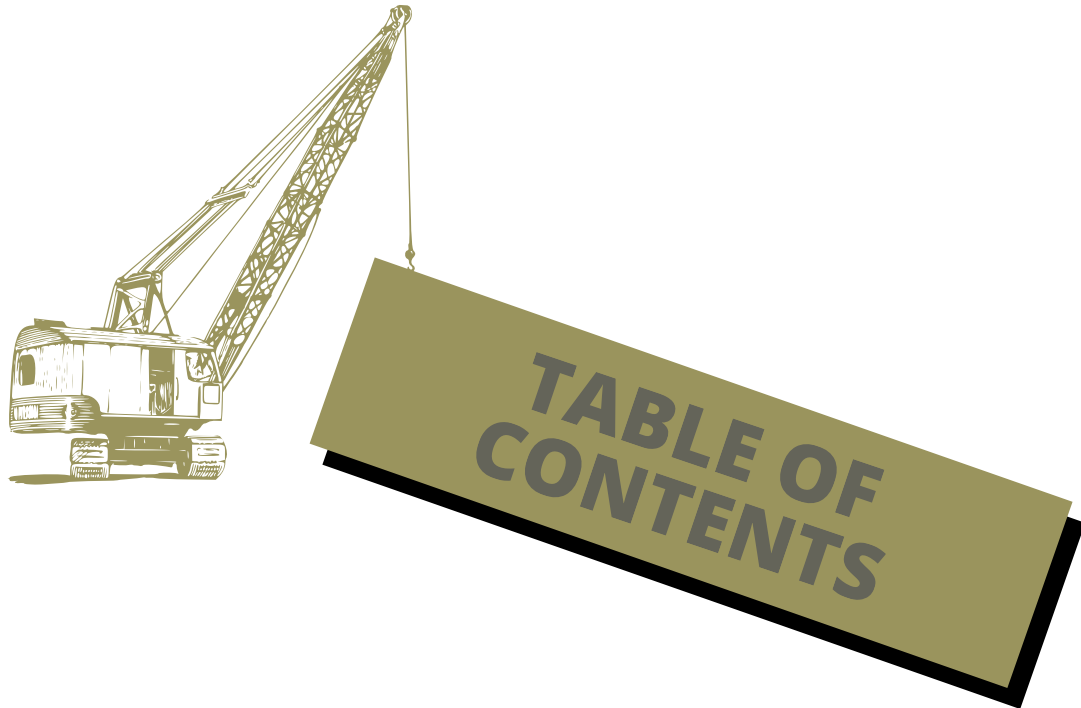


Challenges and difficulties are a part of life and words of encouragement can often help you get out of your rut. It's easy to tell someone to hang in there and to keep a positive outlook when they are going through tough times but when it happens to you, keeping your chin up isn't always the easiest thing to do.

Talent, since time immemorial, has always required a platform to take shape. With the right level of moulding and motivation, it can reach innumerable dimensions, for nothing is beyond the reach of talent.

A heartfelt gratitude to our mentors who have guided us throughout this intricate process and helped us to achieve this exclusive blend of young and intellectual minds that has raised its bars this year as well by remarkably including a high range of articles relating to variety of concepts and project based research of our students.

"If something is important enough, even if the odds are stacked against you, you should still do it." – Elon Musk




1. INDUSTRIAL VENTURE

2. FACULTY WISDOM

3. STUDENT CONTRIBUTION

4. CREDITS



INDUSTRIAL VENTURE

MR. RAVINDRA N. DIDORE

He started his journey as an architecture student, but he was a step ahead of his peers and soon understand the potential the construction industry holds. For him it wasn't just about what he studied in college syllabus, he developed a vision as a student and worked on it. His hunger and eagerness to learn new things and keep himself updated to the upcoming trends has helped him sustain into the competitive environment the industry offers, and is also one of the things that has a major impact on his career success. And he has worked with the finest corporations for over 12 years that has helped him make way for his vision.



Can you tell us a little about your journey from a civil engineer to present fame & success?

I was passionate buildings and designs; I saw them as art. Hence, I stepped inside the world of architecture, I embraced everything it taught me. So, for my architecture internship, I worked with one of the finest in my city Aurangabad, where I learned about townships and high-rise developments. That's when, I realise development is not about architecture alone that goes beyond it. And I decided to pursue Construction Management from NICMAR for my post-graduation. And after NICMAR, my journey as a construction industry professional started in Mumbai. And since then, I have had the privilege of working with the finest people in the industry, on projects ranging from commercial, industrial to luxury homes; it's been over 12 years and I am proud to say I have enjoyed every bit of it.

What efforts do you recommend a student to put during his/her study years, which would be helpful to make him/her to ready for industry life?

In our field, bookish knowledge is not more than enough to resist. You should always try to do small internships during your college years to have on field knowledge. I believe that you will observe there are many new things you will see on the site which you can't learn from the book.

In the current age of growing opportunities in entrepreneurship & research work, what the scope of civil engineering students in the field as fresher?

Any student who wants to pursue career in growing opportunities in entrepreneurship must pursue construction management as an added advantage to get benefitted from current industry scenario. Students pursuing for research work, shall do specialisation in structural design. Opportunities as mentioned in next point.

In last 15 years, many developers and state government are coming up with mega projects like METRO Rails, Green Field Airports, Express ways Delhi-Mumbai & Nagpur- Mumbai, Ports, Tall Residential and commercial buildings with Luxury and ultra-luxury amenities type projects has made Project Management division an important department in organisation. This department keeps track on Time, Cost & Quality of Projects and acts as early warning signal.

There are many industry leaders in construction segment who have their own set up of research centres, where Civil engineers are required for structural designing of complex structures.

What are your predications about innovations & development in the field of civil engineering?

Since ages, only structures with innovations in smart use of materials have made their influence on community. Like - Taj Mahal, Eiffel Tower etc. This explains there is always scope of innovations and development in civil engineering. In this growing age, there are tons of opportunities for the freshers to do something more advance things by doing research works, modern techniques, etc.

What is your advice for aspiring civil engineers in the field of research, innovation & ideas?

One should always gain some experience for the perfection in his work. Research, innovation are amazing opportunity for upcoming engineers. There are lots of ideas for urban civilization.

Do you believe in this age of industrialization is it possible to maintain a balance between environment & constructions?

Yes, many corporate and Government projects are opting for getting green ratings for their projects, from certified organisation. This is picking demand and helping in maintaining balance between environment & constructions.

What are the qualities in a student, industries hunts for?

During recruiting, the industries hunt for the student's skills, capable to complete his task in given time and most importantly students on field knowledge.

According to you what is the most important invention in the field of civil engineering till present?

Software's like MS Project, Primavera. Which helps in analysing project health in less time and taking corrective actions in fast. All these software's and the BIM technology has made the construction process very effective and efficient.

According to you how important is a job experience in the field of civil engineering?

One of the basic and important necessities of human being is shelter "Makan". Hence, experience is very important in this field because it directly deals with the life and life style of whole community. Also, job experience or internship help us while recruiting. It has made or job easy to explain the work.

Can you suggest some new project for student, which can bring change in engineering field?

High Speed Transportation corridor (via, Water + Land + Air)

Sky scraper Tall Buildings – with its own electricity generation plant and water source creation techniques.

Develop self-Transforming infrastructure in city to safeguard humans form natural calamities – In case of Floods, tsunami, Earthquake.

MR. SANJAY R. KULKARNI

He has been a part of the construction industry over the past 30 years. Started as a R.C.C. Consultant, Site Supervisor and Plumbing consultant for M.C.G.M. he still works in the same domain and hasn't lost an inch of zeal for his work since he started. Majority of his work is related to taking Municipal approval of buildings from M.C.G.M. limit and also taking approvals from various Authorities/ Departments of M.C.G.M. / Government of Maharashtra. And taking approvals from other Government departments such as Collector, City Survey and Talathi offices related to ownership of land. In addition to this he also engages himself in Preparations of proposed new building plans, Structural Audit of existing building, Rain water harvesting, Parking layout and manoeuvrability in new proposed buildings.



Can you tell us a little about your journey from a civil engineer to present fame & success?

After completion my graduation I have joined architectural firm which prepares the drawings of all types of buildings and approvals from authority. The interest was created in that stream and decided to do career in same. By studying the rules and regulations of various authority such as M.C.G.M., M.I.D.C. and various authorities and getting the licences from them, I have started my professional practice and continuing same for last 30 years. Currently, I am practicing as a Licences Surveyor, R.C.C. Consultant, Site Supervisor and Plumbing consultant in the region of M.C.G.M. During this journey, I have completed Masters in civil Engineering and LL.B.

What efforts do you recommend a student to put during his/her study years, which would be helpful to make him/her to ready for industry life?

I recommend student to self-assess himself/herself regarding the interest in specific subject/area of civil engineering such as surveying, soil, transportation, hydrology, structural analysis, sanitation etc. And then, after completion of course he/she should start working/gaining further knowledge in

that subject which leads to smoothen the path of he/she of success in industry life.

In the current age of growing opportunities in entrepreneurship & research work, what the scope of civil engineering students in the field as fresher?

As I told earlier, after completion of course and studying/working 2 to 3 years in his/her liking subject, he/she had good scope in civil engineering in the field.

What are your predications about innovations & development in the field of civil engineering?

The civil engineering is very much developed stream. Various innovations and techniques used on field for construction activity. My prediction to maintain, repair or restoration of the same in all types of construction done in the field of civil engineering.

What is your advice for aspiring civil engineers in the field of research, innovation & ideas?

My suggestion is to bifurcate the innovation & ideas by civil engineers as

below:-

- A) The same can be implemented on field.
- B) The same can be implemented over a period.
- C) The same is theoretically correct but practically not possible.

Do you believe in this age of industrialization is it possible to maintain a balance between environment & constructions?

Yes. 100% I believe in this age of industrialization, it possible to maintain balance between environment and constructions. Various acts are in force related to environment and provisions are made in Indian standard codes. By following the rules and regulation and implementing standards given correctly, rigorously the balance between environment and constructions will be maintained.

What are the qualities in a student, industries hunts for?

Physical fitness, awareness and knowledge of subject, punctuality and dedication of work. During recruitment industries mostly hunt for the qualities like extra activities,

internships, leadership qualities, etc students would have done beside degree.

According to you what is the most important invention in the field of civil engineering till present?

Civil engineering itself is important invention. There are many structures, projects related water, and tunnels etc. and so are existing on earth. The list is very long.

According to you how important is a job experience in the field of civil engineering?

Job experience plays important role. By experience, there is less possibility of mistake, accuracy increased with validation.

Can you suggest some new project for student, which can bring change in engineering field?

I suggest some new projects for student related to following subject:-

A) Skyscrapers buildings

B) Projects related to water, soil, Infrastructure such as highway, metro etc.

C) Projects related to structural audit, maintenance of buildings, repairs and restoration.

FACULTY WISDOM



QSWAT FOR EVALUATION

SEDIMENT YIELD

By Prof. Ashwini Purekar

Sediment yield is the amount of sediment eroded from the land surface by runoff and delivered to a stream system or at the basin outlet over a period of time. Estimates of sediment yield are needed for studies of reservoir sedimentation, river morphology and planning of soil and water conservation measures. The present study has been carried out by using Soil Water Assessment Tool (SWAT) for GV - 48 area located in the Gangapur Taluka of Aurangabad district. SWAT requires large number of input parameters. Digital maps viz. Digital elevation model, soil map, Land use land cover map required for input of SWAT have been prepared by using QGIS.

To superscript the issues related with sustainable rainwater management for improving livelihoods watersheds act as an entry point. To assign water management issues, we need to quantify and analyse the different elements of hydrologic processes taking place at that area. Undoubtfully, this analysis should be carried out on a watershed basis as all these processes are happening within individual micro watersheds. We can scientifically formulate strategies for soil and water conservation only after

better understanding the temporal and spatial variation of these hydrologic components. For any watershed the process of sedimentation and erosion is significant, so it is very important to identify the causes and sources of erosion. Different management practices carried out to reduce the erosion rate for this, identification of sources of erosion is important. To quantify the sediment yield from the watershed GV- 48 a physics-based, semi-distributed watershed model, Soil and Water Assessment Tool (SWAT) model was used. The SWAT (Soil and Water Assessment Tool) model is a river basin model developed by US Department of Agriculture - Agricultural Research Service (ARS) in Temple, Texas. The SWAT model is a physically based, long term simulation, continuous time, deterministic, lumped parameter, and originated from agricultural models with spatially distributed parameters operating on a daily time step. Impact of land management practices on water,

sediment and agricultural chemical yields (nutrient loss) in complex and large watersheds with varying land uses, soils and management conditions over a long period of time can be predicted conceptually to achieve the relevancy of SWAT model for watershed GV-48.

Data collection and analysis: Location of the study area Watershed GV-48 is a significant drainage system contributing to Jayakwadi Dam. Watershed area is bounded by North latitudes 19.57° and 19.72° North longitude 74.95° and 75.26° East, falls in the Gangapur Taluka of Aurangabad district in Maharashtra. Geographical area of the watershed is 236km². The main occupation of the village is agriculture as 95.75% of the total watershed area comes under cultivation

General Geology and Hydrogeology: The area experiences Moderately Tropical type of climate. Average annual rainfall of the area is about 796.13 mm. The study area comes under formations of Deccan Trap Basalt of Maharashtra. Due to continuous atmospheric action both weathered basalt and separated sediments are rapidly disintegrated and converted in to an end product of weatherizes i.e., soil. the main constituent of rock is Fe, Mg, Mn, therefore the soil forms mafic minerals show pasty, dark black, humus rich and more ferrite. It is more fertile and namely called as

Black Cotton soil.

Digital Elevation Model: To delineate the watershed and sub basins, to determine drainage networks SWAT uses the digital representation of the topographic surface. DEM is the digital representation of the topographic surface. A 90m-by-90m resolution DEM was downloaded from SRTM. Sub basin parameters such as slope gradient, slope length of terrain and the stream network characteristics such as channel length, width and slope were calculated for the base village area and used by the model.

Land Use/Land Cover Map: A land use map was created by recording the crop type on each plot in the watershed and by identifying the land cover on areas other than cultivated fields. Land use land cover map extracted from bhuvan map.

After successful running SWAT the simulated result is obtain. The results can be visualized on basis of totally, annually daily, monthly and yearly .it gives all type of hydrological components for each subbasin.



STUDY ON EFFECT OF CONCENTRIC STEEL BRACING ON BEHAVIOR FACTOR

By Prof. Tapaswini Panigrahi

A remarkable advancement in the development of high grade of steel materials without bracing systems has taken place in the past few years, Steel structural plays most important role in construction industry. In seismic loads the steel material is necessary to design a structure to perform by using steel bracing in structural system then increase the shear capacity of structure and retrofit as well. In which 'n' numbers of possibilities are arranged in steel bracing such as D, K and V type concentric bracing. To determine ductility and other properties for each concentric bracing push over analysis is performed. Ingredients used in steel are combination of iron and carbon and other elements which is not in constant percentage i.e., in varying percentage. Increase in carbon percentage increases the strength, hardness and brittleness of steel but the properties of ductility of steel decreases. For steel structure used in mild steel, medium carbon steel and low alloy steel. The corrosive resistance of such steel is increased. This study is based on nonlinear analysis of steel frames with eccentric bracings models. Different configurations of frames are

selected such as D, K and V frames by keeping total weight of building is same In the present study, beams and columns were modelled with inelastic flexural deformations using fibre based element using the software SAP2000. The buildings are assumed to be symmetric in plan, and hence a single plane frame may be considered to be representative of the building along one direction. Typical bay width and column height in this study are selected as 6m and 3m respectively. Three steel moment frames with 4, 6 and 8-story were utilized to cover a broad range of fundamental periods.

Effect of Behaviour Factor by Using Push Over Analysis:

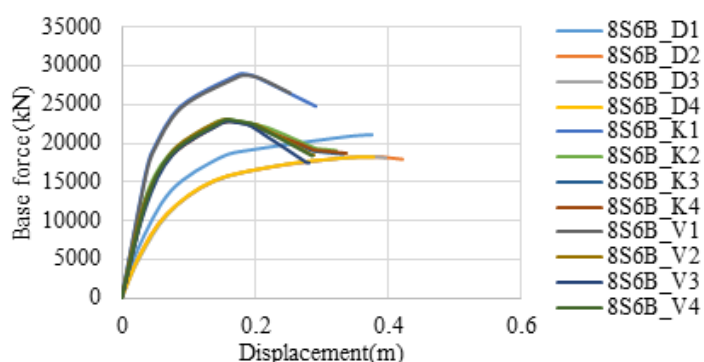
This procedure can be used for checking the adequacy of new structural design as well. This represents carried out under of constant gravity loads and. monotonically increasing also earthquake loads until a target until a target displacement is exceeded As an alternative to the design based on linear - elastic analysis which uses the

Behavior factor (R) which is the ratio of the strength required to maintain the structure elastic to the inelastic design strength of the structure'

This present study reveals that the D-type braced frames exhibit better performance level than that of the other types irrespective of the height of the building. The V-type frames shows the better ductility factor (R_{μ}) than that of other types. Similarly, D-type and V-type shows better over strength factor (R_s). The allowable stress factor is found to be higher in case of the D-type bracing leading to a better value of behaviour factor (R).

Hence, Ductility of a moment-resisting steel frame is to some extent affected by its height. When bracing systems are included, the height dependency of ductility is greatly magnified. Steel-braced frames exhibit higher ductility and therefore higher R factors as compared to the non-braced system. Considering the range of ductility capacities shown by different bracing systems discussed, it is found that the bracing arrangement in D and family, D1 & K1 respectively are found to be performing better compared to that of others Structures subjected to a

uniform lateral load pattern exhibit a higher initial stiffness in its capacity curves when compared to the other pattern lateral load.



STUDY ON LOAD SETTLEMENT BEHAVIOUR USING TWO PILE GROUP WITH BRANCHES

By Prop. Sruthy GS



Nature has always fascinated us by its wonderful architecture. Trees are able to withstand tonnes of its self-weight, wind loads and other forces acting on it simply on their roots penetrating into a medium depth.

It will be a revolutionary footstep in the field of construction if we are able to incorporate this principle of roots to deep foundations like pile.

This study focuses on, mimicking the principle of roots to piles as root piles. This project deals with the study of root piles with various shapes under different loadings and their scope in construction. It will be a great innovation if the cost of construction

can drastically be reduced by minimizing the depth of excavation and length of the pile.

Pile foundations are principally used to transfer the loads from a superstructure, through weak compressible strata or water onto stronger, more compact, less compressible and stiffer soil or rock at depth, increasing the effective size of a foundation and resisting horizontal loads. They are used for large structures, and in situations where the soil is not suitable to prevent excessive settlement.

Generally, piles are classified as; end-bearing piles (where most of the friction is developed at the toe of the pile, bearing on a hard layer) or friction piles (where most of the pile-bearing capacity is developed by shear stresses along the sides of the pile, suitable when harder layers are too deep). Figure 1 shows end bearing piles and friction piles. Most of the piles use both end-bearing and friction, in order to resist the loads acting on it.

Piles are most commonly driven piles, prefabricated off site and then driven into the ground, or bored piles that are poured in situ. If the boring and pouring takes place simultaneously, the piles are called continuous flight augured (CFA) piles.

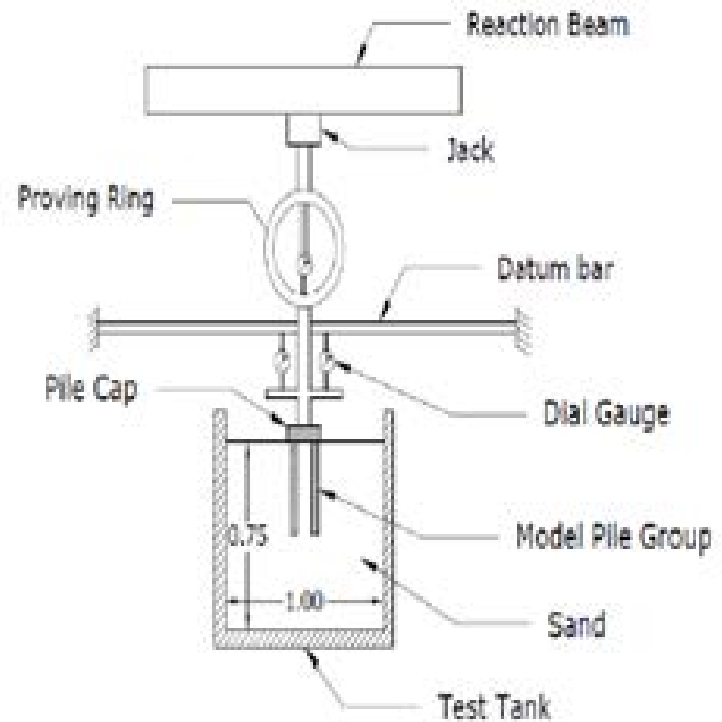
While we look into the nature, trees are able to withstand tonnes of its self-weight, wind loads and other forces acting on it simply on their roots penetrating into a medium depth. Here, the same procedure is being bio mimicked, i.e., the piles are provided with roots as in the case trees.

To study the load transfer mechanism of single piles with branches, 12mm diameter Fe415 grade steel bars has being used. Figure 2a,2b,2c shows the configuration of the piles tested. The branches have been provided at an angle of 120° with the vertical axis.

The test tank is made of brick masonry 23 cm thick. The dimensions of the tank are 75 x 75 x 100 cm. Sand is filled in layers of 5 cm thickness and is compacted using a plate vibrator.

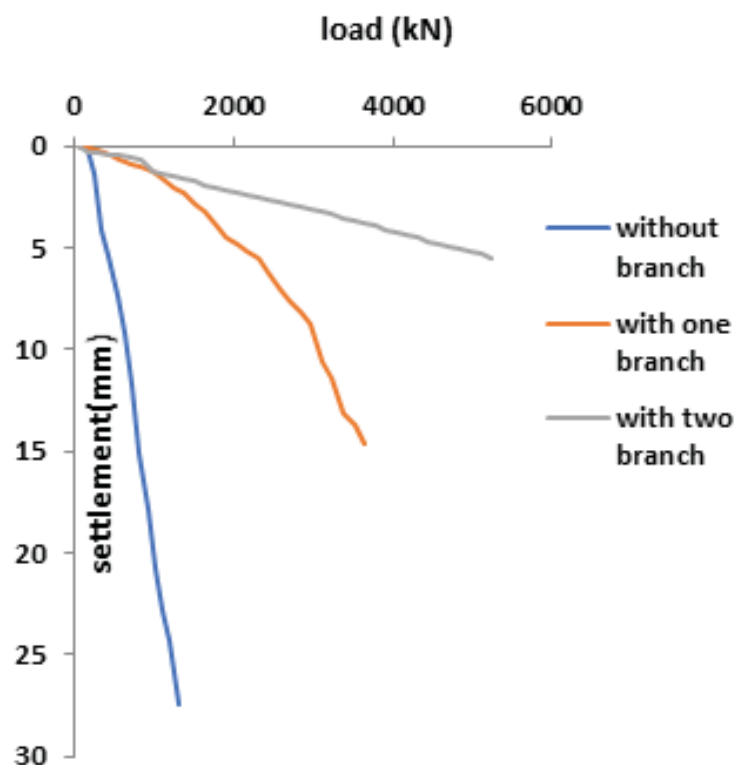
The compactive effort required is determined by trial and error. The test tank is emptied and refilled for each test to ensure that controlled conditions are maintained throughout the investigation.

The loading tests are carried out in a loading frame fabricated with ISMB 300. The load is applied using a hand operated- mechanical jack of capacity 50kN. The applied load is measured



using a proving ring of capacity 10kN and 100kN. The settlement of the pile group is measured using two dial gauges kept diametrically opposite to each other.

The model pile group is placed exactly beneath the centre of loading jack to avoid eccentric loading.



It can be seen that, the load carrying capacity has being increased due to

the provision of branches to the piles. The bearing capacity has been found out at an allowable settlement of 5mm.

The improvement in the bearing capacity is expressed in a non-dimensional parameter called bearing capacity ratio (BCR) which is defined as the ratio of bearing capacity of pile with branches at an allowable settlement to bearing capacity of pile without branch at the same allowable settlement. The BCR found to be 4.16 when one branch as provided, which further enhanced to 11.107 with the provision of two branches.





STUDENT CONTRIBUTION

RAINFALL RUNOFF RIVER BASIN

By Jignesh Jain
Adarsh Mishra
Ankit Kumar Mandal
Pritesh Choudhary

To test the performance of the SWAT Hydrological Model on Sher stream at Belkheri in Narsimpur District of Madhya Pradesh, this study was undertaken.

SWAT (Soil & Water Assessment Tool) is a river basin scale model that was created to measure the effect of land management activities in large, diverse watersheds. It can be used to forecast how land management policies would impact water quality. It is a freely available model. It has the benefit of being able to run over a very long time span of 150 to 300 years. It may be a valuable method in fields such as water supply planning, administration, and policy decision-making.

For this study, the watershed section was divided into eleven watersheds from that principally half-dozen lands were of major usage. From 1995-2008 the accessible data for the hydrological part was split into 2 major teams for calibrating and validating process. Beginning 2 years were warm-up periods. This project was analyzed on a daily and monthly

MODELLING OF A



basis. The study was additionally administered to perform the sensitivity analysis of various parameters chargeable for streamflow. The Sher River flows from Madhya Pradesh and is a main tributary of the Upper Narmada basin. Over 65% of its land is employed for agriculture, with a moderate slope and small forested area. Using a hydrological model such as SWAT, careful planning for effective use of water supply is carried out to fulfill the maximum and productive water demand for proper agricultural practices and productivity. For 12 years, the model was calibrated and tested using regular streamflow observed at the Belkheri gauging site.

The main water sources in India are the snow cover in the Himalayas and the rainfall received during the monsoon season. The climate of India consists of a wide range of weather across a huge geographic scale that isn't persistent. Similarly, in Madhya Pradesh, 2005-06 many districts were suffering from floods, and also within the years ahead some districts were suffering from drought. The main purpose and targets are to study the Rainfall-Runoff behavior of the Belkheri Basin using the SWAT model and to find out the maximum sensitive parameters that are significantly answerable for the hydrologic response with pre-defined situations. Rainfall is the main crucial source for herbal recharge to groundwater regime and is particularly available at some stage in the southwest monsoon period only. Belkheri basin received the most rainfall in the course of the southwest monsoon period and the regular annual rainfall of the basin is 1217.6mm.

The SCS curve number method is used to estimate surface runoff for day-to-day rainfall. Watershed runoff can be measured using several methods. Because of its versatility and simplicity, the soil conservation service (SCS) methodology is used to measure direct runoff. SCS curve range approach is an empirical conceptual approach evolved for computation of surface runoff

beneath varying soil kinds and land uses. In the SCS technique, surface runoff happens whilst the rainfall (in mm)

The hydrologic cycle is incomplete without evapotranspiration. Based on the supply of inputs, SWAT includes various approaches such as the Penman-Monteith approach, Priestley-Taylor method, and Hargreaves method. The Penman-Monteith approach was used in this analysis.

So with this research we were able to conclude that, with adequate resources and accurate engineering proper data can be collected and can be effectively applied to save surface runoff water or rainfall runoff water. More Research & Development is under progress regarding this topic but once this research reaches its optimum it will benefit us as a nation at a whole another level.



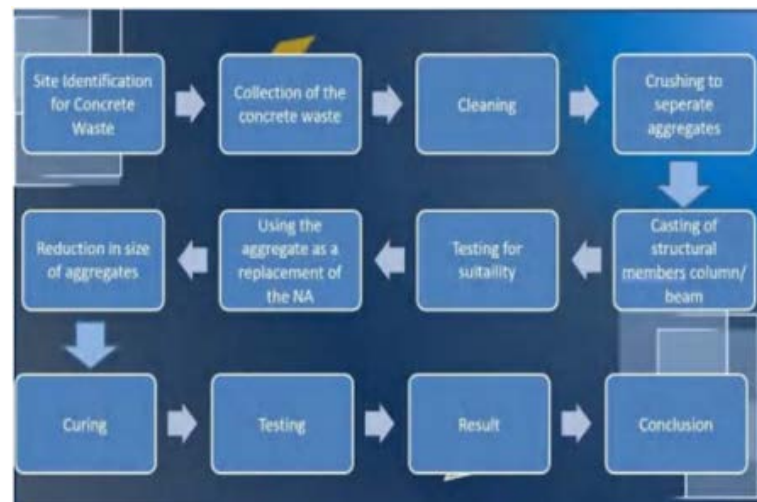
STRUCTURAL PERFORMANCE OF REINFORCED RECYCLED CONCRETE

By Prince Singh
Rahul Yadav
Shubham Ram

As we all know concrete is the most used construction material in the world & the rapid growth in industrialization and urbanization has led to a significant demand for this material worldwide. Coarse and fine natural aggregates add up for approximately 70% of total concrete volume in a cement concrete mix. According to some estimates the global demand for cement is around 20 billion tons per annum.

We all know that there is a huge amount of waste generated from construction and demolition, so there is a need for recycling and reusing this waste. Recycled Concrete Aggregates (RCA) reduces overall construction cost and favors environmental sustainability.

Since Past few decades recycled aggregates, obtained from demolished old concrete structures, have been considered as an alternative material in the preparation of structural concrete with the aim to conserve natural resources and minimize the



environmental impact of the Construction & Demolition (C&D) waste. Recycled aggregate concrete (RAC), which is produced with partial or full substitution of natural aggregates by recycled aggregates in the concrete mix, has been shown to provide significant environmental and economic benefits.

A number of studies and researches were conducted patching Recycled Aggregates (RA) in place of Natural Aggregates (NA). A few of these case studies consist of "Manufacturing Concrete with High Compressive Strength Using Recycled Aggregates", "Mechanical and Durability Properties of RAC", "Flexural Behavior of Reinforced Recycled Concrete

Beams", "Use of Recycled Concrete Aggregate In Structural Concrete", "Strength and Durability Evaluation of Recycled Aggregate Concrete".

A study was conducted with respect to Manufacturing Concrete with High Compressive Strength Using Recycled Aggregates. Under this study, a method of developing high strength concrete from recycled aggregates was proposed based on the Particle Packing Optimization (PPO) & presoaking of recycled aggregates. It was found that soaking the RA prior to the concrete manufacturing results in concrete with high compressive strength and low slump. Average compressive strength achieved was approximately 83.0MPa.

And from this study it was concluded that, the compressive strength results were evaluated for all categories of aggregates. Soaking of RA prior to concrete manufacturing results in concrete with high compressive strength.

A study was conducted for testing the Mechanical and Durability Properties of RAC. Under this study, total 14 batches of concrete mixes were made out of which 3 batches were of Normal aggregates of Concrete (NAC) & 11 batches were of Recycled Aggregates (RA) having different sizes. The workability, compressive strength, modulus of elasticity, flexural strength, splitting tensile strength, drying shrinkage & water absorption of each mix were

determined through series of tests using Universal Testing Machine (UTM) & slump test. From this study it was concluded that, an increase in coarse aggregate size (from 7 to 12 mm) leads to increase in the 28- day elastic modulus and decrease in 28-day flexural and splitting tensile strengths. Mixes prepared with coarse RA had a high drying shrinkage (up to 49% at 70 days) & water absorption (up to 30% at 28 days) than those of companion mixes prepared with finer RA.

For studying the Flexural Behavior of Reinforced Recycled Concrete Beams, a study was conducted. In this study, the aim was to investigate the flexural behavior of RAC. It gains importance in view of the wide potential for demolished concrete to serve as a source of quality aggregate feedstock in a variety of structural and non-structural applications. This review study presents the impact of RCA with different

replacement ratios on flexural strength. From this study it was concluded that, Flexural strength of RCA is lower than the virgin concrete. Beams made with the RAC shows wider cracks at lower spacing. Mid span of RAC beams is larger than that of normal concrete.

For observing the Use of Recycled Concrete Aggregate in Structural Concrete a study was conducted. In this study, the RA were obtained by crushing the cylinder specimens

having strength in the range of 25 MPa- 40 MPa. The fly ash content was 20%, 35% & 50% and water to cement ratio of 0.45, 0.55, and 0.65 was used in the study. It was observed that the addition of fly ash increased the compressive strength of RAC as compared without RAC fly ash. From this study it was concluded that, Compressive strength of all Recycled aggregates Concrete (RAC) mixes is lower than Natural aggregates Concrete (NAC). The Extent of cracking for all flexure critical RAC beam specimens were found to be higher than the NAC beam specimen. For Evaluation of Recycled Aggregate Concrete, Strength and Durability tests were conducted under a study. In this study, Concrete made with RA shows less durability As Compared to Concrete made with NA due to high pore volume which in turn lead to high permeability ratio and water absorption rate. High water absorption is due to cement paste applied on the aggregate which can be countered by saturated surface dry (SSD) condition before mixing.

The whole and Sole objectives of these studies were to find out Suitability of concrete waste as aggregate in new concrete, Suitability and performance of the RAC as a construction material & Analysis and study the performance of Reinforced Recycled Concrete members.

Many research papers were studied and we came to the conclusion,

that to use RCA is difficult in every place but it can be used on certain places like pavements, columns, roads etc. It cannot be used for high rise structures but suitable for lower structures. We all also came to know that it has high water absorption capacity and porosity as compared to natural aggregates so we need to work on that also in order to use it. We all also found that it will be useful in reducing the concrete waste generated from construction and demolition. It can also be useful in getting the LEED certification provided for the Green Building.



ENERGY AUDIT OF RESIDENTIAL BUILDING

By Devesh Ajmera
Harsh Aggarwal
Deep Doshi
Neelay Prabhu

An Audit on energy consumption in modern households: This article delineates the research on the energy audit of residential buildings. We started off with the literature survey and we referred to research papers from some of the prominent researchers. There were research gaps that were identified, majorly owing to the unnecessary consumption of energies at residential buildings. Thus, discovering the problems, we proposed some certain methods to rectify the excessive consumption of energy. These problems showed some promising results to tackle our problems, power monitoring system and comfort monitoring system and usage of energy star rated appliances were the solutions we identified.

Based on the research conducted by Smart Grid Technologies it was evidently found that the majority of residential houses show an excessive utilization of electrical energies in their respective residents, in fact on a collective basis the whole residential

building had shown a huge amount of electrical energy consumption. On the other hand, it surveyed the actual needed electrical energy for the residents of the buildings, and it showed that there was a huge difference in their consumption levels. So, the adjustments that they made were energy star rated appliances which made some impactful changes and showed great difference in the electrical energy consumed.

Identify the Energy Saving and Conservations Opportunity. Report on suitable recommendation with existing and implementation. Plot Cost Benefit Analysis with Breakeven Chart. Check the earth resistance and report on the status of earthling. Provide Awareness' on Electrical Safety to the Person there. Submission of Suitable Energy Audit Report with Breakeven Analysis The heat energy audit of a residential building, reported that there was a loss of heat in the pipeline when the water heater would transfer the water to the supply pipe mainly due to two factors contributing to it is mechanical ventilation and natural ventilation. To solve the problem, the use of heating recovery system which use exchanger heat to reheat the

water was recommended.

The following steps provide a framework for designing a benchmarking plan:

- Establish the goal for benchmarking
- Secure buy-in from leadership
- Build a benchmarking team
- Identify output metrics
- Identify data inputs
- Select a benchmarking tool
- Determine the collection method
- Consider a data verification process
- Evaluate analysis techniques
- Communicate the plan
- Plan for change

TYPES OF ENERGY AUDITING: -

Energy audit is very essential in all the sectors and the type of energy audit to be performed depends mainly on the consumer's need. There are mainly four types of energy auditing:

1) Benchmarking: Benchmarking mainly consists in comparing the measured consumption with reference consumption of other similar buildings or generated by simulation tools to identify excessive or unacceptable running costs. benchmarking is also necessary to identify buildings presenting interesting energy saving potential. An important issue in benchmarking is the use of performance indexes to characterize the building.

2) Walk-through or preliminary audit: The simplest and quickest type of audit is preliminary audit. It is also called a simple audit, screening audit or walk- through audit. It involves

minimal interviews with site-operating personnel, a brief review of facility utility bills and other operating data, and a walk-through of the facility to become familiar with the building operation. Only major problem areas will be covered during this type of audit.

3) General audit: The general audit also called mini-audit, site energy audit or detailed energy audit or complete site energy audit expands on the preliminary audit. Utility bills are collected for a 12-to-36-month period to allow the auditor to evaluate the facility's energy demand rate structures and energy usage profiles. This type of audit will be able to identify all energy- conservation measures appropriate for the facility, given its operating parameters.

4) Investment-grade audit: In most corporate settings, upgrades to a facility's energy infrastructure must compete for capital funding with non-energy related investments. Both energy and non-energy investments are rated on a single set of financial criteria that generally stress the expected return on investment (ROI). The projected operating savings from the implementation of energy projects must be developed such that they provide a high level of confidence.



RECYCLING AND REUSE OF BUILDING WASTE IN CONSTRUCTION

By Shubham Ashta
Kuldeep Deora
Yash Ghag
Prajakta Parit

Recycling is the law of nature, as and when the potential of any material is used, it gets dispersed from entire human race, it is used as full of potential at some another place and time. Construction materials also follows same law and hence it is necessary to recycle construction materials as and when it loses its potentials, so that the quality of the material would be enhanced exceptionally once recycled.

Demolition and construction waste are the major byproducts of construction activities that are generated by the construction industry every year. It is estimated that 15-30% of waste that is dumped in landfills are contribution of construction waste. At project level, the waste generated on site has been estimated to be about 10% of the materials originally purchased while construction. Waste generated by construction sites are not harmful. Activities such as site clearance, material use, material damage, excess procurement and human errors are

also responsible for waste generated.

Primarily wastes should be reused as it will reduce generation of waste. Following are the methods to be followed for reduction of waste

- Proper design: Designing with standard size construction material, specific materials and assemblies that can be easily disassembled at the end of their useful life, using non-toxic interior finishes and materials.

- Use of construction methods that prevents waste: pre-fabricated wooden products such as: door frames, window frames etc. which would reduce the waste on site

- Job-site waste prevention method: Allocating areas for specific use such as storage area, cutting area, recycling stations. Reuse concrete forms or choose reusable metal or fiberglass forms.

Purchase to Prevent Waste. Purchase salvaged, recycled, or recycled-content materials and equipment. Check to ensure the correct amount of each material is delivered to site. Maintain an up-to-date material ordering and delivery schedule to minimize the amount of time that materials are on-site and reduce the chance of damage.

Recycling of Sand & aggregates is

broadly classified in for stages which are screening crushing purification and separation. screening and crushing further involve both primary and secondary crushing. Purification stages is the third steps which is very essential for sand for separation of stone dust from it. then the last stages of separation involve the separation of aggerates and stages to classify the fine aggerates that are sand and course aggerates.

This process will enable to maintain the sustainability, preserving the environment and making primary raw materials available for future. Employing more use of secondary resources (i.e., recycled products). Small and medium sized industries will get opportunities to set their monopoly as the production and consumption pattern will be changed. The use of construction waste management techniques which rely on recycle and reuse of materials have proven to have economic benefits for the construction industry.



DEVELOPMENT AGGREGATES WASTES

OF USING

ARTIFICIAL INDUSTRIAL

By Alpesh Sangam
Shivam Gupta
Khyati Rawal
Divya Surshetwar

According to researchers Concrete is the most extensively used material in the present infrastructure era which consumes natural resources like river sand and natural gravel for its aggregate needs. The coarse aggregate occupies the major volume of concrete which leads to the depletion of natural rock deposits.

Certain measures are being taken by the government to preserve the rich natural resources from depletion. Due to this, researchers focus greatly on replacing the natural aggregate with artificial aggregates which are made from other sources like industrial wastes.

In India, the production of fly ash is estimated to be 273 million tons by the year 2020. Fly-ash or flue ash, also known as pulverized fuel ash. It is a coal combustion product that is composed of the particulates (fine particles of burned fuel) that are driven out of coal-fired boilers together with the flue gases.

As per the records from 2017 only 67% fly ash is effectively used and the remaining 33% is polluting our environment, hence there's a need to develop different ways in which fly ash can be utilized. Government of India initiated with NCAP (National Clean

Air Program) to ensure 100% utilization of fly ash in a sustainable way.

The desired grain size distribution of an artificial fly-ash aggregate is either crushed or by means of agglomeration process. The palletization process is used for manufacturing of lightweight coarse aggregates. Some of the important parameter of consideration for efficiency of the production of pellet are speed of revolution of pelletizer disc, moisture content, and angle of pelletizer disc and duration of palletization. There are many different types of pelletizer machine namely disc type or pan type, drum type, cone type and mixer type.

A cold bonded method is used to increase the strength of the pellet to effectively increase the fly ash/cement ratio. Here two types of fly- ash cement ratio is used here such as 5:1

and 10:1 to check the strength of aggregate.

Fly-ash aggregates are porous in nature so for hardening of the pellets cement is used as a binding material.

There are certain drawbacks of the material fly ash namely it can't form a dense enough mix to sustain load of heavy structures, If this material left unattended can cause pollution levels to rise and further cause breathing illnesses. But Strength of this material can be increased by adding other elements.

The process of strengthening consists of the raw materials like fly ash and Silica fumes, which are inorganic and non-cementitious, and consists of, huge amount of Silica and Alumina. The major task is to convert these non-cementitious materials to cementitious material for that we have used the geopolymerization techniques by this we can satisfy our requirements.

So, we have used the same, but to carry out this geopolymerization, there is the requirement of the alkaline solution, to fulfill this, so have used some alkaline activator like NaOH and KOH having high pH value. By addition of this activators the material gets activated and form a strong bond in between the materials, the final product which will supposed to get is in the solid crystalline form. Now the mixture is ready to go for heating and compaction.

To carry out this process we have used the method similar to hot sintering and pelletizing. In hot sintering process there is simultaneous action of pressure and temperature whereas, in pelletizing, compaction or molding takes place to make them in the form of pellets. So, to make the bonding at the molecular level, and to increase abrasion resistance properties and reduce voids, we decided to opt these methods.

Once the aggregate gets ready to use after a curing period of 28 days then, the tests that we are going to carry out on this is, Impact test, Crushing value test, Specific gravity test, Sieve analysis test and with standard Mix designs.

Research on this concept of using fly ash as an aggregate is still under progress but expected outcomes from this research is achieving the desired strength in near to those of conventional aggregates.

And must be reliable by passing through all the aggregate tests to be done on it.

The other expected outcome is to fill those research gaps, that to make our artificial aggregates more and more dense so that it can withstand major heavy loads and make the concrete strong enough.

Also want to make our aggregates much more compatible with the other ingredients of concrete, which normally those conventional

aggregates do.

Addition to this, want to make complete 100% utilization of fly-ash in a sustainable approach and simultaneously to protect our environment.



IMPROVING TIME AND COST CONTROL IN CONSTRUCTION USING BUILDING INFORMATION METHOD (BIM)

By Aman Singh
Yash Sankhe
Shivam Tajne

Cost and time are one of the major impacting issues in construction projects. A successful project should meet, not only quality outputs but also time and cost objectives. Efficient management for time in projects is need to avoid unnecessary delay in a project. Cost overrun can be the result of lack of control techniques in project management. Massive construction project nowadays, involve many stakeholders from different disciplines. Hence completion of projects with great accuracy is the need of industry today, Delay in projects and cost overrun are the main causes of disputes and abandonment of projects in the industry. It was found that delays and cost overrun effects deep into the industry and leave the construction industry with a bad image. The emergence of Building Information Model (BIM), an alternative technology is believed to solve issues related to project cost

and time control. Timely & accurate feedback and warnings of actual cost enables project managers to take appropriate corrective actions that would minimize cost overrun in a timely manner. As project progresses the time is one of the important factors that has to be monitored because a delay may affect the reputation of the companies as well as it may cause economic disadvantage with respect to project cost.

BIM (Building Information Methods) can be proven to solve these issues for advancement in construction industry. Following steps may be included:

- 1) Preparation of 3-D BIM model using Autodesk's Revit Architecture software for given building plan with details. Quantity Estimation and cost for different items from 3D model using Autodesk's Revit Architecture software.
- 2) Put these details in a Microsoft Excel sheet (.xml format) for further use. Preparation of MSP schedule for construction activities using Microsoft Project.
- 3) Using Autodesk's Nevis Work Software, integrate both the MSP

Schedule and Cost data for each item from excel sheet.

4) Obtain simulated view of project in terms of time and cost as 4D & 5D model.

5) Feed the Actual data of construction site using Microsoft Excel sheet to Nevis Work to obtain the variance of time and cost to observe the critical area for cost variance by simulation.

6) Collecting the details of quantities and cost items with traditional method from office to verify the difference with respect to BIM model.

7) Calculate the difference of traditional method over BIM model and compare. Observe which method is meeting to actual expenditures.

Using advanced technology may cost expensive, because of minute detailing of the project with the help of modelling, but then cost control process is very much beneficial with BIM than a traditional method throughout the project cycle. Hence simulation may become important factor for decision making in construction activities.



DESIGN OF INTELLIGENT FLOOD MONITORING SYSTEM FOR RAPID COMMUNICATION

By Niraj Shinde
Meet Shah
Ritesh Talla
Avinash rathod

Millions of people lose their lives in natural catastrophes that happen around the world and billions of dollars' worth of infrastructures are destroyed in seconds.

Developing nations face such catastrophes like natural calamities that include earthquakes, Cyclones, Floods, etc. with much difficulty as compared to developed nations.

A natural calamity is an event that causes loss of lives, property, and destruction of the environment as well as the economy. There are many natural calamities namely earthquakes, landslides, volcanic eruptions, floods, hurricanes, tornadoes, blizzards, tsunamis, and cyclones are all-natural disasters that take thousands of innocent lives and destroy billions of dollars' worth of habitat and property each year.

In India Flood is the most common natural calamity that people have to face. Almost all of India is a flood-prone region, with extreme

precipitation events such as flash floods. Over the last few decades, torrential rains have become more frequent in central India. In addition, India is one of the world's most disaster-prone nations, with natural disasters impacting 85 percent of Indian land and more than 50 million inhabitants.

To take over these existing problems of flooding such a flooding system is required that provides real-time accurate data collection is required for this use, and sensor networks improve the system capabilities.

Preparation of such a system will not only benefit India but also other developing nations to not only reduce financial loss but also build an early warning and alert system that receives accurate water level and amount of rainfall & mainly to prevent flash floods and such natural calamities.

This intelligent flood monitoring system is fully automated and integrated and helps to update the NDRF

(National disaster response force) about the current (real-time) rainfall data and flood levels to take prior action. In our tipping type rain gauge,

the water from the funnel will drop in our bucket which will collect the water and get tilted down due to the weight of water.

This volume of water will be measured with the help of sensors and will thus give the reading of rainfall in millimeters after calibration. The other side of the bucket will rise and the water will start getting collected and the following procedure will be repeated. The amount of rainfall that took place will be analyzed by Arduino. If the amount of rainfall goes beyond the predetermined value, then it will send a warning message to the respective authority with the help of the Arduino GSM Module. Arduino will be assisted with a battery for supplying power.

With this system in active use, we have overcome the drawbacks of appointing personnel to go and take the reading of water level & most importantly have made such calamities controllable.



GREY WATER-A SECURITY FOR FRESH WATER

By Heramb Bhogate
Suraj Sahani
Rushil Gandhi
Krutik Gangar

WHAT IS A GREYWATER SYSTEM?

Grey water derives its name from its appearance which is cloudy and refers to water that is in between 'white water' (uncontaminated water) and 'black water' (contaminated water). Leftover water from kitchen sinks, cloth washing machines, bathroom and lavatories are referred to as 'grey water' while leftover water from toilets is not considered as grey water. Grey water system then refers to re-use of leftover 'grey water', excluding that from toilets, for irrigation purpose or other uses.

Grey water in some states is considered to be unsafe for use because it has a lower quality than tap water but compared to that from sewerage, it is more nutritious and safer. Filtered grey water is used for irrigation purposes because it contains nutrients that help the plant to grow. In the floor plan illustrated below, a grey water system will be installed in the terrace, which is a

raised part that is used for plantation purposes and application of irrigation.

HOW TO USE THE GREY WATER SYSTEM:

The amount of Greywater to be used will depend with the size of the plot and the landscape to be irrigated. The building to be built will generate water for the Grey water system and plumbing fixtures will be connected to the sources which includes; kitchen sink, cloth washing machine, lavatories and shower tubs. A settling basin will be installed at the first receiving end to equalize flow of water and allow settling of particles. The grey water will then be allowed to flow into a storage tank which contains a Rice filter to further clean up the water. Water entering the tank should not be allowed to stay more than 24 hrs. because it might generate a foul smell. The filtered water will then be passed into the septic tank in which it will be mixed thoroughly letting the waste getting trapped on the walls, then further the water will move into another septic tank where same process will be used and then the chemicals will be left for settling in the gravel and then the alum is been added. Then the water is transferred to another tank where the first layer is made of gravel and followed by another layer of sand. The

work of these two layers is to trap remaining chemicals and dirt remaining in the water. Then the water is further passed through and outlet where chlorination is carried out and an outlet of UV light is been placed to neutralize any remaining bacteria in the water. Then Finally the treated water is stored into a clean tank and can be used for irrigation purposes or drinking purposes.

This way the grey water can be brought back to life and can increase the stock of freshwater for human and plant consumption.



DESIGN OF HEAT INDUCED POROUS BITUMINOUS CONCRETE PAVEMENTS.

By Ayush Jain
Jayesh Kumawat
Mayank Mehra

Water clogging and potholes are two major problem accompanies along with roads. These problems can be dealt by using Porous bituminous concrete using additional steel fibers to make roads. Porous bitumen has a minimum air voids content of about 20%. The first advantage of porous bituminous concrete is reduction in noise pollution by 2-3decibels when compared with regular roads. Porous asphalt has an advantage for drainage of water. The water drains through the porous asphalt and into the stone bed, then, slowly, infiltrates into the soil. Porous bituminous concrete is an environmentally friendly tool for storm water management. One serious road accident in the country occurs every minute and 16 die on Indian roads every hour. This rate can be decreased effectively by using this material for making of roads.

When the road made by porous bituminous concrete is in use there is

a chance of coarse aggregates getting free from binder. This problem is caused due to aging of binder and it is known as raveling. But we can effectively deal with this problem by adding steel fibres in the porous bituminous concrete which will strengthen the binder and help the pavement to heal when induced with heat, which results in increased durability and cost cutting in terms of maintenance which will be highly beneficial for the government as well as common people since chances of accidents will be less because roads will be clear and has low noise than regular roads.

The basic approach will be to use porous bitumen concrete consisting of damaging samples, and then, heat them via induction energy. This cycle can be repeated several times. Healing is the difference between the mechanical resistance before and after heating.

Process involves following steps:

- 1) Design of Porous concrete mixes as per Indian and some other standards. Design of Porous concrete with steel wools as per Indian and some other standards.

- 2) Development of Heat induction mechanism. The development of induction machine which will be

used to heat the road will be necessary to heal the road to increase its durability.

A new opportunity will be introduced in INDIA. To make use of this material in highways, colonies etc, including the places of high rainfall.

The use of this road will cut-off heavy maintenance charges and since its eco-friendly it will benefit the environment as well. The material used in this road falls under green material.

To decrease road accidents by providing smooth roads and clean roads since liquid and small particles will pass through it.

To make this road work exactly as pervious concrete road while increasing its strength so it can be used at the place of heavy traffic too.

As per previous researches, the strength recovery of porous bituminous concrete was successfully used to characterize its self-healing effect. It was found that completely fractured bitumen beam which was used in experiment containing steel fiber can be healed many times due to induction heating. During the induction heating, cracks in bituminous beam disappeared because of the flow of bitumen. Heating should not be too early or too late. If it is too early, porous bitumen concrete can heal the damage. But, if porous bitumen concrete is heated too late, the healing efficiency will be poor, because structural damage such

as permanent deformation or broken stones will have happened, which is beyond the healing capacity of the porous bituminous concrete.



ARTIST'S IMPRESSION

As future Civil Engineers, design and finding art in the structures has become a vital role for us. And it inspires us to combine art and science in the best way possible, and make the best of what our ancestors have provided us with. This section has some structures designed by our students on Google SketchUp.



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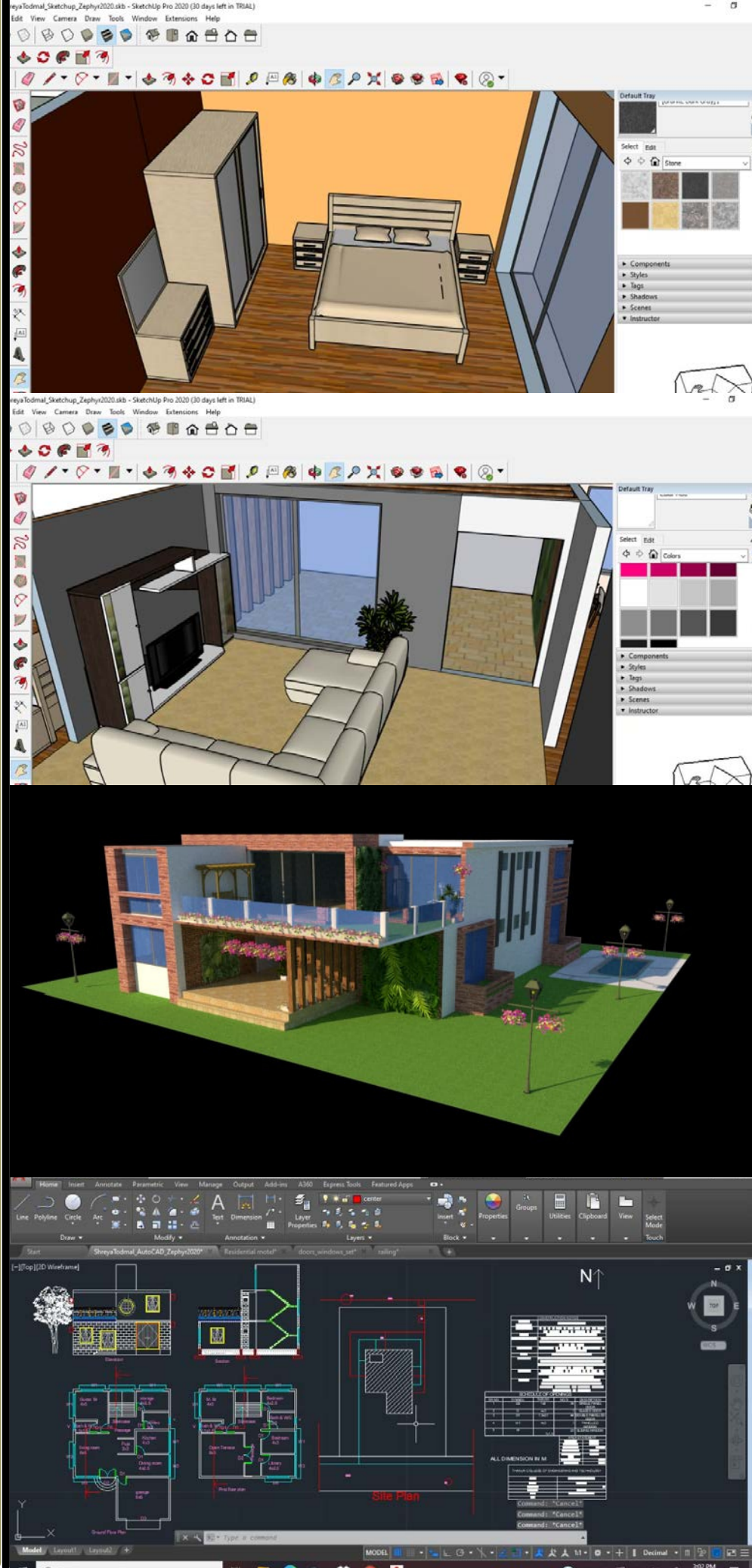
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